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## NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES<sup>1,2</sup>\*

*Richard D. Kearney*\*\*

### GENERAL CONSIDERATIONS

The over-all objective of a study of the legal aspects of the non-navigational uses of international watercourses by the International Law Commission should be to promote certain of the purposes of the United Nations set forth in Article 1 of the Charter.<sup>1</sup> A basic legal characteristic of an international watercourse is that it constitutes a natural resource, usually of substantial importance, in which two or more states have a direct interest. In many cases, this is a vital interest, as the well-being of a state can depend upon the fresh water that is available to it from a watercourse. The extent of the international interests involved and the magnitude of the problem is shown by the fact that, in Africa alone, there are fifty-six rivers in each of which at least two, and as many as nine, states share one hydrological network. Given these circumstances, a legal study of the non-navigational uses of international watercourses should be governed by the effort to develop friendly relations among nations based on the principle of equal rights, the aim of achieving international cooperation in solving international problems of an economic and

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\* The International Law Commission, at its 1974 session, established a subcommittee to explore the legal uses of international watercourses. Each member of the subcommittee prepared a report presenting his views on the subject. *Non-Navigational Uses of International Watercourses* was submitted by Ambassador Richard D. Kearney while serving as the subcommittee's chairman. The subcommittee's final report recommending that the International Law Commission accord priority consideration to the matter was accepted by the Commission and Ambassador Kearney was appointed as Special Rapporteur on the implementation of the Report's recommendations.

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1. 59 Stat. 1031; T.S. 993.

social nature and the purpose of bringing about by peaceful means, and in conformity with the principles of justice and international law, settlement of international disputes over the uses of fresh water.

The development of a study of legal rules based upon these purposes of the United Nations Charter obviously looks toward the progressive development of law as well as its codification. The importance of this aspect of the project was recognized by the General Assembly in Resolution 3071<sup>2</sup> which recommends that the Commission should commence its work by adopting preliminary measures under Article 16 of its Statute.<sup>3</sup> Consequently, the General Assembly did not intend that the Commission delay taking up the work upon international watercourses pending additional developments in the field. The report of the debate in the Sixth Committee, during the 28th Session of the General Assembly (1973) on the work of the International Law Commission, states that "many representatives who spoke on the matter shared the view that the Commission should accord the topic a degree of priority."<sup>4</sup>

The debate reflected the belief that the development of international water law is essential to the full development of international watercourses: the development of international watercourses is a matter of great consequence to the world as a whole. The 1970 revised edition of the United Nations Report in Integrated River Basin Development summed up the situation concisely:

So long as the present rate of world population increase continues there will be heavy pressure in many regions for the expansion of cultivated acreage through drainage and irrigation. It also seems probable that even with anticipated expansion of atomic energy production there will be need for large investment in hydroelectric power installations to meet growing energy consumption. Rapid industrialization will place greater demands upon water supply and threaten streams with a greater volume of waste. Only drastic changes in production technology or in population growth may change this prospect for increasing concern with water resources. To fail to take steps now to deal effectively with these needs would seem not cautious but reckless. We know that river development programmes take a long

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2. 28 U.N. GAOR Supp. 30, at 139, U.N. Doc. A/9030 (1974).

3. G.A. Res. 3071 (XXVIII) (1973).

4. G.A. Doc. A/9334 at 33 (1973).

time to plan and carry out. Once completed they endure for decades or centuries. Delay in improving the basic methods of study threatens the soundness of projects which may be undertaken in later years, and would be false economy.<sup>5</sup>

During the four years that have elapsed since the revised report appeared, there have been no developments that would indicate any lessening of future needs for fresh water. The world population continues to grow at a phenomenal rate. The requirements for energy continue to grow at an even more fantastic rate. The demands upon water by agriculture and industry are rising with each passing day.

In this context, it is worthy of note that in 1970 the Report expressed the view:

The vital character of current and impending disputes on international streams has been shown in chapter IV where it is pointed out that lack of accepted international law on the uses of these streams presents a major obstacle in the settlement of differences, with the result that progress in development is often held up for years, to the detriment not only of the countries concerned but of the economy of the world in general. A number of organizations are now engaged in an effort to clarify and secure general adoption of principles of international law applicable to the development of international river basins. The Panel recommends that the United Nations lend its support and encouragement to this effort to formulate principles as a basis for agreements between countries in order to avoid controversies and settle disputes between them. It also has been demonstrated that the earlier there can be agreement upon basic data and upon general plans the greater the likelihood of reaching an understanding on schedules for regulation and use of the flowing waters. Typically, the most intense friction arises over disputed data or over specific projects which are put forward before there has been discussion of broader aims.<sup>6</sup>

Nothing has happened since 1970 in the field of international watercourse law that establishes any lesser urgency for action in that field. The Commission should treat the subject as one that merits a degree of priority.

