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FIFTH REPORT ON THE LAW OF THE NON-NAVIGATIONAL USES OF
INTERNATIONAL WATERCOURSES

by

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INTRODUCTION

1. In his fourth report on the law of the non-navigational uses of international watercourses, the Special Rapporteur set forth a "schedule for submission of remaining material" concerning the present topic (A/CN.4/412, paras. 8-10). The schedule indicated that in 1989 he would submit for the consideration of the International Law Commission parts VI (water-related hazards and dangers) and VII (relationship between non-navigational and navigational uses) of the proposed outline of the topic, as well as material relating to the subtopic, "Regulation of international watercourses" (*ibid.*, para. 8). The Special Rapporteur noted that he intended to have submitted the full set of draft articles by 1990, and that adhering to this schedule would allow the Commission to complete the first reading of the draft articles by the end of its current term of office (1991). Accordingly, the present report considers the subtopics of water-related hazards and dangers (part VI of the draft articles), relationship between non-navigational and navigational uses (part VII of the draft articles) and regulation of international watercourses.

I. WATER-RELATED HAZARDS AND DANGERS

(PART VI OF THE DRAFT ARTICLES)

Introduction

2. In his fourth report, the Special Rapporteur submitted an article entitled "Pollution or environmental emergencies" as part of a set of draft articles on the subtopic of environmental protection, pollution and related matters. Owing to the limited time available during the fortieth session of the Commission for consideration of the fourth report, as well as for organizational reasons, the Special Rapporteur suggested that this particular article not be discussed extensively at that session. He indicated his intention to submit a new, comprehensive article on water-related hazards and dangers during the forty-first session. ^{1/} The idea of broadening the scope of the article received support both in the Commission ^{2/} and in the Sixth Committee. ^{3/}

^{1/} Report of the International Law Commission on the work of its fortieth session (Official Records of the General Assembly, Forty-third Session, Supplement No. 10 (A/43/10)), para. 130.

^{2/} E.g., the statements of Mr. Calero-Rodriguez (A/CN.4/SR.2067), Mr. Eiriksson (A/CN.4/SR.2068) and Mr. Yankov (A/CN.4/SR.2067).

^{3/} E.g., the statement of the representative of Venezuela (A/C.6/43/SR.29, para. 37).

3. On the surface, there might appear to be a basic difference between emergencies and dangerous situations involving pollution and those such as floods and floating ice: while the former are often the result of human activity, the causes of the latter are frequently natural. Such a difference in factual causes of disasters or dangerous situations could be thought to justify different regulatory régimes. However, while it is sometimes possible to separate water-related dangers, hazards and catastrophes that are man-made from those whose causes are entirely natural, this is not always the case. Phenomena which are often purely natural may in some instances be exacerbated, or even wholly caused, by human intervention. Floods, for example, may be caused or rendered more harmful by such activities as the construction of canals ^{4/} or dams ^{5/} or land-use practices, such as deforestation, ^{6/} which cause unnaturally rapid run-off. Conversely, nature may interact with human activities to produce disastrous consequences, as in the case of flooding caused by earthquake damage to dams.

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4. Thus there is a continuum of possibilities, ranging from the wholly natural hazard or disaster at one end, to that which is entirely man-made at the other. ^{7/}

^{4/} Canals may collect and concentrate surface run-off, discharging a large quantity of water at a single point (the end of the canal). For an instance of State practice involving such a problem, see the situation discussed in paragraphs 55 to 63 below involving a canal between the United States city of Douglas and the Mexican city of Agua Prieta, report in M. Whiteman, Digest of International Law, vol. 6, 1968, pp. 26-65.

^{5/} The sudden release of a large volume of water from a dam may produce harmful effects downstream. The release may be deliberate (e.g., in order to protect the dam itself) or may be caused by rupture of the dam. Finally, the damming of a river may prevent it from being "scoured" downstream of the dam by spring run-offs, resulting in siltation of the river bed and consequent inadequate carrying capacity of the river channel. This, in turn, may cause the river to overflow its banks.

^{6/} Some observers have attributed the particularly severe floods in Bangladesh in 1987 and 1988 in part to upstream deforestation. E.g., The New York Times, 3 October 1988, p. A1 and p. A6, col. 5; Masum, "Some aspects of impact of floods on Bangladesh economy", p. 1, paper presented at the International Seminar on Bangladesh Floods: Regional and Global Environmental Perspectives, organized jointly by the Bangladesh Research Bureau and SCOPE/Bangladesh, 4-8 March 1989 (hereinafter referred to as "1989 Flood Seminar"; page references are to the conference brochure); and Kahn, "Flood hazard in Bangladesh and its impacts on the rural environment", p. 3, paper presented at the 1989 Flood Seminar, ibid. See generally footnote 8 below, and the sources there cited.

^{7/} See the following description of the nature of instances of force majeure:

"[T]he material causes giving rise to events or occurrences termed force majeure may vary. Force majeure may certainly be due to a natural disaster like an earthquake, but also to situations having their roots in human causes

/...

The legal régimes of prevention, mitigation and reparation should therefore take into account not only the nature of the disaster (e.g., flood versus chemical spill) but also the degree to which human intervention contributes to harmful consequences. It would appear, prima facie, that the obligations of watercourse States would increase with the degree to human involvement. As will be seen below, however, this does not necessarily indicate a complete absence of obligation even where natural forces are entirely responsible for a water-related danger. On the contrary, State practice, chiefly in the form of international agreements, is replete with examples of obligations of co-operation, notification, and the like which are triggered by dangers whose causes are entirely natural, such as floods and floating ice. Illustrations of this practice are set forth below.

5. It may be concluded from the foregoing discussion that all types of water-related hazards and dangers, whether natural, man-made, or a combination of the two, may be treated in a single article or set of articles. Nevertheless, the Commission may wish to consider whether the draft articles relating to this subtopic should contain not only primary rules setting forth the obligations of watercourse States, but also secondary rules specifying the consequences of the breach of those obligations. For while watercourse States may well bear obligations in respect of hazards and dangers whose causes are entirely natural, the consequences of breaching those obligations may not be so extensive as those that would follow from the breach of rules requiring watercourse States to refrain from causing or exacerbating harmful water-related hazards or dangers. 8/

6. Indeed, it is precisely the potential for harmful, or even catastrophic extraterritorial consequences of a State's use of a watercourse (or even of other

(continued)

such as a war, a revolution, mob violence, etc. Moreover, certain causes that eventually may give rise to force majeure may originate from natural as well as from human causes. For instance, a fire may be man-made but also be provoked by a thunderbolt; a situation of absolute economic necessity amounting to force majeure may be due to a drought by lack of rain but also to disruption in world commodity markets or mismanagement of the national economy, etc."

"Force majeure" and "fortuitous event" as circumstances precluding wrongfulness: survey of State practice, international judicial decisions and doctrine", study prepared by the Secretariat, Yearbook ... 1978, vol. II (Part One), document A/CN.4/315, para. 4.

8/ For an indication of the possible range of consequences, i.e., of the elements of reparation lato sensu, see draft Article 6 as proposed by Mr. Riphagen, Yearbook ... 1984, vol. II (Part Two), document A/3910, para. 350, note 322.

/...

resources, 9/) that makes co-operation between watercourse States essential. The report of the Panel of Experts on the Legal and Institutional Aspects of International Water Resources Development emphasizes the necessity for States to "organiz[e] themselves to deal with [harmful effects of the use of water] in a rational manner on the basis of technical information and careful, integrated basin, or system, co-operation and planning." 10/ It continues:

"The conditions most often giving rise to ... complaints and creating the need for deliberate international planning (in order to satisfy or forestall complaints) are those that cause, in other States, shortage of surface or ground-water supply; flooding; siltation; salinization; depletion of fish and elimination of breeding areas; eutrophication; excess vegetation; concentrations of salts or other chemicals, untreated sewage, radio-active substances, oil or other waste products (introduced from ship or shore); changes in temperature; blockage of passage (fish, vessels and timber); the diminishing of scouring; and, of course, changes in flow. Thus, even the otherwise innocent and beneficial use of fertilizers, the attempt to control the invasive water hyacinth, the construction of weirs for water storage and flood control, the drainage of a swamp, the cooling of a thermoelectric plant, or the return of irrigation water to the river may produce damaging results in other parts of the basin. Although the harm occurs most often downstream, among the numerous exceptions to this general rule are the effects in boundary streams and lakes. Some conditions are likely to be felt both upstream and downstream, particularly when fishing, navigation or timber floating is involved.

"... The aspects discussed above are only illustrative of the kinds of problems that have greater prospect of solution once the States sharing the same water resources system accept the necessity of active international

9/ "[T]he development or exploitation of resources other than water by one State in the system may cause a substantial impact on the quantity or quality of water available for development or utilization by another State in the system. The logging off of the headwaters area of a stream in one State may trigger serious land erosion that causes a heavy burden of silt to be carried downstream into another State and a detrimental alteration in the natural timing of flow, thereby adversely affecting the downstream State's uses."

Natural Resources/Water Series No. 1, Management of International Water Resources: Institutional and Legal Aspects, United Nations publication, Sales No. E.75.II.A.2), para. 42 (hereafter cited as Management of International Water Resources), citing Cano, "Relationship between water and other natural resources", International Law Association, Report of the Fifty-third Conference, Buenos Aires, 1968 (London, 1969), annex, pp. 531-538.

10/ Ibid., para. 50.

co-operation or collaboration to achieve their own objectives more effectively." 11/

7. Another factor that may contribute to water-related dangers and which therefore makes co-operation between watercourse States increasingly important is the phenomenon of global warming.

"About 35 per cent of the continental United States experienced severe drought conditions in 1988. ...

"Western parts of the Soviet Union were also hot and dry in 1988. China showed the variability of weather, with some areas of the north-central and south-central regions receiving torrential rains and much of eastern and southeastern China being abnormally dry. The monsoon in India, which had largely failed in 1987, came back in 1988 with the heaviest rains in 70 years. Bangladesh experienced one of the most devastating floods in its history; three quarters of the land was under water, and loss of life was heavy. Torrential rains also caused extreme flooding in the Sudan in August [of 1988].

"...

"The intense drought, heat, and other extreme weather triggered renewed concern over global climate changes caused by the greenhouse effect, whereby gases - primarily carbon dioxide - trap the Sun's radiant energy in the lower atmosphere and warm the air near the Earth's surface. Although there was vigorous debate among atmospheric scientists over direct linkage of the 1988 drought to the greenhouse effect, there was irrefutable evidence of the continued rise worldwide in levels of atmospheric carbon dioxide and other trace gases as a result of a century of human industry. Three major international organizations - the International Council of Scientific Unions, the United Nations Environment Programme, and the World Meteorological Organization - issued a report calling for immediate action in developing policies for responding to climatic change. The report also urged approval and implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer ..." 12/

Scientists and other observers have predicted that global warming could lead to especially severe conditions in countries with tropical climates.

"Semi-arid areas like much of sub-Saharan Africa might suffer from even lower rainfall. Many semi-arid areas are already marginal for agriculture, are highly sensitive to changes in climate, and have had severe droughts and

11/ Ibid., paras. 51 and 52.

12/ 1989 Encyclopedia Britannica Book of the Year (Encyclopaedia Britannica, Inc., Chicago 1989) pp. 159 and 160; see also p. 195.

famines for the last several decades. Tropical humid climates could become hotter and wetter, with an increase in the frequency and severity of tropical storms. Floods, which between 1968 and 1988 killed more than 80,000 people and affected at least 200 million more, could worsen. Natural disasters such as floods, now unusual, could become increasingly common.

