

## *Mar del Plata Action Plan:*

### RECOMMENDATIONS

#### *A. Assessment of Water Resources*

In most countries there are serious inadequacies in the availability of data on water resources, particularly in relation to ground water and water quality. Hitherto, relatively little importance has been attached to its systematic measurement. The processing and compilation of data have also been seriously neglected.

**To improve the management of water resources, greater knowledge about their quantity and quality is needed. Regular and systematic collection of hydro-meteorological, hydrological and hydrogeological data needs to be promoted and be accompanied by a system for processing quantitative and qualitative information for various types of water bodies. The data should be used to estimate available precipitation, surface-water and ground-water resources and the potentials for augmenting these resources. Countries should review, strengthen and co-ordinate arrangements for the collection of basic data. Network densities should be improved; mechanisms for data collection, processing and publication and arrangement for monitoring water quality should be reinforced.**

To this end, it is recommended that countries should:

(a) Establish a national body with comprehensive responsibilities for water-resources data, or allocate existing functions in a more co-ordinated way, and establish data banks for the systematic collection, processing, storage and dissemination of data in agreed formats and at specified intervals of time;

(b) Expand and extend the network of hydrological and meteorological stations, taking a long-term view of future needs, following as far as possible the recommendations of the United Nations specialized agencies on standardization of instruments and techniques and comparability of data, and use existing meteorological and hydrological data series for the study of seasonal and annual fluctuations in climate and water resources. Such analysis could also be used in the planning and design of networks;

(c) Establish observation networks and strengthen existing systems and facilities for measurements and recording fluctuations in ground-water quality and level; organize the collection of all existing data on ground water (borehole logs, geological structure, and hydrogeological characteristics, etc.) systematically index such data, and attempt a quantitative assessment so as to

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*General note.* Many recommendations for action contain references to national or country action, organization, policies and legislation. A number of countries with federal systems of government interpret such recommendations in the light of their constitutional division of responsibilities. Actions, organization, policies and legislation in these countries accordingly will be taken at the appropriate level of government.

determine the present status of and gaps in knowledge; increase the search for, and determination of, the variables of aquifers, with an evaluation of their potential and the possibilities of recharge;

(d) Standardize and organize as far as possible the processing and publication of data so as to keep the statistics up to date and take advantage of the observations made in stations operated by different institutions;

(e) Include consideration of diseases associated with water as an integral part of water assessments and the consideration of the interrelationships of water quality, quantity and related land use;

(f) Make periodic assessments of surface- and ground-water resources, including rainfall, evaporation and run-off, lakes, lagoons, glaciers and snowfields, both for individual basins and at the national level, in order to determine a programme of investigation for the future in relation to development needs; intensify programmes already under way and formulate new programmes wherever needed;

(g) Provide the means for national mechanisms so established to use, as appropriate, modern technologies (remote sensing, nuclear methods, geophysical techniques, analogue and mathematical models) in collecting, retrieving and processing data on the quantity or quality of water resources; manual data-processing methods may still satisfy the simple requirements of small collections, although it may be necessary to introduce various degrees of automation, ranging from small punch-card machines to large electronic computing systems;

(h) Standardize measurement techniques and instruments, and automate stations as appropriate; reference should be made to international standards and recommendations adopted by Governments through various international organizations;

(i) Support and promote national contributions to regional and international programmes on hydrological studies (e.g. the International Hydrological Programme and Operational Hydrological Programme);

(j) Co-operate in the co-ordination, collection and exchange of relevant data in the case of shared resources;

(k) Appropriate substantially increased financial resources for activities related to water resources assessment and to establish or strengthen related institutions and services as necessary;

(l) Establish or strengthen training programmes and facilities for meteorologists, hydrologists and hydrogeologists at professional and subprofessional levels;

(m) Prepare an inventory of mineral and thermal waters in countries possessing such resources with a view to studying and developing their industrial potential as well as their use as spas;

(n) Develop methods for the estimation of available water resources using aerological observations for the computation of the atmospheric water budget in large river basins, rivers and continents;

(o) Provide for the studying and analysing of hydrological data on surface and ground water by multidisciplinary teams so as to make adequate information available for planning purposes;

(p) Include the development of forecasting methods in quantitative and qualitative assessment, especially in the developing countries;

(q) Include effective decision-making methods in the management of water quality, based on techniques of natural quality regulation that have been proved in practice;

(r) Take specific national characteristics and conditions into account in different countries in assessing water quality and establishing water-quality criteria.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

*(a) Surface water*

- (i) Offer technical assistance, at the request of interested Governments, to review the adequacy of existing networks and make available the use of advanced techniques such as remote sensing;
- (ii) Offer technical assistance, including personnel, funds, equipment and training, to strengthen the networks and to establish laboratories for comprehensive water analysis;
- (iii) Offer assistance and facilities for the establishment of data banks, processing and periodic publication of data by modern methods of electronic data processing, archiving and retrieval;
- (iv) Help in making qualitative and quantitative assessments of surface-water resources, both gross and economically usable quantities, for different sectoral uses;
- (v) Strengthen, in general, technical assistance programmes for the development of integrated national data systems.