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5. U.N. Doc. E/3066/Rev. 1 at 8 (E.70.II.A.4.) (1970).

6. *Id.* at 44.

## BASIS OF WORK

The lack of a clearly defined body of customary international law on watercourse uses has had, as noted above, unfortunate repercussions upon the development of those watercourses. Nevertheless, there is a very substantial background of state practice and of "doctrine" that provides an adequate basis for the construction of a series of rules on the use, and misuse, of such waters. The excellent report of the Secretary-General on the Legal Problems Relating to the Utilization and Uses of International Rivers of 1963,<sup>7</sup> as brought up-to-date by the supplementary report of 1974,<sup>8</sup> contains in its five volumes, more than ample support for this conclusion. The summary of treaties, in effect relating to uses of international rivers contained in Volume I of the 1963 Report, demonstrates the wealth of material on particular uses of particular waterways that is available for synthesis. Moreover, the summary establishes that the experience available from the implementation of these treaties is, in many cases, of such long-standing as to have special value. Several examples are: the Convention of 1843 to regulate drawing of the water of Flanders (Belgium-Netherlands);<sup>9</sup> the 1857 Convention concerning regularization of the flow of the waters of Lake Constance (Baden, Bavaria, Austria, Switzerland and Wüttemberg);<sup>10</sup> and the French-Spanish Convention regarding fishing in the Pïtessoa River of 1886.<sup>11</sup>

There is not a substantial body of international adjudication regarding non-navigational international water uses. It is worth noting, however, that the two leading cases, the *Diversion of the Waters of the River Meuse*,<sup>12</sup> and the *Lake Lanoux Arbitration*,<sup>13</sup> both arose from disputes over the interpretation of treaties of some antiquity, in the former an agreement of 1863,<sup>14</sup> the latter

7. U.N. GAOR Plen., 2d vol., U.N. Doc. A/5409 (1963).

8. Int'l. L. Comm'n.: *Report on the work of its 26th Session*, 6 May-26 July, 1974, U.N. Doc. A/CN.4/274(1974).

9. Convention Conclue entre la Belgique et les Pays-Bas, Pour Regler l'Ecoulement des Eaux des Flanders, 20 mai 1943, 1 *Recueil des Traités et Conventions Concernant Le Royaume de Belgique* (Desire de Garcia de la Vega) 323-30.

10. 6 *Recueil Officiel des Lois et Ordannances de la Confederation Suisse* 26 (1860).

11. Convention Relative e l'Exercice de la Beche dans le Bidassoa, signee a Bayonne le 18 Fevrier 1886, *Nouveau Recueil General de Droits*, deuxieme serie tome 12 at 687.

12. *Diversion of Water from the River Meuse* [1937] P.C.I.J., ser. A/B, No. 53.

13. *Lake Lanoux Arbitration* (Spain v. France), 12 U.N.R.I.A.A. 281 (1963) [in French], 53 AM. J. INT'L L. 156 (1950) [extracted English version].

14. Convention de Commerce et de Navigation entre la Belgique et les Pays-Bas, fait

one of 1866.<sup>15</sup> The paucity of judicial decision, moreover, is more than counter-balanced by the amount of research and study that has been devoted to the legal aspects of international watercourse uses during the past three-quarters of a century.