"Indeed, climate disruption caused by the greenhouse effect may already be evident. Global temperatures in 1988 were again at or near the record for the period of instrumental data, with temperatures elevated by .7°F relative to the average for the 30-year period beginning in 1950. The five warmest years in this century all occurred during the 1980s. Moreover, the rate of global warming for the past two decades was higher than any in recorded history." ^{13/}

These phenomena indicate that demands for fresh water are likely to intensify in some regions of the world, while other areas may experience increased flooding. It is submitted that the Commission should bear these factors in mind in its consideration of the subtopic of water-related hazards and dangers.

8. The balance of this chapter of the report will be divided into two sections, each of which will survey authorities relating to different kinds of natural hazards or conditions. The first section will deal with floods and related problems, and the second will treat other water-related problems and conditions. As these problems have been discussed in reports previously submitted to the

^{13/} Wirth, "Climate chaos", Foreign Policy, No. 74, Spring 1989, pp. 9 and 10. Mr. Wirth observes that "[t]he greenhouse effect, if unchecked, is likely to cause unpredictable disruptions in the balance of power worldwide, exacerbating the risk of war" (ibid., p. 10). See also World Commission on Environment and Development, Our Common Future (1987), p. 294:

"Environmental threats to security are now beginning to emerge on a global scale. The most worrisome of these stem from the possible consequences of global warming caused by the atmospheric build-up of carbon dioxide and other gases."

To the same or similar effect, see Stockholm International Peace Research Institute, United Nations Environment Programme, Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action, Oxford University Press, Oxford (A. H. Westing, ed. 1986); Gleick, "The implications of global climatic changes for international security", Background Paper No. 14 for the Conference on Developing Policies for Responding to Future Climatic Change, Villach, Austria, 28 September-2 October 1987; and Gleick, "Greenhouse warming and international politics: problems facing developing countries" (in press Ambio, 1988).

Commission, 14/ the surveys of authorities presented below will be illustrative only and no attempt will be made at exhaustive coverage. The chapter will conclude with the submission of a proposed set of articles on water-related hazards and dangers. While the article to be proposed will cover both man-made and natural incidents, as explained above, the following survey will not deal with pollution as such, 15/ since that subject was covered in the fourth report (see A/CN.4/412/Add.1, paras. 38-88, and especially A/CN.4/412/Add.2, pp. 23-25).

A. Floods and related problems

Introduction

9. Because floods and other water-related hazards are often factually interrelated, international agreements and other authorities frequently deal with them together. These factual and consequent legal interrelationships provide the basis for the grouping of a number of different problems in this section of the report. The problem which has received by far the most attention in treaties as well as in the work of international organizations is that of floods. This is probably due to the fact that floods consistently rank at the top of the list of natural disasters. 16/ The present section will therefore focus on that particular hazard, but will also deal with the following situations: ice conditions; drainage problems; flow obstructions; siltation; and erosion. Section B will then take up the problems of saline intrusion and drought.

10. As already indicated, floods constitute one of the world's most serious natural hazards. 17/ They occur annually in many parts of the world - e.g., India, Pakistan, Bangladesh and the People's Republic of China - and have struck countries

14/ See especially S. Schwebel, "Third report on the law of the non-navigational uses of international watercourses", Yearbook ... 1982, vol. II (Part One), document A/CN.4/348, paras. 337-379. See also J. Evensen, "First report on the law of the non-navigational uses of international watercourses", (Yearbook ... 1983, vol. II (Part One), document A/CN.4/367, paras. 176-182).

15/ Two of the topics to be considered, siltation and salt-water intrusion, could be regarded as forms of pollution. Beyond those subjects, however, pollution is not dealt with in the present report.

16/ For example, one study reports that floods caused nearly 40 per cent of the total loss of life from all natural disasters during the twenty-year period after 1947. L. Sheehan and K. Hewitt, "A pilot survey of global natural disasters of the past twenty years", Natural Hazard Research Working Paper No. II, Toronto, Canada (1969).

17/ See Natural Resources/Water Series No. 5, Guidelines for Flood Loss Prevention and Management in Developing Countries (United Nations publication, Sales No. E.76.II.A.7) (hereafter referred to as "Natural Resources/Water Series No. 5"), pp. 2-9 ("The magnitude of the world flood problem").

on nearly every continent. 18/ Losses of life, property and income caused by floods in some parts of the world are extremely high. In the Southeast Asia region as a whole, floods annually destroy more than 10 million acres of crops and cause property losses of more than \$US 1,000 million. 19/ There have been floods which have caused deaths of more than 1 million people, have left as many as 10 million homeless and have inundated up to 10 million acres of agricultural land. 20/ Loss of life from floods in Southeast Asia alone averages more than 300 per year, 21/ and floods appear to be increasing in severity in the Asian subcontinent and Africa. 22/

11. Developing countries have been particularly hard hit by floods.

"In South-East Asia thousands of people drown annually and floods destroy more than 10 million acres of crops each year. Flood losses, already large, are getting larger owing to the continual movement of population and economic

18/ See the table contained in Natural Resources/Water Series No. 5 (supra, note 17), pp. 4 and 5, documenting "significant historical flood events" in Eastern, Southern and Southwest Asia, North and South America, Western, Central and Eastern Europe, and certain island States. With regard to Africa, see, e.g., the report of particularly heavy flooding in the Sudan in 1988 (infra, note 22).

19/ W. R. Derrick Sewell and Harold D. Foster, "Flood management in developing countries: a model for identifying appropriate strategies", in River Basin Development, Policies and Planning, vol. 1 (Proceedings of the United Nations Interregional Seminar on "River Basin and Interbasin Development", 16-26 September 1975), (1976) p. 84.

20/ Natural Resources/Water Series No. 5 (supra, note 17), p. 1.

21/ Water Resources Journal (ST/ECAFE/SER.C/90).

22/ See the discussion, in paragraph 7 of the present report, of the possible relationship between the phenomenon of global warming and increased flood activity. As already noted, Bangladesh experienced particularly severe flooding during both of the past two years, 1987 and 1988. In the 1988 flood, nearly three quarters of the country was inundated. According to government reports, the floods claimed more than 2,000 lives, many more suffered from waterborne diseases, and at least 30 million were believed homeless (1989 Encyclopedia Britannica Book of the Year (supra, note 12), pp. 154 and 159). Over 2,000 lives have also been lost in a single flood in India (see Natural Resources/Water Series No. 5 (supra, note 17), p. 3). More recently, the death toll from floods that submerged many areas in India's Northwest provinces was estimated at 1,000 and hundreds of thousands of residents in four affected States of India had to be evacuated. Nine thousand towns and villages were said to be affected. (The New York Times, 3 October 1988, p. A1; see also The New York Times report on Hurricane Gilbert, 1 October 1988, p. A3). "Torrential rains also caused extreme flooding in The Sudan in August [of 1988]." (1989 Encyclopedia Britannica Book of the Year (supra, note 12), p. 159).

activities onto flood plains. This process is exemplified by Bangladesh, most of which is in the Ganges-Brahmaputra delta." 23/

But floods can strike developed and developing countries alike:

"[M]ore than 20 per cent of the population of Hungary, Iraq, Japan, Malaysia, the Netherlands and Senegal lives in areas that may be inundated by major floods." 23/

12. Increases in flood loss can be expected in the future as greater use is made of flood plains, particularly in developing countries, for agricultural, industrial and urban development. 24/

"Flood plain occupancy poses a major dilemma. On the one hand flood plains provide attractive locations for various human activities, notably agriculture and transportation. Taking advantage of the rich alluvial soils, some of the world's great civilizations developed in the bottom lands of major rivers, notably along the banks of the Tigris and Euphrates, the Nile, the Indus and the Yangtze. The flat lands in river valleys also provide transportation corridors and building sites for homes and factories. ... Not surprisingly, therefore, flood plains have become the focus of a considerable portion of the world's settlements and economic activities.

"Flood plain occupancy, however, can be costly and in some cases may lead to disaster, for once in a while the river may overflow its banks and exact a heavy toll of property damage, income loss, and perhaps loss of life as well." 25/

13. Deforestation in upland watersheds has been identified as a major cause of increased flooding in the countries of South and South-East Asia and Latin America. 26/ In India, for example, 20 million hectares are flooded annually, partly as a result of upland deforestation, resulting in flood damage in excess of \$US 1 billion annually in the Ganges plain alone. 27/

23/ Natural Resources/Water Series No. 5 (supra, note 17), p. iii.

24/ W. R. Derrick Sewell and Harold D. Foster (supra, note 19), p. 86.

25/ Natural Resources/Water Series No. 5 (supra, note 17), p. 1.

26/ "Development and international economic co-operation: long-term trends in social and economic development - Overall socio-economic perspectives of the world economy to the year 2000", report of the Secretary-General (A/43/554), para. 188.

27/ Ibid., citing World Bank, "Environment, Growth and Development", World Bank, Washington, D.C., 16 March 1987, p. 3.

14. Five types of floods have been recognized. These are: (a) floods caused by melting snow; (b) floods caused by ice jams and ice breaking up; (c) conventional storm floods; (d) cyclonic storm floods; and (e) rain-induced mud flows. 28/ Of course, other factors, such as upstream embankments (reducing the total area of the flood plain) and land-use practices, and the deposition of large quantities of sediment (thus reducing the carrying capacity of a river channel) can also contribute to a more regular cycle of flooding.

15. When the problem of floods affects more than one country, experience has demonstrated that the most effective method of dealing with it is through international co-operation. 29/ At minimum, co-operation is necessary in the collection and exchange of data relating to hydrological conditions. 30/ But effective flood control and disaster prevention programmes entail higher levels of co-operation. These may be achieved by building upon the data-exchange relationship, step by step, through the development of forecasting and warning systems, and ultimately the joint planning and execution of flood prevention and control works. 31/

16. A 1972 report by the Committee on International Water Resources Law of the International Law Association provides an interesting historical perspective upon human experience with floods, describes their causes and effects and lists typical preventive measures:

"Floods and their disastrous effects upon the adjoining lands have occupied and vexed mankind since immemorial times. Together with the need for irrigation, water control was one of the decisive factors of the rise of the first civilizations originating in the river valleys of the Nile, the Tigris-Euphrates, the Indus and the Hoangho ...

"The periodic floods occurring in these river valleys have been converting large tracts of naturally dry lands into fertile fields by

28/ See Natural Resources/Water Series No. 5 (supra, note 17), p. 13. See also International Law Association, Report of the Fifty-fifth Conference, New York, 1972 (1974), p. 44 (hereafter referred to as "ILA Report").

29/ This conclusion is borne out by the numerous international agreements and other authorities reviewed below. See also W. R. Derrick Sewell and Harold D. Foster (supra, note 19), p. 91.

30/ Ibid. This form of co-operation would already be required by article 10, provisionally adopted by the Commission at its fortieth session.

31/ Ibid. For examples of such strategies for the minimization of flood damage, see the methods identified in the report of the International Law Association's Committee on Water Resources Law in paragraph 16 of the present report.

transforming inundation into regulated irrigation. But at the same time, these floods can be the causes of catastrophes in many parts of the world Large amounts of money have to be spent every year to provide relief for flood-affected people and to repair public works. Permanent damage is done by floods when they leave behind swamps as a potential for disease and epidemics, or when stagnating flood and its subsequent evaporation during the dry season causes the accumulation of harmful salts, thus laying waste vast stretches of good land.