*(b) Ground water*

- (i) Offer assistance for the establishment or strengthening of observational networks for recording quantitative and qualitative characteristics of ground-water resources;
- (ii) Offer assistance for the establishment of ground-water data banks and for reviewing the studies, locating gaps and formulating programmes of future investigations and prospection;
- (iii) Offer help, including personnel and equipment, to make available the use of advanced techniques, such as geophysical methods, nuclear techniques, mathematical models, etc.

*(c) Snow and ice*

Advise on international standards and the establishment of observation networks regarding snow and ice in order to permit international exchange of this information, especially concerning international rivers.

*B. Water Use and Efficiency*

In many areas of the world, water is wasted or used in excess of actual needs. Often water is not used efficiently for agricultural purposes owing to losses in transit, unsuitable irrigation systems or lack of institutional co-ordination. Since irrigation is the principal water user in a great many countries, and since water and land capable of being cultivated are becoming increasingly scarce, there is a special need to achieve greater efficiency in the use of both these resources. At the same time, there is an imperative need in some regions to increase total agricultural production and productivity in order to

increase food production. Furthermore, a large portion of the world's population does not have reasonable access to safe water supply and lacks hygienic waste-disposal facilities. In urban and industrial areas, the provision of adequate facilities and services for treatment of wastes generally lags behind the provision of water supplies, with consequent problems in water-quality management. In many parts of the world only a small part of the potential for hydroelectric power generation has been developed, even though the utilization of these resources may, in many cases, be very attractive as a result of the world energy situation. The growth of population also calls for ever larger areas for recreation and fisheries. In many regions, rivers also constitute one of the main means of communication and the potential for inland water transport should be developed. The value of inland water resources for food production should be recognized as important to protein supply.

*Instruments to improve the efficiency of water use*

Since water is a limited and valuable resource and since its development requires high investment, its use must be efficient and must secure the highest possible level of national welfare.

**Effective legislation should be framed to promote the efficient and equitable use and protection of water and water-related ecosystems. Pricing and other economic incentives should be used to promote the efficient and equitable use of water.**

To this end it is recommended that national institutions for water resource management should:

- (a) Carry out research studies on the actual and potential quantities of water to be used by the various sectors, and encourage effective application of the results of these studies;
- (b) Create incentives for increasing the efficiency of water use, such as financial assistance by Governments or credits for the adoption of new technologies, and introduce where appropriate scales of charges that reflect the real economic cost of water or that rationalize subsidies within the framework of a sound water policy;
- (c) Evolve appropriate procedures for economic methods of reusing and recycling water, and where relevant introduce dual water systems for drinking and other uses;
- (d) Enforce clear punitive arrangements to encourage the reduction or elimination of contaminant discharges which do not conform to standards, and provide adequate powers of applying deterrents and punishments;
- (e) Promote, and develop by means of suitable incentives and appropriate policies, the efficiency of waste-water purification systems and the adoption of less polluting technologies;
- (f) Take measures to encourage the use in productive activities of technologies which consume little water or which reuse it;
- (g) Because water is a valuable and scarce resource deliberate administrative policies should be established, such as measuring supplies, licensing diversions, charging for water and penalizing wasteful and polluting acts;
- (h) Encourage the use of associations of water users or other local community organizations to instil a collective responsibility in the decision-making process for the programming, financing and care in the use of water;

- (i) Use school programmes and all public media to disseminate information concerning proper water use practices.