At the outset, the work was carried on largely by private bodies. The 1911 Resolution on International Regulations Regarding the Use of International Watercourses of the Institute of International Law is notable for the breadth of its approach at a time when as the Resolution itself says: "International law has dealt with the right of navigation with respect to international rivers but the use of water for the purposes of industry, agriculture, etc. was not foreseen by international law."<sup>16</sup>

The proposed "regulations" include:

- (2) Alterations injurious to the water, the emptying therein of injurious matter (from factories, etc.) is forbidden;
- (3) No establishment (especially factories using hydraulic power) may take so much water that the constitution, otherwise called the utilizable or essential character, of the stream shall, when it reaches the territory downstream, be seriously modified;<sup>17</sup>

These requirements indicate that concern over fresh-water pollution, far from being a development of the past few years, has a considerable history.<sup>18</sup>

Some intergovernmental efforts were made between the two world wars in the field. The Geneva Convention of 1923 on Development of Hydraulic Power,<sup>19</sup> negotiated under the auspices of

a La Haye, 12 mai 1863, 5 *Recueil des Traités et Conventions Concernant Le Royaume de Belgique* (Desire de Garcia de la Vega) 335-38.

15. *Traité de Limitation Conclue a Bayonne, le 26 mai 1866, entre la France et l'Espagne*, 9 *Recueil de Traités de la France* (de Clercq) 532-46.

16. "International Regulations Regarding the Use of International Watercourses for Purposes Other Than Navigation," adopted by the Institute of International Law at Madrid, April 20, 1911, 5 *Annuaire de l'Institut de Droit International*, Ed. Nouvelle Abregée 1359 (1911); English translation in Griffin, *Legal Aspects of the Use of Systems of International Waters*, memorandum, Dep't. of State, S. Doc. 118, 85th Cong., 2d Sess., 86; extracted English translation in 3 *WHITEMAN, DIGEST OF INTERNATIONAL LAW* 921 (1965) [hereinafter cited as 3 *WHITEMAN INT'L. DIGEST*].

17. 3 *WHITEMAN INT'L. DIGEST* at 922.

18. It might be noted that the Treaty with Great Britain on the Boundary between the United States and Canada, January 11, 1909, T.S. No. 548, flatly prohibited the pollution of boundary waters or waters flowing across the boundary on either side to the injury of health or property on the other side. Unfortunately, for many years the provision was honoured more in the breach than in the observance.

19. Convention on the Development of Hydraulic Power Affecting More Than One State, opened for signature December 9, 1923, 36 L.N.T.S. 75.

the League of Nations, while based on the principle of negotiation, was the first recognition in a major multilateral convention that in planning for optimum use of a river, development plans should be drawn up without regard to national boundaries.

The Declaration of Montevideo concerning the Industrial and Agricultural Use of International Rivers of 1933, (Seventh Inter-American Conference), adopted, *inter alia*, the principles that:

2. . . . No State may, without the consent of the other riparian State, introduce into waters of an international character, for the industrial or agricultural exploitation of their waters, any alteration which may prove injurious to the margin of the other interested State.
3. . . . In case of damages referred to in the foregoing article an agreement of the parties shall always be necessary . . . .
4. The same principles shall be applied to successive rivers as those established in Articles 2 and 3 with regard to contiguous rivers.<sup>20</sup>

Much of the declaration is concerned with procedures for transmittal of information, technical consultation and settlement of disputes.

The ever-increasing demands upon fresh water supplies during the three decades since the end of World War II have forced worldwide recognition of the physical fact that fresh water is too precious a commodity to be wasted and that international co-operation is the essential element if waste is to be avoided. The result has been the development, at an almost exponential rate, of treaties, studies, reports and recommendations with regard to all of the human activities that affect the uses of fresh water and how the fullest extent of co-operation can be achieved in developing these uses for the greatest good of all mankind.

The Supplementary Report of the Secretary-General illustrates the change in approach by states to the problem of international watercourses.<sup>21</sup> While almost all of the treaties summarized in the 1965 report were concerned with a particular use or a very restricted number of uses of an international waterway, a very substantial number of the treaties in the 1974 report, and particu-

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20. Declaration on the Industrial and Agricultural Use of International Rivers, adopted by the Seventh International Conference of American States at Montevideo, Uruguay, December 3-26, 1933; Final Act, Cerrito, J., Florensa, 1934 at 114.

21. See note 7 *supra*.

larly multilateral treaties, deal with the over-all development of river basins. This is especially true of African States.