"It appears at first sight that flood control is primarily a problem of science and technology, and that its execution is an object of municipal legislation and administration.

"Of the various causes of floods, the most important are: intense and prolonged rainfall, thunderstorms, hurricanes, cyclones, snowmelts, ice jams, slips from mountain sides and overtopping and failure of tanks, reservoirs, dams, bursting of lakes causing a sudden release of large volumes of water, choking up of tributaries by the main rivers at their outfalls, heavy rainfall synchronizing with the spill of the rivers, inadequate and inefficient drainage in low lying and flat areas, silting of river beds due to large amounts of silts brought down by the rivers, earthquakes, land slides and erosion, flooding in the lower reaches and deltas due to heavy silting at the mouths of the rivers, synchronizing of high tides and floods in the channels, creating of bars due to littoral drifts and lack of proper controlling structures to regulate the distribution of water in different channels in the deltaic regions.

"Some of the usual methods which have been developed to minimize the damage created by floods are the following:

- "(1) Construction of dikes, flood walls, levees, or embankments to protect lands from flood waters and keep flood waters within the usual main channel.
- "(2) Increasing the discharge capacity of the main channel by either straightening or widening or deepening or by a combination of all the three.
- "(3) Diverting part or whole of the flood waters in excess of the carrying capacity of the main channel.
- "(4) Constructing reservoirs to withhold flood waters temporarily and release them later on in such quantities as the channel is capable of carrying.
- "(5) Taking steps to decrease the rate of discharge by improved land use practice, e.g. afforestation, substitution of erosion inducing crops by soil protecting crops.

"(6) Use of flood forecasting and issue of early warnings to minimize loss of life and property." 32/

17. While floods are often associated with purely harmful consequences, it should not be forgotten that some kinds of flooding can have certain beneficial effects as well. In some countries, either historically or at present, floods are an annual occurrence 33/ and may serve to irrigate agricultural land, and even enrich it through sediment deposition. 34/

"In some cases man has learned to live with such periodic inundations of the flood plain and has turned them to economic advantage. In most cases, however, floods are regarded as a hazard rather than as an advantage. Flood hazards in the third world countries [have] become [a] serious problem for overall development since recovery from flood damages in these countries [is] much more difficult." 35/

This chapter and the following survey address the problems arising from these negative effects with which floods are normally associated.

32/ ILA Report (supra, note 28), p. 43.

33/ For example, Bangladesh "is subject to annual flooding by overbank spills due to drainage congestion, rainfall run-off, and storm-tidal surges". (Bhuiya, "Environmental aspects of floods and flood-control measures of Bangladesh", 1989 Flood Seminar (supra, note 6), p. 40).

The nilometer of Ancient Egypt was a device that measured human welfare in terms of the level of the River Nile. See, e.g., Curry, "Questioning the nilometer", paper presented at the 1989 Flood Seminar (supra, note 6), figure 1, p. 2. The scale ranged from "hunger" at 12 "ells" of water (one ell is equivalent to 1.1 meters or 45 inches), through "suffering" (13 ells), "happiness" (14 ells), "security" (15 ells) and "abundance" (16 ells), to "disaster" (18 ells). Thus, while extremely low levels of water were equated with an insufficient food supply, and high levels with prosperity, extremely high water levels meant terrible misfortune.

34/ See the discussion of siltation in paras. 45-49 of the present report.

35/ Kahn, "Flood hazard in Bangladesh and its impacts on the rural environment", paper presented at the 1989 Flood Seminar, (supra, note 6), abstracted in ibid., p. 37.

1. State practice

(a) State practice as reflected in international agreements

18. One form of evidence of international custom is the appearance of similar provisions in a wide range of international agreements. ^{36/} There is indeed a broad array of treaties that contain provisions concerning floods. Many of these

^{36/} This is especially true when the agreements "deal with matters generally regulated by international law," as opposed to "treaties which deal with matters which are clearly recognized as within the discretion of the States" An example of the former category "would be treaties on riparian rights as there are requirements of international customary law about riparian States' duties toward others." (L. Henkin, R. Pugh, O. Schachter and H. Smit, International Law 87 (2d ed. 1987) (hereinafter L. Henkin, et al.)). See also Hackworth, Digest of International Law 17 (1940); and Hyde, International Law 10-11 (2d ed. 1945).

On "the general international law significance of similar provisions contained in many separate treaties," specifically with regard to the law of international watercourses, see R. Hayton, "The formation of the customary rules of international drainage basin law", in A. Garretson, R. Hayton and C. Olmstead, The Law of International Drainage Basins 834, 868-71 (1967). See also the North Sea Continental Shelf Cases, [1969], International Court of Justice, Report 4. The International Court of Justice there recognized the possibility that a rule embodied in a treaty or treaties could pass into the general corpus of international law, and be "accepted as such by the opinio juris, so as to have become binding even for countries which have never, and do not, become parties to the Convention. There is no doubt that this process is a perfectly possible one and does from time to time occur: it constitutes indeed one of the recognized methods by which new rules of customary international law may be formed. At the same time this result is not lightly to be regarded as having been attained." (Ibid., para. 71). Judge Lachs, in his separate opinion, declared that "the general practice of States should be recognized as prima facie evidence that it is accepted as law. Such evidence may, of course, be controverted - even on the test of practice itself, if it shows 'much uncertainty and contradiction' (Asylum, Judgment, I.C.J. Reports 1950, p. 277). It may also be controverted on the test of opinio juris with regard to 'the States in question' or the parties to the case." (Ibid.)

A "Memorandum on legal aspects of the use of systems of international waters", prepared by the United States Department of State, provides further support for the use of similar treaty provisions as evidence of a rule of general international watercourse law:

"It is accepted legal doctrine that the existence of customary rules of international law, i.e. of practices accepted as law, may be inferred from similar provisions in a number of treaties.

"Well over 100 treaties which have governed or today govern systems of international waters have been entered into all over the world. These

/...

agreements, often in the same article, also address ice conditions such as ice jams (which may block river flows and subsequently release them, leading to flooding) and ice flows; ^{37/} some also deal with problems of flow obstructions, siltation and erosion.

(i) Floods

19. Treaty provisions concerning floods are collected and systematized most usefully in a report submitted in 1972 by the International Law Association's Committee on International Water Resources Law. ^{38/} Only illustrative examples will be referred to here.

20. A number of agreements require consultation, notification, the exchange of data and information, the operation of warning systems, the preparation of surveys and studies, the planning and execution of flood control measures, and the operation and maintenance of works. Perhaps most frequent are provisions requiring the monitoring of river levels, regular reporting, and warning of any sudden change that may give rise to flood danger. Illustrative is article 20 of the 1963 Treaty between Hungary and Romania concerning the régime of the Hungarian-Romanian State frontier and co-operation in frontier matters, which provides:

"The two parties shall transmit to each other in good time any information concerning the level of water and ice conditions in frontier waters which is of interest to the Contracting Parties if such information may

(continued)

treaties indicate that there are principles limiting the power of States to use systems of international waters without regard to injurious effects on neighbouring States." Senate Doc. No. 118, 85th Cong., 2d Sess. (1958), p. 63.

See generally Akehurst, "Custom as a source of international law", 47 British Yearbook of International Law 42-52 (1974-75); Baxter, "Treaties and custom", 129 Recueil des Cours 25-102 (1970-I); Shihata, "The treaty as a law-declaring and custom-making instrument", 22 Revue Egyptienne de Droit International 51 (1966); and Thirlway, International Customary Law and Codification (1972).

^{37/} As already noted, one of the five ways in which floods may be caused is by ice jams and the break-up of ice. Natural Resources/Water Series No. 5 (supra, note 17), p. 13.

^{38/} ILA Report (supra, note 28), Part II, Flood Control, pp. 43-97.

serve to avert danger from floods or drifting ice. Similarly, they shall agree, if necessary, on a regular system of signals to be used during periods of high water or drifting ice." 39/

Another provision requiring the exchange of information with a view to averting flood hazards is article 17 of the 1958 treaty between the USSR and Afghanistan concerning the régime of the Soviet-Afghan State frontier:

"The competent authorities of the Contracting Parties shall exchange as regularly as possible such information concerning the level and volume of water in frontier rivers and also concerning precipitation in the interior of the territory of the two Parties as might avert danger or damage from flooding." 40/

39/ United Nations, Treaty Series, vol. 576, p. 330. See also article 19 of the 1948 Agreement between Poland and the USSR concerning the régime on the Soviet-Polish State frontier, Legislative Texts and Treaty Provisions concerning the utilization of international rivers for other purposes than navigation (ST/Leg/Ser.3/12) (hereafter referred to as "Legislative Texts"), Treaty No. 240, p. 887.

40/ United Nations, Treaty Series, vol. 321, p. 166; Legislative Texts (supra, note 39), p. 276. An identical provision is contained in article 14 of the 1957 Treaty concerning the régime of the Soviet-Iranian frontier and the procedure for the settlement of frontier disputes and incidents (with Protocol and Annexes) (United Nations, Treaty Series, vol. 457, p. 161).

See also the following examples of treaty provisions concerning the exchange of data and information with a view to averting flood danger:

The Treaty between the United States and Canada relating to co-operative development of the water resources of the Columbia River basin, and annexes, which provides that "[h]ydrometeorological information will be made available to the entities in both countries for immediate and continuing use in flood control and power operations". (See section 2 of Annex A of the Treaty (United Nations, Treaty Series, vol. 542, p. 244).)

The 1964 Agreement between Bulgaria and Greece on co-operation in the utilization of the waters of the rivers crossing the two countries provides for the parties to exchange the necessary data and information "[i]n order that measures may be taken in time to prevent the flooding of lands under cultivation ..."
(Yearbook ... 1974, vol. II (Part Two), p. 315).

The 1948 Agreement between Poland and the USSR concerning the régime on the Soviet-Polish State frontier provides in article 19, first sentence, that "[t]he competent authorities of the Contracting Parties shall exchange information concerning the level and volume of water and ice conditions on frontier waters, if

21. A number of agreements emphasize the necessity of providing early warning of flood danger. For example, article 17 of the 1944 Treaty between the United States and Mexico relating to the utilization of the waters of the Colorado and Tijuana rivers and the Rio Grande (Rio Bravo) from Fort Quitman, Texas, to the Gulf of Mexico provides:

"Each Government agrees to furnish the other Governments, as far in advance as practicable, any information it may have in regard to such extraordinary discharges of water from reservoirs and flood flows on its own territory as may produce floods on the territory of the other." 41/

Similarly, in article 4 of the 1960 Indus Waters Treaty between India and Pakistan, each of the two States

"agrees to communicate to the other Party, as far in advance as practicable, any information it may have in regard to such extraordinary discharges of water from reservoirs and flood flows as may affect the other Party." 42/

To the same effect is article 8 of the 1955 Agreement between Yugoslavia and Hungary, which provides as follows:

"The local authorities of the Contracting Parties shall advise each other, by the quickest possible means, of any danger from high water or ice and of any other danger which may arise on watercourses which form the State frontier and watercourses and water systems intersected by the State frontier." 43/

(continued)

such information may help to avert the dangers created by floods or floating ice." (Legislative Texts (supra, note 39), Treaty No. 240, p. 887).

See also the 1927 Agreement between Germany and Poland regarding the administration of the section of the Wasta forming the frontier, and traffic on that section, with Executive Provisions and Final Protocol, League of Nations, Treaty Series, vol. LXXI, p. 369.