Both the United Nations and the specialized agencies have produced notable studies on uses of fresh water. The previously mentioned report on Integrated River Basin Development<sup>22</sup> is an outstanding contribution, as is also the study on "Abstraction and Use of Water: a Comparison of Legal Regimes."<sup>23</sup> The Food and Agriculture Organization and the World Health Organization have issued valuable studies, notably in the area of river pollution,<sup>24</sup> and the International Atomic Energy Agency has done the same in the field of water pollution by radioactive wastes, which stress the need for international collaboration to deal with the unusual dangers posed by these materials.<sup>25</sup>

The regional organizations have also been energetic. A sub-committee of the Asian-African Legal Consultative Committee has been developing a set of "general rules" during the last five years which are based upon treatment of uses of fresh water from the drainage basin point of view.<sup>26</sup> The Inter-American Judicial Committee issued, in 1965, a draft convention on "the industrial and agricultural use of international rivers and lakes."<sup>27</sup> One of the core provisions is Article 6, which provides:

In cases in which the utilization of an international river or lake results or may result in damage or injury to another interested State, the consent of that interested State shall be required, as well as the payment of indemnification for any damage or harm done, when such is claimed.<sup>28</sup>

In the following year, the Inter-American Social and Economic Council adopted a resolution on "[c]ontrol and economic utilization of hydrographic basins and streams in Latin-America."<sup>29</sup>

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22. See note 5 *supra*.

23. U.N. Doc. ST/ECA/154 (E.72.II.A.10).

24. Among the numerous examples might be mentioned the studies of the water laws in various parts of the world which appear in the F.A.O. Agricultural Papers: the U.S.A., No. 2 (1950); the Muslim countries, No. 43 (1954); South America, No. 56 (1956); *etc.*, now being revised or published in book form.

25. Disposal of Radioactive Wastes into Rivers, Lakes and Estuaries, I.A.E.A., Safety Series No. 36 (1971).

26. Asian-African Legal Consultation Committee, Report of the 13th Session (Lagos), 1972, 69 *et seq.*

27. Organization of American States: Inter-American Juridical Committee Revised Report and Draft Convention, *Industrial and Agricultural Use of International Rivers and Lakes*, CIJ-79 (1965), O.A.S. Off. Rec., (OEA/Ser.I/VI.2) [English].

28. *Id.* at 19.

29. 1 Final Report of the 4th Annual Meeting of the Inter-American Economic and Social Council (1966) 48.



This resolution urged joint studies on "control and utilization of the hydrographic basins and streams of the region of which they are a part, for the purposes of promoting, through multinational projects, their utilization for the common good . . . ."<sup>30</sup>

The Economic Commission for Europe (ECE) has issued a number of studies prepared by its Committee on Electric Power regarding the hydroelectric development of successive and contiguous rivers and lakes, which it treated as separate problems, but which, in both cases, look toward co-operative effort as the effective method of ensuring the greatest benefits to all States concerned.<sup>31</sup>

In 1971, the ECE Committee on Water Problems submitted a Recommendation to ECE governments concerning river basin management.<sup>32</sup> The report stressed the need for establishment of regional organs to operate in river basins and proposed a series of practical steps in setting up co-operative efforts to improve water use.

The major non-governmental legal organizations concerned with the development of international law have also made recent notable contributions in the field of water uses. The Institute of International Law issued, in 1961, a report on the Utilization of Non-Maritime International Waters (except for navigation).<sup>33</sup> This report, based in large part upon the work of Professor Juraj Andrassey, sets forth as its initial premise:

Considering that the economic importance of the waters is transformed by modern technology and that the application of modern technology to the waters of an hydrographic basin which include the territory of several States affects in general all those States and renders necessary its re-statement in juridical terms. . . .<sup>34</sup>

The report proposes seven articles on water utilization. Article 2 lays down the basic principle that "every state has the right to utilize waters which traverse or border its territory, subject to the

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30. *Id.*

31. Pierre Savette, *Legal Aspects of Hydro-Electric Development of Rivers and Lakes of Common Interest* (1952), E/ECE/136 (mimeo), (E/ECE/EP/98 rev. 1).

32. Proceedings of the Seminar on River Basin Management, London, June 1970, ST/ECE/WATER/3 (70.II.E.17.).

33. *Resolution on the Utilization of Non-Maritime International Waters*, adopted by the Institute of International Law at Salzburg, 1965, 65 *Rev. gen. dr. int. pub.* 908 (1961); English translation by Briggs, 56 *AM. J. INT'L. L.* 737 (1962); extracted English translation in 3 *WHITEMAN INT'L. DIGEST* at 922.

34. 3 *WHITEMAN INT'L. DIGEST* at 922-23.

limits imposed by international law. . . . This right is limited by the right of utilization of other States interested in the same watercourse or hydrographic basin."<sup>35</sup>

In 1966, the International Law Association adopted the Helsinki Rules on the Uses of the Waters of International Rivers.<sup>36</sup> The rules are divided into six chapters, of which the first specifies that the rules are applicable to the waters of an international drainage basin and defines such a basin. Chapter 2 lays down rules for the "equitable utilization of the water of an international drainage basin" on the basis that a "basin state is entitled, within its territory to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin."<sup>37</sup> One of the more far-reaching rules is that "[a] user or category of user is not entitled to any inherent preference over any other user or category of user."<sup>38</sup>

This recapitulation of a few of the legal developments in the field of the utilization of international watercourses demonstrates the existence of a very considerable body of resources upon which the Commission can draw in its development of the principles which should govern the uses of fresh water.

#### SCOPE OF THE STUDY

The Commission has been requested to study the legal aspects of the non-navigational uses of "international watercourses."<sup>39</sup> A preliminary question of basic importance is the extent of the waters included in "international watercourses." It might be noted that the 1911 Resolution of the Institute of International Law was titled "International Regulations regarding the use of International Watercourses."<sup>40</sup> In the Regulations, however, the term stream is used, and specific provision is made that the term also applies to lakes located in more than one State. However, as previously pointed out, in its 1961 Rules, the Institute refers in the first preambular paragraph of the Resolution to

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35. *Id.* at 923.

36. INTERNATIONAL LAW ASSOCIATION, *Helsinki Rules on the Uses of the Waters of International Rivers*, in REPORT OF THE FIFTY-SECOND CONFERENCE, HELSINKI 1966, at 477 (1967).

37. *Id.* at 486.

38. *Id.* at 491.

39. G.A. Res. 2669 (XXV) 1970; G.A. Res. 2780 (XXVI) 1971; G.A. Res. 2926 (XXVII) 1972.

40. See note 16 *supra*.

the fact that "the application of modern technology to the waters of a hydrographic basin which includes the territory of several States affects, in general, all these States."<sup>41</sup> Article I refers to "the utilization of waters which form part of a watercourse or hydrographic basin which extends over the territory of two or more States."<sup>42</sup> In this context, the two terms appear to be used interchangeably.

Also, as previously noted the International Rivers Subcommittee of the Afro-Asian Legal Consultative Committee has been conducting its work on the basis of the concept of an "international drainage basin." This is a term which has gained more general currency than the possibly more technical term "hydrographic basin." In this connection, it should be recalled that the multilateral treaties in effect with respect to the Senegal<sup>43</sup> and Niger<sup>44</sup> rivers deal with the river basins, while the Cameroon-Chad-Niger-Nigerian Convention of 1964 specifically deals with the Chad Basin.<sup>45</sup>

The Treaty on the River Plate Basin,<sup>46</sup> signed by Argentina, Bolivia, Brazil, Paraguay and Uruguay on April 23, 1969, is an agreement in which the parties agree to combine their efforts or promoting the harmonious development and physical integration of the River Plate Basin, and of its areas of influence which are immediate and identifiable. The agreement contemplates the drafting of operating agreements and legal instruments with the end of ensuring reasonable utilization of water resources, particularly through regulation of watercourses and their multiple and equitable uses. Article II of the Treaty provides for annual meetings of the Foreign Ministers of the River Plate States to draft policy directions to achieve the objectives of the Treaty. At the

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41. 3 WHITEMAN INT'L. DIGEST at 922-23.

42. *Id.* at 923.

43. Convention Relating to the Development of the Senegal River Basin, signed at Bamako, Mali, 26 July 1963, Senegal, [1965] J.O. 171; 3 L. SOHN, BASIC DOCUMENTS OF AFRICAN REGIONAL ORGANIZATIONS 1015 (1972).

44. Act Regarding Navigation and Economic Co-operation among the States of the Niger Basin, signed at Niamev, Niger, 26 October 1963, Nigeria, Federal Ministry of Justice, *Nigeria's Treaties in Force, 1960-68*, 209 (1969); 3 L. SOHN, BASIC DOCUMENTS OF AFRICAN REGIONAL ORGANIZATIONS 1032 (1972).