41/ United Nations, Treaty Series, vol. 3, p. 314; United Nations Legislative Texts (supra, note 39), Treaty No. 77, p. 236; and Yearbook ... 1974, vol. II (Part Two), document A/CN.4/SER.A/1974/Add.1 (Part 2), para. 211.

42/ United Nations, Treaty Series, vol. 362, p. 4 (para. 8, second sentence); Legislative Texts (supra, note 39), Treaty No. 98, p. 305.

43/ Agreement, with the Statute of the Yugoslav-Hungarian Water Economy Commission, Legislative Texts (supra, note 39), Treaty No. 223, p. 833. See also article 1, sect. 2, paras. (m) and (n).

22. The 1952 Agreement between Poland and the German Democratic Republic concerning navigation in the frontier waters and the use and maintenance of frontier waters calls for the parties not only to take precautionary measures against and warn of flood danger, but also to take concerted action to remedy any dike failure. Contained in chapter III of the agreement, entitled "Principles of co-operation in precautionary measures against flooding and ice-floes", article 21 provides as follows:

"Each Contracting Party shall take precautions against flooding on its own territory in accordance with its applicable provisions and shall where necessary inform the other Party of the danger of a burst in any dike.

"If a dike bursts, the two Parties shall immediately combine their efforts to repair the damage, furnishing technical facilities and the necessary labour.

"The Party which asks for assistance shall bear the cost involved." 44/

23. Some agreements include very specific requirements concerning the monitoring of water levels during periods of high water. For example, article 3 of the Protocol entered into by Iraq and Turkey in 1946 relative to the regulation of the waters of the Tigris and Euphrates and of their tributaries, provides as follows:

"During periods of high-water the levels of water observed every day at 8 a.m. by the stations equipped for telegraphic communication, such as Diyarbakir, Cizre, etc., on the Tigris and Keban, etc., on the Euphrates, shall be communicated by telegram to the competent authorities designated by Iraq for this purpose.

"The levels of water observed outside periods of high-water shall be communicated to the same authorities by means of bi-monthly bulletins." 45/

A similar provision is found in the 1956 Treaty between France and the Federal Republic of Germany concerning the settlement of the Saar question, under which the authorities of the two countries are to maintain a water-level reporting service.

44/ Legislative Texts (supra, note 39), Treaty No. 213, p. 770.

45/ Protocol, annexed to the Treaty of Friendship and Neighbourly Relations between Iraq and Turkey, Art. 3, paras. 3 and 4, United Nations, Treaty Series, vol. 37, p. 280; Legislative Texts (supra, note 39), Treaty No. 104, p. 337, summarized in Yearbook ... 1974, vol. II (Part Two), p. 97. Paragraph 3 of article 3 provides that: "The cost of the above-mentioned communications shall be defrayed by Iraq."

In particular,

"As soon as a flood warning alert is transmitted by the Sarrebourg station on the upper course of the Saar, the operations of the Saar flood warning service at Saarbrücken shall be set in motion. From that time onward, the competent reporting services shall remain in constant touch with each other until notice of the end of the alert is transmitted by the Saarbrücken station.

"With a view to expediting the transmission of reports, the Federal Republic of Germany shall maintain a special telephone line between the competent office at Sarreguemines and the inland navigation office at Saarbrücken. The said telephone line shall run along the tow-path as a cable and shall accordingly be situated on French soil upstream from kilometre 75.617 (as measured on the left bank.)" 46/

24. Reflecting the importance that States attach to the proper functioning of monitoring and early warning systems, some agreements allow one party to inspect gauging stations on the territory of the other party. For example, article 3 of the above-mentioned 1946 Protocol between Iraq and Turkey concerning the Tigris and Euphrates provides in pertinent part as follows:

"Turkey shall install permanent observation stations and shall ensure their operation and maintenance. The cost of operations of these stations shall be defrayed in equal parts by Iraq and Turkey, as from the date of entry into force of the present Protocol.

"The permanent observation stations shall be inspected at stated intervals by Iraqi and Turkish technical experts." 47/

25. A number of agreements provide for the parties to take joint measures to avert flood damage. Among the examples of these treaties is the Agreement concluded between France and the Federal Republic of Germany concerning the development of the Rhine between Strasbourg/Kiehl and Lauterbourg/Neuburgweier. Article 9 of the Agreement provides as follows:

"On the basis of the findings of the Commission to Study Flooding of the Rhine, the Contracting parties shall as soon as possible conclude an Agreement concerning measures to be taken for protection against flooding and apportionment of the resulting costs, taking into account the contributions of all kinds to be expected from the other States concerned." 48/

46/ Annex 8 of the Treaty, article 9, Legislative Texts, (*supra*, note 39), Treaty No. 179, p. 659, summarized in Yearbook ... 1974, vol. II (Part Two), document A/5409, paras. 996 *et seq.*

47/ Legislative Texts, (*supra*, note 39), Treaty No. 104, p. 377.

48/ United Nations, Treaty Series, vol. 760, p. 346.

26. Similarly, the Agreement between Poland and the Soviet Union concerning the use of water resources in frontier waters provides for the parties to "take co-ordinated action with a view to the elimination or reduction of danger resulting from floods, drifting ice and other natural phenomena" 49/

27. The 1958 Agreement between Czechoslovakia and Poland concerning the use of water resources in frontier waters provides not only for the parties to furnish each other with reports on high water, drifting ice and other hazards, but also for the parties to "come to agreement on what joint steps are to be taken for the elimination or reduction of danger in the event of floods or drifting ice and on how the costs thereby incurred are to be met." 50/

28. A large number of agreements call for co-operation between watercourse States in the preparation and exchange of surveys and studies relating, inter alia, to flood control. The 1961 Treaty between the United States and Canada relating to co-operative development of the water resources of the Columbia River Basin, for example, contains the following pertinent provisions:

"The Permanent Engineering Board shall:

- (a) Assemble records of the flows of the Columbia River and the Kootenay River at the Canada-United States of America boundary;
- (b) Report to the United States of America and Canada whenever there is substantial deviation from the hydroelectric and flood control operating plans and, if appropriate, include in the report recommendations for remedial action and compensatory adjustments; ..."

"Annex A - Principles of Operation -

"General ...

"A hydrometeorological system, including snow courses, precipitation stations and streamflow gauges, will be established and operated as mutually agreed by

49/ See article 8, para. 2, United Nations, Treaty Series, vol. 552, p. 188. The Agreement between Yugoslavia and Hungary, together with the Statute of the Yugoslav-Hungarian Water Economy Commission of 1955, empowers the Commission "to draw up regulations for protection against flooding and ice and such other regulations as may be necessary." (Article 4 (2), Legislative Texts, (supra, note 39), p. 832).

50/ Article 8, para. 2, United Nations, Treaty Series, vol. 538, p. 108.

the entities and in consulting with the Permanent Engineering Board, for use in establishing data for detailed programming of flood control and power operations" 51/

29. Another of the many examples of treaties containing this kind of provision is the 1956 Agreement between the Soviet Union and the People's Republic of China on joint research operations to determine the natural resources of the Amur River Basin and the prospects for development of its productive potentialities and on planning and survey operations to prepare a scheme for the multipurpose exploitation of the Argun River and the Upper Amur River. Annexes I and II of the Agreement contain the following provisions of present interest:

"Annex No. 1

"...

"Research operations shall be carried out as indicated in the following sections:

"1. Study of natural conditions

"...

"3. Surveys of water and water power resources

"Study of the water power potential of the Amur River and of the main rivers of the Amur River Basin and preparation of preliminary proposals relating to possible outline schemes for the regulation and use of its waters, with a view to the construction of hydro-electric power stations, the improvement of navigation conditions, the prevention of floods, the execution of land-improvement projects and the development of the fishing industry.

"...

"Annex No. 2

"...

"Planning and survey operations shall be carried out as indicated in the following sections:

51/ Legislative Texts (supra, note 39), Treaty No. 63, p. 208. See also the 1944 Treaty between the United States and Mexico (supra, note 41), articles 6, 12 (d), 13 and 16.

"A. Survey operations

"1. Hydrometric operations to study the régime of the Argun and Amur Rivers from the source to the Maly Khingan range, and of their main tributaries on both banks.

"The purpose of the hydrometric operations shall be to provide data to determine the variations in the level and the flow of the rivers, their winter flow, their solid flow and the chemical composition of the water.

"2. Geodetic and topographical operations:

"...

"(c) Surveys of flood areas of water reservoirs of top-priority projects, on the scale 1:25,000; ...

"3. Engineering and geological surveys:

"...

"(g) Exploration of flood areas, for top-priority projects; ...

"B. Planning operations

"...

"4. Evaluation of the economic consequences of regulating the flow of water in order to reduce the frequency and scale of flooding of economically valuable territory on both banks caused by sudden rises in the river level and to create favourable conditions for land improvement.

"...

"6. Estimation of losses due to flooding under different variants of the scheme." 52/

52/ Legislative Texts (supra, note 39), Treaty No. 87, pp. 283-285. See also the 1959 Agreement between the United Arab Republic and the Sudan for the full utilization of the Nile waters, and the 1960 Protocol concerning the establishment of the Permanent Joint Technical Committee, article IV, paras. 1 and 2, Legislative Texts (supra, note 39), Treaty No. 34, p. 143; the 1926 Agreement between South Africa and Portugal regulating the use of the waters of the Kunene River for the purposes of generating hydraulic power and of inundation and irrigation in the mandated territory of South West Africa, articles 8, 9 and 10, Legislative Texts (supra, note 39), Treaty No. 29, p. 132; and the 1959 Agreement between Nepal and India on the Gandak Irrigation and Power Project, articles 1 and 3, Legislative Texts (supra, note 39), Treaty No. 96, p. 295.

30. The foregoing are but a few examples of the many treaty provisions relating to floods. It has been seen that States, in their agreements, often deal with floods and ice conditions together. The following section presents some additional illustrations of provisions concerning the latter problem.

(ii) Ice conditions

31. Ice conditions may give rise to flood hazards or may pose dangers of their own, such as obstruction of navigation and threats to such structures as piers and bridges. The manner in which ice conditions cause flooding is explained in a United Nations study as follows:

"Floods caused by ice jams and ice breaking up also occur in the early spring. They often occur at constriction points such as at a sharp bend, gorge, bridge-crossing or any other physical obstacle. They may also occur where the gradient of a channel changes from steep to gentle, or at the point where a stream discharges into a lake. In Canada and the USSR such floods typically occur when the ice and snow in the headwaters of northward flowing streams melt more rapidly than ice and snow in the lower reaches." 53/

32. The 1952 Agreement between Poland and the German Democratic Republic concerning frontier waters contains detailed provisions requiring co-operative action in relation to ice conditions:

"Article 19

"The two Contracting Parties undertake to exercise joint vigilance and to co-operate with each other to prevent the formation of potentially dangerous ice barriers. The technical direction of works for protection against ice shall be undertaken by the Polish Party.

"The Polish Party shall inform the German Party in good time of the place and time of ice clearance operations on the frontier sector of the river Oder, the middle and lower reaches of the Oder, and the Nya Luzycka (Lausitzer Neisse).

"Ice-breaking operations shall proceed upriver from the mouth of the Oder. Where necessary, and provided that no danger to the lower reaches of the river is entailed, local ice barriers may be demolished by blasting.