45. Convention and Statute Relating to the Development of the Chad Basin, signed at Fort Lamy, Chad, 22 May 1964, Nigeria, Federal Ministry of Justice, *Nigeria's Treaties in Force, 1960-68*, 217 (1969); 3 L. SOHN, BASIC DOCUMENTS OF AFRICAN REGIONAL ORGANIZATIONS 1003 (1972).

46. Treaty on the River Plate Basin, opened for signature April 23, 1969, 5 DERECHO DE LA INTEGRACION 129.

4th Meeting in 1973 the Foreign Ministers adopted the "Act of Ascunción"<sup>47</sup> composed of 25 resolutions. These resolutions carried ahead the work of developing the River Plate Basin as an integrated unit.

The Helsinki Rules, as previously noted, are grounded upon "international drainage basins" as the geographical unit of application.<sup>48</sup> The report of the International Law Association regarding the Rules<sup>49</sup> contains a reasoned account of the factors that made the basin approach the only satisfactory one under present conditions. Possibly the best brief summary of these factors is contained in a Preamble to the 1971 Report of the ECE Governments by the Committee on Water Problems:

1. Rapid industrial development and intensive urbanization, together with increased standards of living throughout the last decades have resulted in ever higher demands for water and an increasing deterioration of the environment in virtually all ECE countries. These growing demands, including more stringent needs for high quality water, in conjunction with the natural fluctuations and the growing pollution of the water resources, have caused water shortages to occur in more and more regions. In certain areas water has thus become a determining factor in the location of water-using industries, and a shortage of it is considered a limiting factor in economic and social development. It is accepted that only careful planning and rational management of the allocation, utilization and conservation of water resources as well as a disciplined use of water for the various legitimate purposes can assure that requirements will be met in the future and that the natural environment will be improved and preserved. However, there is a growing gap between the standard of management of water resources and available modern technology. On the basis of existing experience it appears that the improvement of water resources management may best be attained through the establishment of appropriate regional organs which operate in the framework of natural river basins, sub-basins or groups of smaller basins, as physical and administrative conditions may require in individual countries.<sup>50</sup>

On the basis of the foregoing analysis of the substantial amount of modern state practice, and the evidence of an overwhelming

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47. G.A. A/CN.4/274 (1974), 173-74.

48. See note 36 *supra*.

49. *Id.*

50. U.N. Doc. E/ECE/WATER/7 (1971).

consensus in expert studies, it appears desirable that "the international drainage basin" should be adopted as the appropriate geographic unit of study in considering the legal aspects of the non-navigational uses of "international watercourses."

#### THE USES OF FRESH WATER

In reviewing the non-navigational uses of international watercourses, it is helpful to begin by considering the limitations which the nature of drainage basins places upon those uses. The primary consideration is that each river basin has, in its natural state, a limited amount of fresh water. The amount available at any specific point in time varies according to seasonal flow and total annual amounts may vary according to cyclical patterns. However, because fresh water is a renewable resource, over any substantial period of time, the amount of water in a natural state can be considered as a constant.<sup>51</sup>

The elementary fact that the amount of water in a drainage basin is limited gives rise to the equally elementary corollary that the uses which can be made of the water are limited by the available supply. If a river is used for both irrigation and domestic purposes the diversion of water for agricultural purposes may limit the amount of water available for drinking, washing, waste disposal and the myriad other requirements of daily life. Conversely, if domestic requirements are given priority, agricultural production may have to be reduced in a situation of short water supply.

Another fact that must be taken into account is that reduction in the quality of the water in a drainage basin can limit its availability for uses in the same manner as a reduction in quantity. A striking example of this fact is illustrated by the recent problems resulting from increased salinity in the Colorado River. The operation of a new irrigation district in the United States substantially raised salinity levels in Colorado River water used for irrigation in Mexico. The Mexican Government demanded a reduction in the salinity because, while the United States was delivering the same amount of water, crop production in the Mexicali Valley was reduced because of the salt content of the water delivered. The problem was solved by an arrangement to

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51. Fundamental changes in climate can result in long-term increase or decrease in the fresh water supply of a region. However, this is a factor that should be dealt with only after devising principles for the normal situation.

channel enough of the saline return flows from the irrigation district into the ocean instead of back into the Colorado River, to reduce to acceptable levels the salinity of the water used in the Mexicali valley.<sup>52</sup> As the amount of water delivered to Mexico remained constant, the result is a net loss of water to the United States.

In addition to the limitations that quantity and quality impose on the utility of the resource, it is necessary to take into account the methods by which water can be put to use. There are a variety of uses that do not necessarily require any changes in the natural state of a watercourse. These include navigation, timber-floating, fishing and recreation. Nevertheless, for optimum results, even these uses may require modification in natural flows as, for example, the use of locks to enable vessels to by-pass falls and rapids. Other major uses require storage of water through the construction of dams, control of the rate of flow through sluice gates or diversions of water from its natural course into artificial channels such as aqueducts and canals. In all of these cases the result of the use will occasion some degree of change in the quantity or quality of the water available, or both. In addition, there will be side-effects upon the watercourse that should be taken into account. For example, hydroelectric production is, in itself, an uncomplicated use of a river. Basically, it involves nothing more than the passage of water through turbines at a sufficient rate of flow to activate a dynamo which in turn will produce an electric current. The physical principle involved, from the standpoint of water use, is simply that of gravity. It would seem, therefore, that hydroelectric production should have an insubstantial effect upon the quantity or quality of water in a river. This conclusion, however, would ignore the requirements of hydroelectric operation. The system must be able to meet demands for electricity throughout the year regardless of seasonal changes in the rate of flow. It should also have a reserve of water to maintain production through the cyclical changes of flow. Because the flow of water through the turbines relies upon gravity, there must be a basic layer of water to raise the water that is to go through the turbines above the level at which the force of gravity will operate. Substantial hydroelectric production thus requires the storage of substantial quantities of water through the

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52. Recommendations to Improve Immediately the Quality of Colorado River Waters Going to Mexico, July 14, 1972, 23 U.S.T. 1286, T.I.A.S. No. 7404.

construction of a dam at locations where an artificial lake of considerable depth can be formed.<sup>53</sup> It is therefore necessary to consider the results of the creation of an artificial lake upon the quantity and quality of water in a drainage basin.

An effect upon quantity is that, while hydroelectric production itself does not cause any loss of water, the creation of an artificial lake will result in losses because of evaporation. This can be especially important in arid and semi-arid regions. One effect upon quality is that sediment flow in a river can be markedly altered by the construction of a dam. Sediment which was formerly carried downstream tends to remain in the artificial lake as silt. If the area downstream from the dam relies upon the sedimentation process to renew farming land, there can be a loss of agricultural production.

Possible side effects are that the requirements of hydroelectric production, with the consequent variance in releases of stored water to meet varying demands for electrical energy, can result in the intermittent flooding or erosion of downstream riparian land, thus making it unusable for agriculture or habitation. However, such a dam can also be operated to reduce or eliminate the often devastating effects of seasonal flooding in a downstream region or can provide regulated flows which will increase production of electrical energy by downstream hydroelectric facilities. Such regulated flows can also be used for irrigation purposes.

Diversion of water for agricultural purposes has marked effects upon both quantity and quality of available fresh water. The food that we eat is principally liquid as is most obviously demonstrated when dehydrated food is prepared for eating. Relatively small amounts of irrigation water are returned directly to the watercourse and even the water that is returned usually has been appreciably changed by the residues of fertilizers, insecticides and similar chemical aids for the farmer. The water incorporated into foodstuffs may be, but usually is not, returned to the drainage basin of origin. Shipment of bananas from Costa Rica to Geneva thus is also a diversion of water from the San Juan basin to the Rhone.

Diversion for domestic uses of water normally has a lesser impact upon quantity than upon quality. The use of waterways

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53. This requirement is not absolute in regions where there is a reasonably constant flow of water at a sharp gradient, such as in certain mountain ranges and lake outlets. Also, controlled flows from major installations can support production of electricity at points downstream.

as a principal, if not the principal, method of waste disposal, is a practice as old as the earliest settlements of mankind. Rivers have a remarkable facility to cleanse themselves through the ability of natural organisms to neutralize natural wastes. Massive increases in urban populations, which are mainly centered along watercourses, are, however, outstripping the ability of rivers to dispose of natural wastes.