"The Polish Party shall take into account, in carrying out ice-breaking operations, the wishes and requirements of the German Party, with a view to preventing any danger to German territory. The German Party shall provide the Polish Party at its request with appropriate technical facilities

53/ Natural Resources/Water Series No. 3 (supra, note 17), p. 13 (emphasis deleted).

(ice-breakers and blasting operatives) for the ice clearance operations. The competent authorities of the two Contracting Parties shall agree on the extent of the technical facilities which each Party shall be required to provide for ice-breaking purposes.

"Article 20

"In the event of damage or accident during blasting operations, each Party undertakes to come to the other's assistance, subject to reimbursement of the expenses entailed in the provision of such assistance.

"...

"Article 22

"The labour costs involved in operating the ice-breakers used shall be borne by the Party to which the ice-breakers belong.

"Where labour is employed in blasting operations carried out by one Party at the other Party's request, the two Parties shall divide the cost of such works equally between them." 54/

33. An example of a treaty provision that addresses the problem of ice floes is contained in the 1958 Agreement between Yugoslavia and Bulgaria concerning water economy questions. That treaty provides in its article 8 for the local authorities of the contracting parties to "advise each other, by the most rapid possible means, of any danger from high water or drifting ice and of any other danger which may arise on rivers and tributaries followed or intersected by the State frontier." 55/

54/ 1952 Agreement between Poland and the German Democratic Republic concerning navigation in the frontier waters and the use and maintenance of frontier waters, United Nations, Treaty Series, vol. 304, p. 171; Legislative Texts (supra, note 39), Treaty No. 213, pp. 769 and 770. See also the provisions of this chapter of the agreement concerning floods, in paragraph 22 of the present text.

55/ United Nations, Treaty Series, vol. 367, p. 104; Legislative Texts (supra, note 39), Treaty No. 161, p. 560. See also the 1956 Treaty between Hungary and Austria concerning the regulation of water economy questions in the frontier regions, which requires parties to "notify each other as quickly as possible of any danger of flood or ice ... in connection with frontier waters which comes to their attention" (see article 11 of the treaty (United Nations, Treaty Series, vol. 438, p. 148); article 7 of the Treaty between Finland and the Union of Soviet Socialist Republics (United Nations, Treaty Series, vol. 379, p. 330); article 19 of the 1956 Agreement between the Union of the Soviet Socialist Republics and Czechoslovakia concerning the régime of the Soviet-Czechoslovak frontier and the procedure for settlement of frontier incidents (United Nations, Treaty Series, vol. 266, p. 302); and the Treaty between Hungary and the USSR concerning the régime of the Soviet-Hungarian State frontier and Final Protocol (Legislative Texts (supra, note 39), p. 823).

/...

34. Some agreements call upon the parties to take positive measures, including the construction of works of various kinds, with a view to providing protection against hazardous ice conditions. An illustration of such a provision is found in the 1967 Treaty between Austria and Czechoslovakia concerning the regulation of water management questions relating to frontier waters. Article 4 of that agreement provides in pertinent part that the parties shall, in accordance with their domestic regulations, "promote the construction in their territories of hydraulic installations and facilities to provide protection against the danger of flooding and ice along the frontier waters." 56/

35. Like ice conditions, problems of drainage can be closely related to flooding. After noting other injurious effects of poor drainage, the following section briefly reviews treaty provisions dealing with this problem.

(iii) Drainage problems

36. A helpful summary of the kinds of problems that can be caused by insufficient drainage is provided by the following passage from the third report of Judge Schwebel:

"Adequate drainage of surplus waters is an ancient problem [citing treaties dating from 1816]. Lack of it ruins soils, keeps ground-water tables injuriously high and causes standing, stagnant water, or local flooding. 57/ It is not surprising in this context that drainage and flood prevention have often been linked in State practice, since improved drainage increases the flow of water in the watercourse into which the drains discharge. Uncontrolled discharges of drainage waters can mean the inundation of the

56/ United Nations, Treaty Series, vol. 728, p. 313, summarized in Yearbook ... 1974, vol. II (Part Two), document A/CN.4/274, para. 285.

57/ "Waterlogging and 'salinization' of once fertile soil is a well-known consequence of inadequate drainage. This is the case in the Indus Basin. See resolution VII of the World Food Conference, 'Scientific water management: irrigation, drainage and flood control' (Report of the World Food Conference, Rome, 5 and 6 November 1974, (United Nations publication, Sales No. 75.II.A.3), pp. 10 and 11)."

Frequent reference to problems created by "ponding", due to insufficient drainage after floods, was made at the 1989 Flood Seminar (supra, note 6). This phenomenon not only destroys crops but also can give rise to water-borne diseases and their vectors.

territory of downstream system States. Drainage has thus been the subject of system-State agreement for the purpose of flood control or prevention." 58/

37. Such an accord is the 1928 Treaty between Austria and Czechoslovakia regarding the settlement of legal questions connected with the frontier. 59/ Article 29 of that agreement provides in relevant part as follows:

"1. The Contracting States shall promote the construction of such works as are designed to protect the frontier waters and the contiguous flood area against damage by floods, and ensure the draining and irrigation of the adjacent territory, or as the case may be, regularise the flow of water, provide the frontier communes with water, and ensure the utilisation of the waterpower supplied by the frontier waterways.

"2. In order to enable such works to be constructed in a businesslike way and in conformity with sound engineering principles, the Contracting States agree as to [a number of principles that are set forth in the treaty, among which are]:

"...

"(b) When systematically regularizing a frontier waterway ..., care shall be taken to secure as far as possible the normal outflow of medium high water Care shall also be taken ... to avoid any excessive draining of the land situated on one side or the other, and to facilitate the employment of muddy water on this land and its irrigation during periods of drought." 60/

A more recent agreement between the same parties, after requiring that they provide protection against flooding and floating ice, stipulates that they shall also take measures "to ensure that frontier waters are kept clean and to construct hydraulic

58/ S. Schwebel, third report (supra, note 14), para. 356, citing, inter alia, the 1843 Convention between Belgium and the Netherlands on the discharge of the Flanders [river] waters, article 8, Legislative Texts (supra, note 39), Treaty No. 155, p. 543; and the 1905 Convention between the Netherlands and Prussia concerning the Dinkel and Vechte rivers, article 1, sect. 4, article IV, sect. 2; and article V, ibid., Treaty No. 310, pp. 752-755.

59/ Described in article 27, paragraph 6, of the Treaty of Peace between the Allied and Associated Powers and Austria, League of Nations, Treaty Series, vol. 108, p. 56; Legislative Texts (supra, note 39), Treaty No. 130, p. 452.

60/ Ibid., p. 455.

installations and facilities for the drainage or irrigation of adjoining territory" 61/

38. Drainage problems are also addressed by the 1960 Treaty between the Netherlands and the Federal Republic of Germany concerning the course of the common frontier and boundary waters. 62/ This agreement illustrates how a general obligation to consider the interests of, and avoid injuring the neighbouring State may have, as one of its concrete applications, a duty to provide for adequate drainage:

"(1) The Contracting Parties undertake to give due regard, in the performance of their tasks in the field of water management, to the neighbouring State's interests in the boundary waters. 63/ To that end, they agree to take or to support all measures required to establish and to maintain within the sections of the boundary waters situated in their respective territories such orderly conditions as will mutually safeguard their interests, and they shall neither take nor tolerate any measures causing substantial prejudice to the neighbouring State.

"2. In performing the obligations undertaken in paragraph 1, the Contracting Parties shall in particular take or support, within an appropriate period of time, all measures required:

"(a) To secure and maintain the adequate drainage of the boundary waters, to the extent to which such is required in the interest of the neighbouring State;

"(b) To prevent inundations and other damage resulting from the inadequate servicing of sluices and weirs; ...

61/ 1967 Treaty concerning the regulation of water management questions relating to frontier waters (Austria-Czechoslovakia), article 4, para. 2, United Nations, Treaty Series, vol. 728, p. 313, as summarized in Yearbook ... 1974, vol. II (Part Two), document A/CN.4/274, para. 285.

62/ 1960 Treaty between the Netherlands and the Federal Republic of Germany concerning the course of the common frontier, the boundary waters, real property situated near the frontier, traffic crossing the frontier on land and via inland waters, and other frontier questions, United Nations, Treaty Series, vol. 508, p. 148; Legislative Texts (supra, note 39), Treaty No. 212, p. 757. See also the 1905 Convention between the Netherlands and Prussia concerning the Dinkel and Vechte rivers, article 1, sect. 4, which provides that "[t]he drainage of surplus water shall be carried out in such a manner as to prevent, as far as possible, any overflowing of banks of the Dinkel River" (Legislative Texts (supra, note 39), Treaty No. 210, p. 752).

63/ The term "boundary waters" is defined in Article 36 of the agreement as "surface waters ... which cross or, in some of their sections, form the frontier between Germany and the Netherlands." (Ibid., p. 757).

"3. In addition, the Contracting Parties shall endeavour, within the limits of their financial resources, ... to participate financially, where such participation is equitable, in measures taken in respect of the boundary waters within the territory of the neighbouring State." 64/

These provisions illustrate how the interrelated phenomena of inadequate drainage and floods (inundation) may be treated together and demonstrate a willingness to enter into the kind of co-operation that is necessary in dealing with these common problems.

39. A comprehensive agreement concerning all questions of water economy was entered into in 1956 between Albania and Yugoslavia. Article 1 of the treaty contains the following relevant provisions:

"2. The provisions of this Agreement shall apply to all water economy questions ... and in particular to:

"...

"(c) The discharge of water, drainage and similar measures;

"(d) Protection against flooding; ...

"(i) Protection against soil erosion" 65/

40. In the 1960 Indus Waters Treaty, Pakistan agreed to "maintain in good order its portion of [certain] drainages" The agreement further provides:

"(5) If India finds it necessary that any of [those] drainages ... should be deepened or widened in Pakistan, Pakistan agrees to undertake to do so as a work of public interest, provided India agrees to pay the cost of the deepening or widening.

"(6) Each Party will use its best endeavours to maintain the natural channels of the Rivers, as on the Effective Date, in such condition as will avoid, as far as practicable, any obstruction to the flow in these channels likely to cause material damage to the other Party." 66/

These provisions once again evidence a recognition of the interrelationship between flooding, drainage, and flow obstructions. The latter problem is the subject of the next section.

64/ *Ibid.*, article 58, pp. 757 and 758.

65/ 1956 Agreement between Yugoslavia and Albania concerning water economy questions, together with the statute of the Yugoslav-Albanian Water Economic Commission and with the Protocol concerning fishing in frontier lakes and rivers, article 1, para. 2, *Legislative Texts* (*supra*, note 39), Treaty No. 128, pp. 441 and 442.

66/ Article 4, paras. 4, 5 and 6, United Nations, *Treaty Series*, vol. 419, p. 138; *Legislative Texts* (*supra*, note 39), Treaty No. 98, p. 305.

(iv) Flow obstructions

41. Flow obstructions may be caused by ice, may inhibit drainage or cause erosion, and may ultimately lead to flooding. However, they may also be unrelated to these other conditions, constituting a hazard, in their own right, to such activities as hydropower generation and navigation, and may even cause the displacement of river channels. Obstructions to the flow of a watercourse may result from human activity, but are often caused by events such as landslides and earthquakes, by natural logjams, or by such processes as the accumulation of sediment or of debris. Most treaties addressing the other hazards and conditions dealt with in this chapter also provide for measures to be taken in respect of flow obstructions. In addition to the provisions already mentioned, the following are illustrative.

42. In the 1961 Treaty between the USSR and Poland concerning the régime of the Soviet-Polish State frontier and co-operation and mutual assistance in frontier matters, the parties agree that they will "jointly take the necessary steps to remove any obstacles which may cause displacement of frontier rivers or canals, or which may obstruct the natural flow of water, navigation and timber floating along them." 67/ The agreement goes on to provide that if joint works must be undertaken for the purpose of removing such obstacles, "the appropriate authorities of the Parties shall decide how the works are to be executed. The expenses involved shall be divided equally between them unless a special agreement is concluded on this question." 68/

43. Hungary and Romania agreed in 1963 to ensure that their frontier waters are kept in good condition, and to "take the necessary steps to remove any obstacles which may cause displacement of the beds of frontier rivers or a change in the position of canals or which obstruct the natural flow of water." 69/ The agreement provides further that "[w]here a frontier river, stream or canal shifts its bed spontaneously or as a result of some natural phenomenon, the Parties must jointly and on the basis of equality undertake the work of correcting the bed if that is found necessary." 70/

44. These agreements demonstrate the importance States attach to protecting against damage caused by flow obstructions. Less dramatic but sometimes equally harmful are accumulations of sediment, which can also change the course of entire rivers.

67/ United Nations, Treaty Series, vol. 420, p. 161, article 16, para. 3.

68/ Ibid. (as summarized in Yearbook ... 1974, vol. II (Part Two), document A/CN.4/274, paras. 178-181).

69/ 1963 Treaty concerning the régime of the Hungarian-Romanian State frontier and co-operation in frontier matters, article 16, paras. 1 and 2, United Nations, Treaty Series, vol. 576, p. 275.

70/ Ibid., article 16, para. 4.

(v) Siltation

45. Many watercourses carry heavy sediment loads, as evidenced by the formation of large deltas by the world's major rivers. The annual loads of the Parana in South America and the Ganges-Brahmaputra system in Bangladesh are each approximately 250 million tons of dry solids. ^{71/} Silt accumulations can create navigational and other hazards, and can even divert a river from its original channel. The sediment carried by watercourses can gradually fill in reservoirs, smother spawning beds, clog or damage water supply intakes and treatment plants, and foreclose recreational uses. ^{72/} The introduction of sediment into watercourses can result from natural causes (e.g., heavy runoff), human conduct (e.g., land-use practices such as overgrazing or deforestation, leading to erosion ^{73/}), or both.

46. Sedimentation can be both a cause and effect of flooding. It can cause a river to overflow its banks by filling the riverbed, thus reducing its carrying capacity. While floods can cause widespread damage through the silt they transport, the same sediment can also have beneficial effects:

"Catastrophic sediment movements which disrupt agricultural patterns and transport facilities are a major result of large-scale flooding. Sediment is also an essential component of soils, and an agent of transport of nutrients and essential minerals. Thus sediment is both a hazard and a resource and contingency planning for flood events requires provisions for sediment management." ^{74/}

47. Efforts to remedy siltation problems are further complicated when the sediment originates in another country. Whether the causes of sedimentation are natural or not, watershed management to stabilize headwater areas may be necessary to curb its

^{71/} With regard to the Parana, see Hayton, "The Plata Basin", in A. Barretson, R. Hayton and C. Olmstead, eds., The Law of International Drainage Basins (1967), p. 440, note 374. Concerning the Ganges-Brahmaputra, see paper presented by Prof. J. Riddell at the 1989 Flood Seminar (supra, note 6), abstracted in the conference brochure at p. 31.

^{72/} These and other adverse effects of siltation are described in S. Schwebel, Third report (supra, note 14), p. 158.

^{73/} "Dredging and placer mining for precious metals and stones, or dredging for sands and gravels, can result in considerable sediment load" S. Schwebel, Third report (supra, note 14), p. 157, note 631.

^{74/} Kranck, "Sediment movement associated with flood events", 1989 Flood Seminar (supra, note 6), p. 29. See also S. Schwebel, Third report (supra, note 14), p. 158: "[I]rrigation by inundation has from ancient times depended upon the annual deposit of silt upon agricultural land for renewal of fertility; stemming the transport of silt has major significance for the downstream State dependent upon this 'gift' of nature."

harmful effects. Not only is prevention generally more efficient than cure, efforts to eliminate sediment build-up are often overwhelmed by the volume of silt being transported. ^{75/} This is not to say, however, that elimination of the problem at its source is a simple matter:

"Corrective measures may require extensive and unceasing effort on the part usually of an upstream State whose own uses of the watercourse may be insignificant or unaffected [by the silt]. Clearly, concerted action and contribution by the system States to be benefited by the measures are called for." ^{76/}

48. An early agreement that addresses the problem of siltation is the 1892 Treaty for the regulation of the Rhine, article XVII of which provides as follows:

"The Swiss Federal Council and the Government of Austria-Hungary shall make every effort, in the catchment basins of the tributaries of the Rhine, to carry out corrective measures, construct dams and execute other works calculated to retain sediments in order to reduce drifting in the bed of the Rhine as much as possible and to maintain a regular course for that river in the future.

"Each Government reserves the right to determine the time of execution and the extent of the various measures to correct the flow; nevertheless, the work shall be undertaken as promptly as possible and shall be actively pursued, beginning with the tributaries which cause the greatest damage owing to their heavy load of sediment." ^{77/}

^{75/} "The Plata international watercourse system in South America suffers exceedingly from the problem of siltation. ... The Parana's annual silt load is about 250 million tons, two of the results of which are the choked delta where it meets the Uruguay River to form the Plata River and the constant dredging required in the area of the port of Buenos Aires."

S. Schwebel, Third report (supra, note 14), para. 367. See also Riddell, "The Role of Dredging in Flood Alleviation", paper presented at 1989 Flood Seminar (supra, note 6), abstracted at p. 31 of the conference brochure. Professor Riddell notes that "[w]hile it is unlikely that removal of the sediment is a practical proposal in all situations [and specifically in the case of Bangladesh], dredging may provide a useful solution in critical areas". Ibid.

^{76/} S. Schwebel, Third report (supra, note 14), p. 158.

^{77/} 1892 Treaty for the regulation of the Rhine from the confluence of the Ill, upstream, to the point downstream where the river flows into the Lake of Constance, article 17; Legislative Texts, (supra, note 39), Treaty No. 142, p. 500.

49. To the extent that harmful siltation results directly or indirectly from human conduct it would fall within the definition of pollution proposed in the fourth report (see A/CN.4/412/Add.2, art. 16 [17], para. 1). While some of the effects of siltation are similar to those of the introduction of chemicals into a watercourse, other effects are more akin to those produced by flow obstructions. This may explain why States have sometimes dealt separately with problems of siltation and pollution.

(vi) Erosion

50. Soil erosion can have a number of harmful effects on watercourses and their use. As noted above, it produces sediment, whose deposition can result in flooding, the filling-in of channels, and other harmful effects. Erosion may also cause damage to the banks and beds of watercourses. In recognition of these problems, States have included provisions in their watercourse agreements designed to avoid harmful erosion.

51. An illustration of a treaty whose scope is specifically defined to include the problem of erosion is the 1958 Agreement between Bulgaria and Yugoslavia concerning water economy questions. Article 1 of that accord provides that it shall apply to "all water-economy questions, ... and in particular to: ... (h) Protection against soil erosion in forested and agricultural areas (afforestation, soil conservation, the erection of retaining-walls and silting control) ...". 78/

52. The 1960 Indus Waters Treaty between India and Pakistan includes a general safeguard clause concerning activities designed, inter alia, to promote drainage and to conserve soil against erosion:

"Nothing in this Treaty shall be construed as having the effect of preventing either Party from undertaking schemes of drainage, river training, conservation of soil against erosions and dredging, or from removal of stones, gravel or sand from the beds of the Rivers: Provided that:

"(a) In executing any of the schemes mentioned above, each Party will avoid, as far as practicable, any material damage to the other Party ...". 79/

78/ United Nations, Treaty Series, vol. 367, p. 104; Legislative Texts, (supra, note 39), Treaty No. 161, p. 558. A similar approach is taken by the 1955 Agreement between Yugoslavia and Romania concerning questions of water control on water control systems and watercourses on or intersected by the State frontier, together with the statute of the Yugoslav-Romanian Water Control Commission, article 1, para. (i), Legislative Texts (supra, note 39), Treaty No. 253, p. 928.

79/ Article 4, para. 3; Legislative Texts (supra, note 39), Treaty No. 98, p. 304.

53. Finally, the 1969 Convention between France and the Federal Republic of Germany illustrates the concern of States for protecting watercourse channels against erosion. In that agreement, the two States undertake to develop jointly "[t]he course of the Rhine downstream from the Iffezheim barrage with a view to preventing or remedying erosion of the river-bed". 80/

54. The foregoing review of the practice of States as reflected in their agreements reveals a widely shared concern of long standing for the prevention and regulation of the different events, conditions and other problems that have been considered. Evidence of State practice in the form of diplomatic communications and official papers is not so readily available, as it is often not published. None the less, that which has been discovered offers further support for the proposition that States regard such hazards and dangers as floods as matters that are governed by rules of general international law.

(b) State practice as reflected in diplomatic correspondence and other official papers dealing with specific cases

55. Diplomatic exchanges between the United States and Mexico concerning two separate problems provide illustrations of the views taken by States regarding their mutual rights and obligations in such cases. The first instance concerned the channeling of surface runoff from the United States into Mexico, as described in the following passages of a note to the United States Secretary of State (Acheson) from the Ambassador of Mexico (de la Colina), dated 1 October 1951:

"I have the honor to inform Your Excellency that for several years, without any authorization therefor, part of the surface runoff caused by rains has been diverted artificially by a canal extending from the United States to Mexico east of the city of Douglas, Arizona, and crossing to the east of the Mexican town of Agua Prieta through areas which formerly were outside the boundary of the town but which now, because of the town's growth, are within its limits.

"The rains that fell during 1948 destroyed part of the Mexican embankment of the canal and caused damage to private properties. Since then, during each rainy season, the roads from Agua Prieta to its airport and its municipal cemetery are cut off, and the properties and even the lives of the persons who live near the canal are endangered.

"The Mexican authorities are suggesting three solutions to this problem:

"One solution, and without doubt the most effective, consists in the construction of a new diversion canal more removed from Agua Prieta. With this in view, the two Sections of the International Boundary and Water

80/ Convention concerning development of the Rhine between Strasbourg/Kahl and Lauterbourg/Neuburgweier; United Nations, Treaty Series, vol. 760, p. 347.

Commission have proceeded to make the necessary topographical surveys. Since the canal was constructed by the United States, with no agreement whatever with my country, and since its location has been the principal cause of the damage sustained by our nationals, my Government considers that it devolves upon Your Excellency's Government to finance the necessary work and to pay the damages. The second solution lies in the reconstruction in Mexican territory of the damaged embankment of the canal and the recognition by the Government of the United States of its obligation to pay the costs connected therewith. The third and last solution consists in closing up the canal and constructing a small levee to protect the city of Agua Prieta, along the dividing line, although this diversion would cause damage to the city of Douglas and its inhabitants.

"Obviously, the first of the above-mentioned solutions is the most equitable and desirable, and therefore my Government would like Your Excellency's Government to meet the costs of planning and constructing the new canal and of indemnifying the Mexican citizens who have sustained damage.