This problem has been intensified by the use of fresh water for industrial purposes. The scope of the problem is illustrated by the estimate that production of a ton of finished steel requires about 160,000 litres (35,000 gallons) of water. In the United States, at current population rates, this means a requirement by steel mills of over 18,000,000,000,000 litres (4,000,000,000,000, gallons) of water per year. Water that has been used in steel manufacturing contains oil, scales (flakes of iron oxide) and heat. In addition, certain steel processes require the use of chemicals such as hydrochloric acid in an aqueous solution. Direct discharge of waste waters from a steel mill into a river would obviously impair the quality of the water.<sup>54</sup>

The manufacturing of steel, while an important element in industrial production, represents only a small proportion of the enormous demands made by industry as a whole upon the quantity and quality of fresh water. These demands are further complicated by the scientific revolution that has resulted in thousands of new materials and products. These not only employ immense quantities of water in production, but result in wastes that are invulnerable to the natural cleansing processes of rivers. The 1968 European Agreement on the Restriction of the Use of Certain Detergents in Washing and Cleaning Products<sup>55</sup> is an example of measures necessary to meet this type of problem.

The purpose of this incomplete and superficial summary of fresh water uses has been to demonstrate that the nature of fresh water, the means available for putting it to use and the various uses to which it can be put are all interconnected. Even a use such as fishing which in itself has no effect upon water quantity or quality, can be easily destroyed by a reduction in the amount of water available, or in the quality of water available.

The major uses are, under present and any conceivable

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54. It is noteworthy that in highly industrialized areas the water brought into steel mills for use is so polluted that it must be cleaned before it can be used for steel-making.

55. European Agreement on the Restriction of the Use of Certain Detergents in Washing and Cleaning Products, *opened for signature* September 16, 1968, Europ. T.S. No. 64.



future conditions, in direct competition with each other in drainage basins. The competing claims of domestic consumption, irrigation, industrial use, energy production and waste disposal are placing burdens upon many watercourses which they cannot meet.

#### INTERNATIONAL ASPECTS OF WATER USE

When there is competition by users for the limited amount of water in a drainage basin or the necessity of improving quality to increase the amount of usable water, if the basin is entirely or substantially within the jurisdiction of one state, there are no insuperable obstacles to management of the watercourse to produce the maximum benefits at the lowest costs. If the drainage basin includes two or more states the physical limitations of quantity and quality are supplemented by what is often an equally effective limitation—the principle of national sovereignty.

It would be premature, at this stage, to engage in a discussion of the various theories and arguments as to the relationship of sovereignty to the water in a river which is moving through one national territory into another national territory or moving along the boundaries of two national territories. That question is the central issue to a study of the legal aspects of uses of international watercourses.

The essential requirement is to underscore the point that the problems of conflicting uses retain the same character irrespective of the introduction of national boundaries into a watercourse because the physical limitations of quantity and quality and the physical means of making use of the water all remain unchanged. The initial aim of the Commission's study, therefore, should be to determine the contribution which law can make to laying a foundation for co-operative action by states in harmonizing the uses made of fresh water in international watercourses. In addition, although there are widely varying differences among international watercourses with respect to hydrographic conditions, environmental factors, development of the economies concerned and uses made of the waters, these differences should not inhibit the Commission from seeking to ascertain the basic legal principles that apply to all basins. The discussion of uses has established that it is the interaction of varying uses with the factors of quantity and quality that give rise to the need for a legal regime to govern the use of water. This is true regardless of the amount

or quality of the water available or the number or kind of uses made of the water, or the presence or absence of international boundaries.

#### ORGANIZATION OF WORK

The essential interrelationships that govern the uses of fresh water do not require simultaneous inquiry into the legal aspects of all those uses. However, because of the interrelationships a study of the use of international watercourses for waste disposal, for example, has to be carried on in the realization that reduction of pollution has direct impact upon agricultural, domestic and industrial uses of water, and that this impact can have far-reaching economic, financial and political effects. Consequently, it is essential to continually cross-check the effect of principles applying to any particular use or group of uses upon a use or uses not covered by the proposed principles.

Another aspect of organization of work of the Commission in this field which requires consideration is the extent to which the co-operation of international organizations that have become deeply involved in various aspects of water-use planning, should be sought. Equally, it is necessary to take advantage of the experience of individual states in dealing with water problems. Initially, this information should be sought through a brief questionnaire to national governments. It may, however, be desirable in the future, to seek more specific information directly from water control commissions and similar bodies.

Pending receipt of information from states and international organizations, studies should be commenced to determine what tentative principles can be derived from published practice and conventions. Special attention should be paid to the methods of co-operation that have been developed for international watercourses and what the results of such co-operation have been.