"My Government takes the liberty of suggesting that Your Excellency's Government authorize the United States Commissioner to hold conversations with the Mexican Commissioner in order to reach an agreement on the points set forth above." 81/

56. The United States replied to the Mexican Ambassador in a note dated 5 February 1952, which described the results of informal discussions that had been held between the officials of Douglas and Agua Prieta:

"... I am informed that in the year 1919 the City of Douglas undertook the construction of a drainage canal known as the Rose Street Ditch for the purpose of preventing flood damage. The officials of Agua Prieta expressed an interest, and all construction was suspended while representatives of the two cities conferred. The Mexican officials participating in the discussions, according to my information, consented to resumption of construction and even persuaded the City of Douglas to extend the canal, at considerable expense to itself, from the boundary line southward for approximately 1500 feet so that it would discharge into the large arroyo where its flood waters now flow. All parties on both sides of the border seemed to be satisfied at the time and, I believe you will agree, most cordially took advantage of the canal for many years. Hence a question of damages does not seem to arise.

"The present unfortunate situation appears to have developed from the expansion of the City of Agua Prieta toward and beyond the flood arroyo. With the simultaneous expansions of the city of Douglas, the existing drainage canals have become inadequate and represent a matter of concern to both

81/ M. Whiteman, Digest of International Law, vol. 6, 1968, pp. 262 and 263.

cities. As a consequence the International Boundary and Water Commission undertook informal studies and surveys in 1949 and 1950, and the results suggest the desirability of constructing new flood control works in each of our two countries.

"My Government agrees that the International Boundary and Water Commission should continue its studies with the intention of bringing them to a conclusion and of submitting a joint report as early as possible in this year. This report might include recommendations not only concerning remedial measures but also with respect to an equitable division of costs between our Governments" 82/

57. In a note dated 24 March 1955, the Ambassador of Mexico (Tello) advised the American Secretary of State (Dulles) that the situation had not yet been remedied and that, in order to protect Agua Prieta from floods, Mexico would "begin building certain protective works to prevent the entry into Agua Prieta of rain water collected by the Rose Street Canal in Douglas". The Ambassador noted that United States authorities might wish to take measures "to prevent consequences which the return of such water might have in the City of Douglas", and stated that his Government "reserves the right to present a claim for the damage which the residents of Agua Prieta have suffered thus far" 83/

58. On 12 May 1955, the American Assistant Secretary of State (Holland) wrote the following to the mayor of the city of Douglas concerning the flooding problem and the protective works to be built by the Government of Mexico:

"The Department understands that the problem results from the unnatural discharge into Mexico of flood waters originating near Douglas through works constructed by Douglas. There appears to be no occasion nor justification for an international project. In the opinion of both the United States and Mexican Sections of the International Boundary and Water Commission, the problem can be remedied by each city taking entirely feasible and relatively inexpensive steps to prevent the unnatural discharge of flood waters into the other. ...

"... Since neither the United States nor the city of Douglas would have the right, without the consent of the Government of Mexico, to divert water from its natural course in the United States into Mexico to the detriment of citizens of the latter country, there would seem to be no doubt that Mexico has the right to prevent water coming into Mexico through the Rose Street canal by the construction at any time of a dike on the Mexican side of the international boundary. On the other hand, the principle of international law which obligates every state to respect the full sovereignty of other states

82/ Ibid., pp. 263 and 264.

83/ Ibid., p. 264.

and to refrain from creating or authorizing or countenancing the creation on its territory of any agency, such as the Rose Street canal, which causes injury to another state or its inhabitants, is one of long standing and universal recognition." 84/

Mexico subsequently placed an earth embankment across the canal on the Mexican side of the boundary and the city of Douglas took measures that would be adequate to deal at least with normal storm runoffs. 85/

59. This exchange indicates a recognition of the principle that one State may not, through the alteration of natural runoff patterns (or "diver[sion] of water from its natural course"), cause appreciable harm to another State, and that a State threatened by such harm may take appropriate and reasonable precautionary measures. Similar principles were involved in a case that arose only several years later, involving the danger of flooding.

60. On 20 May 1957, the United States Commissioner on the International Boundary and Water Commission (IBWC) informed the Mexican Commissioner that the construction of a highway in Mexico posed a flood danger to the United States. The highway, which paralleled the boundary, crossed two canyons that drain northward from Mexico into the United States. It was constructed of earth fill "up to 60 feet in height without culverts" and, according to the United States Commissioner, was "therefore subject to failure [and] could result in flows at the mouths of the canyons at rates greatly exceeding those of natural flows. At the mouths of the canyons in the United States there are residences and properties which would be seriously damaged by such flows." 86/ The United States Commissioner concluded by stating:

"... I will appreciate an examination of the problem by your Section, and, if the conditions found are as reported to me, that appropriate arrangements be made with the proper authorities in Mexico to take such remedial measures as required to eliminate this threat to interests in my country." 86/

61. The State Government of Baja California (Mexico) drew up plans for culverts but the plans were considered inadequate by engineers of the United States Section of IBWC and was finally abandoned. The State Government prepared a new set of plans which the United States Section considered as appearing adequate with certain suggested modifications.

84/ Ibid., p. 265.

85/ Ibid., referring to a memorandum by engineer Friedkin, United States Section, International Boundary and Water Commission, to the United States Commissioner, of 11 July 1955.

86/ Ibid., p. 260.

62. The United States Ambassador (Hill) sent a note to the Mexican Foreign Office on 29 July 1959, which observed that culverts which had been installed were being covered by embankment fill, rendering compliance with the State Government's plan increasingly unlikely. The note continued:

"In the opinion of engineers of the United States Government who are closely familiar with the recent construction, the embankment at Arroyo de San Antonio [Goat Canyon] will fail in certain circumstances of flood, and the modifications made at the Arroyo de las Cabras are not adequate to ensure its security. It too must be expected to fail in certain circumstances. Since the rainy season in that area begins as a rule in November, when considerable runoff in the arroyos must be anticipated, the matter is not only grave but urgent.

"My Government has accordingly instructed me to urge the Government of Mexico to take appropriate steps to prevent the damage to property and the injury to persons that are likely to result from the improper construction of the highway. I urge particularly that further construction at the Arroyo de las Cabras be suspended until arrangements can be made by the Government of Mexico for adoption of features essential for the security of the embankment in that canyon, and that the embankment at the Arroyo de San Antonio be opened to prevent the accumulation of flood water pending installation of similar modifications at that canyon.

"In view of the foregoing, I am instructed to reserve all the rights that the United States may have under international law in the event that damage in the United States results from the construction of the highway." 87/

63. While some steps towards remedying the situation were thereafter taken, part of the highway was subsequently washed away when water was captured behind the embankments as predicted. Legislation was later passed in the United States authorizing the Secretary of State to enter into an agreement with the Government of Mexico for the joint construction, operation, and maintenance by the two States of an international flood control project. 88/ Such an agreement was concluded on 19 June 1967. 89/

64. Heads of State and other government officials sometimes make statements concerning the rights and obligations under international law of their States and others with reference to specific cases or situations. While not as illuminating as diplomatic exchanges with reference to a specific problem, these statements do indicate the position of the Government in question with reference to the situation being addressed.

87/ Ibid., pp. 261 and 262.

88/ Ibid., p. 262.

89/ International Boundary and Water Commission, United States and Mexico, Minute No. 225. See also the statement by the President of the United States on the Agreement in Weekly Comp. of Pres. Docs., vol. 3, No. 27, 10 July 1967, p. 981.

65. At the opening session of the International Seminar on Bangladesh Floods: Regional and Global Environmental Perspectives, the President of Bangladesh delivered an address in which he stated in part, with reference to that country's flood problems:

"[T]hese problems need co-operation and integrated approach of all the countries of this region. Nowhere, interdependence is more vital than the rational use and management of internationally shared rivers. Shared rivers are archetypical examples of [the need for] ... co-operation on the basis of equity, mutual trust and respect. ... Bangladesh has agreed upon the formation of joint study teams and task force[s] [with neighbouring countries] to study and suggest ways and means for harnessing, developing and rationally managing this vitally important resource. ...

"... The requirement of co-operation has now transformed from political concession or morality into international legal duty. An act contrary to this legal order is a breach of international obligation." 90/

66. This emphasis on the need for co-operation in addressing flood problems is reflected not only in the agreements surveyed above, but also in the work of international organizations, which will be reviewed in the following section.

90/ Address by Hussain Muhammad Ershad, President of the People's Republic of Bangladesh, 1989 Flood Seminar (supra, note 6), pp. 8 and 9.

2. Declarations, resolutions and recommendations adopted by intergovernmental organizations, conferences and meetings

67. Among the decisions adopted at the United Nations Water Conference held at Mar del Plata in 1977 is recommendation E of the Mar del Plata Action Plan, which concerns natural hazards. ^{91/} This recommendation recognizes the need in many countries to strengthen programmes for the reduction of losses associated with floods within the framework programmes for land and water management, and for disaster prevention and preparedness generally. It further calls upon countries to provide effective flood protection by means of structural and non-structural measures; to develop flood forecasting and warning systems as well as measures to combat and evaluate floods; and to improve the collection of data on flood damage.

68. At its forty-second session in 1987, the Economic Commission for Europe (ECE) adopted a set of principles on co-operation in the field of transboundary waters ^{92/} and recommended that ECE member Governments apply the principles in formulating and implementing their water policies. By their terms, the principles "address only issues regarding control and prevention of transboundary water pollution, as well as flood management in transboundary waters ...". ^{93/} Principles 2 and 2(a), set forth under the rubric "Co-operation", provide in relevant part as follows:

"2. Transboundary effects of natural phenomena and human activities on transboundary waters are best regulated by the concerted efforts of the countries immediately concerned. Therefore, co-operation should be established as practical as possible among riparian countries leading to a constant and comprehensive exchange of information, regular consultations and decisions concerning issues of mutual interest: objectives, standards and norms, monitoring, planning, research and development programmes and concrete measures, including the implementation and surveillance of such measures.

"2(a). On the basis of the principle of reciprocity, good faith and good-neighbourliness and in the interest of rational water-resource management and protection of these resources against pollution, riparian countries are called upon to enter into consultation if a riparian country so desires, aiming at co-operation regarding:

^{91/} Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1988 (United Nations publication, Sales No. E.77.II.A.12), paras. 62-65). See also report of the Secretary-General (E/C.7/1989/6), "Summary of conclusions", "F. Improved efficiency in the management of natural hazards: floods".

^{92/} Document E/ECE(42)/L.19, p. 13.

^{93/} Ibid., p. 14.

- "- Protection of ecosystems, especially the aquatic environment;
- "- Prevention and control of transboundary water pollution;
- "- Protection against such dangerous hazards as accidental pollution, floods and ice drifts in transboundary waters; and
- "- Harmonized use of transboundary waters." 94/

69. Recommendations concerning "Reduction of flood risks", "Monitoring and data processing", "Exchange of information", and "Warning and alarm systems" are set forth in principles 9 through 12, respectively. They provide in part as follows:

"Reduction of flood risks

"9. For transboundary water subject to risk of flooding, contracting parties should draw up programmes, jointly if necessary, in order to reduce the risk of floods and ice drifts.

"9(a). Such programmes involve both harmonized construction measures along the waters and non-structural measures. The latter may comprise mutual information and notification (warning and alarm systems) before and during floods caused by precipitation and ice jams; relocation; flood mapping and zoning. When construction measures are envisaged, the entire river basin that may be affected should be investigated to avoid shifting problems onto other river sections as a result of measures taken elsewhere. In principle, activities that may increase the risk of flooding should be offset by measures which diminish these risks. The joint preparation of mathematical models for the simulation of floods is to be recommended as well as their application in designing measures and joint flood-control strategies.

94/ Ibid., p. 15. See also decision on co-operation in the field of transboundary waters, adopted by ECE at its forty-first session (1986) in its decision B (41), especially recommendation 10 concerning the establishment of early warning systems and agreement on measures to prevent floods and to limit their downstream impact. Two Decades of Co-operation on Water, Declarations and Recommendations by the Economic Commission for Europe (United Nations, 1988), p. 24. With regard to national water policy, see Principle 3 (f), contained in the "Declaration of policy on the rational use of water", adopted by ECE at its thirty-ninth session (1984) in its decision C (XXXIX). According to that principle, "[i]n formulating and adopting a future-oriented national water policy, ... special emphasis should be given to: ... (f) Measures to combat harmful effects of water: flooding, soil erosion, etc." (ibid., p. 15.)

"Monitoring and data processing

"10. Contracting parties should establish and implement co-ordinated programmes for monitoring and observation of transboundary water quality, transboundary water pollution, accidental pollution, floods and ice drifts. Likewise, common methodologies should be agreed upon for data processing and evaluation procedures.

"...

"Exchange of information

"11. Contracting parties should, by means of transboundary agreements or other relevant arrangements, provide for the widest possible exchange, as early as possible, of data and information regarding transboundary water quality and quantity relevant to the control of water pollution, accidental pollution, floods and ice drifts in transboundary waters.

"11(a). In addition to supplying each other with information on events, measures and plans at the national level affecting the other contracting parties, as well as on implementation of jointly harmonized programmes, contracting parties should maintain a permanent exchange of information on their practical experience and research. Joint commissions offer numerous opportunities for this exchange, but joint lectures and seminars serve also as suitable means of passing on a great deal of scientific and practical information.

"...

"Warning and alarm systems

"12. Contracting parties concerned should set up and operate efficient warning and alarm systems to counteract special cases of pollution such as pollution from accidents, negligence and offences and to reduce risks of floods and ice drifts. In such emergency cases, parties involved could consider the possibility of mutual assistance on an agreed basis.

"12(a). Warning and alarm systems should consist of a small number of main communication centres, whether permanently manned or rapidly made operational which, on the basis of the national reporting system, would ensure the speediest possible transmission of data and forecasts following previously determined patterns.

"12(b). Warning and alarm systems on transboundary waters should moreover be operated efficiently to permit early undertaking of corrective and protective measures, containment of damage and reduction of risks from natural phenomena and human activities on transboundary rivers.

/...

"12(c). In this connection, contracting parties should inform each other of measures taken on their territory to reduce or eliminate causes of accidental pollution, floods and ice drifts." 95/

70. The recent Interregional Meeting on River and Lake Basin Development held in Addis Ababa on 10-16 October 1988 adopted a recommendation on legal and institutional matters which recognizes the importance of the affirmative participation of watercourse States, on an equitable basis, in maintaining international watercourses in good order:

"... a basin State's right to an equitable share in the uses of the waters of an international drainage basin may be conditional upon that State's willingness, on a reciprocal basis, to participate affirmatively in the reasonable measures and programmes necessary to keep the system of waters in good order (equitable participation)." 96/

71. The Council of the Organization for Economic Co-operation and Development (OECD) adopted a decision on the "Exchange of Information concerning Accidents Capable of Causing Transfrontier Damage" on 3 July 1988. 97/ This decision, which relates principally to accidents at "hazardous installations", 98/ calls upon member countries to "exchange information and consult one another, on a reciprocal basis if so desired, with the objective of preventing accidents capable of causing

95/ Ibid., pp. 18-20.

96/ Recommendation 4 (Legal and Institutional) of the Interregional Meeting, with emphasis on the African region (ECA/NRD/IMRLBD/42), p. 37.

97/ International Legal Materials, vol. 28, 1989, p. 247. See also the OECD Council decision-recommendation concerning "Provision of information to the public and public participation in decision-making processes related to the prevention of, and response to, accidents involving hazardous substances", International Legal Materials, vol. 2 (1989), p. 277.

98/ The term "hazardous installation" is defined in Appendix II, para. (a) of the decision, as:

"an industrial installation which contains more than the threshold quantity of any of the hazardous substances mentioned in Appendix III and in which are used, stored or produced such hazardous substances which are capable, in the event of an accident, of causing serious damage to human health or the environment, including property, outside the installation site, with the exclusion of military or nuclear installations ...". (Ibid., p. 254.)

transfrontier damage and reducing damage should such an accident occur." 99/ Appendix I of the decision sets forth detailed regulations for the exchange of information relating to the prevention of, and response to, accidents at hazardous installations. Member States are enjoined to enter into consultations with a view to organizing emergency plans (Title C), and to transmit an emergency warning to exposed countries immediately "[i]n the event of an accident or imminent threat of an accident capable of causing transfrontier damage ...". 100/ Appendix III of the decision contains a listing of threshold quantities of specified hazardous substances. 101/ This list is to be reviewed and updated on a regular basis. 102/

3. Reports and studies prepared by intergovernmental and international non-governmental organizations

(a) Intergovernmental organizations

72. The Office of the United Nations Disaster Relief Co-ordinator (UNDRO) has prepared a useful study entitled "Water: resource and hazard", concerning protection from natural disasters in general and water-related disasters in particular. 103/ In addressing "prevention" in relation to water-related disasters, the study makes the following observation under the heading "International co-operation and co-ordination":

"In the case of inter-state or international rivers, any failure on the part of river management and other authorities concerned to harmonize or co-operate in river improvement schemes, especially dam or channel enlargement or the construction of entirely new channels or embankments in higher reaches, will inevitably have adverse effects upon people living in downstream areas." 104/

The study goes on to discuss "preparedness" for water-related disasters, and makes the following suggestions concerning "early warning systems":

99/ Ibid., p. 250, para. 1.

100/ Ibid., p. 252, Appendix I, para. 11.

101/ Ibid., p. 255.

102/ Ibid., p. 250, para. 5 of the decision.

103/ Document UNDRO/87/3. See also the Draft Code of Conduct on Accidental Pollution of Transboundary Inland Waters, prepared by government rapporteurs under the auspices of ECE, Senior Advisers to ECE Governments on Environmental and Water Problems (ENVWA/WP.3/R.1) of 30 March 1988.

104/ Ibid., p. 14.

"One important aspect of preparedness is forecasting and early warning. An effective flood warning system must be based on reliable forecasting. Flood forecasting involves the use of precipitation stations (rainfall gauges), stream flow gauges, weather radars, synoptic meteorological networks, reconnaissance aircrafts and meteorological satellites. Warnings are disseminated through radio, television, local emergency communication facilities, sirens and visual signals, such as different colour lights placed in elevated locations." 104/

73. One of the conclusions reached at the 1981 Dakar Interregional Meeting of International River Organizations on the topic of "Progress in co-operative arrangements" stressed the importance of concerted action to deal with water-related hazards and dangers:

"5. The prevention and mitigation of floods, droughts and other hazards natural and man-made, are increasingly of concern to the co-operating States because of the numerous changes that are taking place at accelerating rates within the watersheds; therefore, new or strengthened activities must be undertaken to deal effectively with the detrimental effects of water-related hazards and conditions. The international river and lake organizations are appropriate bodies for initiating studies and recommending measures, contingency plans and warning systems, as well as for conducting the necessary ongoing review of conditions and the adequacy of measures undertaken." 105/

74. The Economic Commission for Europe in 1976 issued a report, prepared under the auspices of the ECE Committee on Water Problems, entitled "Rational methods of flood control planning in river basin development". 106/ The report was prepared on the basis of Government replies to a questionnaire adopted by the Committee on Water Problems. It draws the following "conclusion" from Government responses to questions on the topic, "Principles and main trends of international agreements on flood control":

"International flood control agreements concluded by those countries which replied to the questionnaire aim at the establishment of a co-operation which in all cases refers to an exchange of information on the development of a flood situation and, in most cases, [to] the establishment of joint, co-ordinated plans for the construction of protective works and to mutual commitments resulting therefrom." 107/

105/ "Experiences in the development and management of international river and lake basins", Natural Resources/Water Series No. 10 (United Nations publication, Sales No. E.82.II.A.17), part one, "Report of the meeting", para. 49.

106/ Document ECE/WATER/17 (United Nations publication, Sales No. E.76.II.E.26).

107/ Ibid., p. 52.

(b) International non-governmental organizations

75. Apart from the work of previous Special Rapporteurs of the Commission, the set of seven articles on flood control adopted in 1972 by the International Law Association still constitute the only major effort at stating the general legal rules governing these problems and formulating recommendations in relation to them. The articles read as follows:

"Article 1

"In the context of the following articles.

"1. 'Floods' means the rising of water levels which would have detrimental effects on life and property in co-basin States.

"2. 'Flood control' means the taking of all appropriate steps to protect land areas from floods or to minimize damage therefrom.

"Article 2

"Basin States shall co-operate in measures of flood control in a spirit of good neighbourliness, having due regard to their interests and well-being as co-basin States.

"Article 3

"Co-operation with respect to flood control may, by agreement between basin States, include among others:

"(a) Collection and exchange of relevant data;

"(b) Preparation of surveys, investigations and studies and their mutual exchange;

"(c) Planning and designing of relevant measures;

"(d) Execution of flood control measures;

"(e) Operation and maintenance of works;

"(f) Flood forecasting and communication of flood warnings;

"(g) Setting up of a regular information service charged to transmit the height of water levels and the discharge quantities.

"Article 4

"1. Basin States should communicate amongst themselves as soon as possible on any occasion such as heavy rainfalls, sudden melting of snow or other events likely to create floods [or] dangerous rises of water levels in their territory.

"2. Basin States should set up an effective system of transmission in order to fulfil the provisions contained in paragraph 1, and should ensure priority to the communication of flood warnings in emergency cases. If necessary a special system of translation should be built up between the basin States.

"Article 5

"1. The use of the channel of rivers and lakes for the discharge of excess waters shall be free and not subject to any limitation provided this is not incompatible with the object of flood control.

"2. Basin States should maintain in good order their portions of watercourses including works for flood control.

"3. No basin State shall be prevented from undertaking schemes of drainage, river draining, conservation of soil against erosion and dredging, or from removal of stones, gravel or sand from the beds of its portions of watercourses provided that, in executing any of these schemes, it avoids any unreasonable interference with the object of flood control, and provided that such schemes are not contrary to any legal restrictions which may exist otherwise.

"4. Basin States should ensure the prompt execution of repairs or other emergency measures for minimization of damage by flooding during periods of high waters.

"Article 6

"1. Expenses for collection and exchange of relevant data, for preparation of surveys, investigations and studies, for flood forecasting and communication of flood warnings, as well as for the setting up of a regular information service shall be borne jointly by the basin States co-operating in such matters.

"2. Expenses for special works undertaken by agreement in the territory of one basin State at the request of another basin State shall be borne by the requesting State, unless the cost is distributed otherwise under the agreement.

"Article 7

"A basin State is not liable to pay compensation for damage caused to another basin State by floods originating in that basin State unless it has acted contrary to what could be reasonably expected under the circumstances, and unless the damage caused is substantial." 108/