*Efficiency and efficacy in regulation and distribution of the resources*

**National mechanisms for the management of water resources should apply the best measures to improve the existing systems and the best available techniques for planning and design of conservation and distribution systems in the most efficient way and should equally attend to proper maintenance, control at the regional, national and farm level and operation of delivery systems to increase efficiency.**

To this end, it is recommended that:

- (a) Measures be taken to utilize ground-water aquifers in the form of collective and integrated systems, whenever possible and useful, taking into account the regulation and use of surface-water resources. This will provide an opportunity to exploit the ground-water aquifers to their physical limits, to protect spring and ground water from overdraught and salinity, as well as to ensure proper sharing of the resources;
- (b) Studies should explore the potential of ground-water basins, the use of aquifers as storage and distribution systems, and the conjunctive use of surface and subsurface resources to maximize efficacy and efficiency;
- (c) Systems analysis and modelling techniques should be applied to improve efficiency and efficacy in storage operation and distribution systems;
- (d) Studies should explore further the possibility of effecting interbasin transfers of water; special attention should be given to environmental impact studies;
- (e) Measures should be taken to ensure systematic planning of the distribution of water among the various users as a prerequisite for full and rational utilization of the volume of water available for exploitation;
- (f) Programmes should be strengthened for the dissemination of existing information and experience;
- (g) Studies should explore the extent to which new effluents generated from new demands will effectively reduce the scale of projected resource development.

*Measurement and projections of water demand*

In many countries no systematic measurements are being made for planning purposes concerning the use and consumption of water by sectors. The absence of this information has hampered the use of more sophisticated methods of estimating future requirements. Where projections have been made they have not been based on uniform norms or comparable methodologies.

**In order to project future water needs it is desirable to have data on use and consumption and quality by type of user and also the information necessary to estimate the effect of the application of different policy instruments (tariffs, taxes, etc.) in influencing the various areas of demand. The demand for water for different purposes should be estimated at different periods of time in conformity with national development goals to provide the basis and the perspective for the planned development of available water resources.**

To this end, it is recommended that national bodies responsible for water resource management should:

- (a) Initiate action to estimate the demand for water for different purposes, e.g., community water supply, agriculture, industry hydroelectricity, etc.;
- (b) Ensure that statistics on the use and consumption of water should be organized, improved and amplified on the basis of those prepared by the existing services, supplemented by censuses, surveys, etc.; censuses on productive activities should include information on volumes of water used, sources of supply, coefficients of reuse, and quality data;
- (c) Identify the targets to be achieved over different periods of time, taking into consideration the anticipated population growths, and the priority to be given in such matters as the number of people to be served with reasonable access to safe water supply; areas to be irrigated under different crops, and specific production per unit of water; and the units of hydropower to be installed to satisfy anticipated demand;
- (d) Endeavour, as far as is practicable, to adopt the norms and methodologies recommended by the United Nations in making such demand projections;
- (e) Base their approach to long-term demand estimates on the use of methodologies involving models which include the population and population location variable. In this context, countries should also take into account an evaluation of the over-all demand for water-consuming basic goods and services on the part of the population;
- (f) Consider conservation as an explicit policy, bearing in mind changes in demand, water-use practices, lifestyles and settlement patterns;
- (g) Evolve appropriate methodology for the management of demand, using suitable concepts, such as "risk indices".

International organizations and other supporting bodies should, as appropriate, assist, at the request of countries or subregional intergovernmental organizations, in the drawing up of demand projections for countries as well as for river basins in accordance with the commonly accepted norms and techniques.

#### *Community water supply and waste disposal*

**In order to implement recommendation C. 12 of Habitat: United Nations Conference on Human Settlements,\* the decade 1980-1990 should be designated the international drinking water supply and sanitation decade and should be devoted to implementing the national plans for drinking water supply and sanitation in accordance with the plan of action contained in resolution II below. This implementation will require a concerted effort by countries and the international community to ensure a reliable drinking-water supply and provide basic sanitary facilities to all urban and rural communities on the basis of specific targets to be set up by each country, taking into account its sanitary, social and economic conditions.**

To this end it is recommended that countries should:

- (a) Set targets for community water supply and waste disposal and formulate specific action programmes to attain them, while evaluating the progress made at regular intervals;

*\*Report of Habitat: United Nations Conference on Human Settlements (United Nations publication, Sales No.: E.76.IV.7), chap. II; see also Habitat in Retrospect, Margaret R. Biswas, International Journal of Environmental Studies, January, 1978.*

- (b) Establish standards of quality and quantity that are consistent with the public health, economic and social policies of Governments, ensuring by appropriate measures, duly applied, that those standards are observed;
- (c) Ensure the co-ordination of community water-supply and waste-disposal planning with over-all water planning and policy as well as with over-all economic development;
- (d) Adopt policies for the mobilization of users and local labour in the planning, financing, construction, operation and maintenance of projects for the supply of drinking water and the disposal of waste water;
- (e) Consider carefully inequalities in the standard of drinking water and sewerage services among the various sectors of the population. As far as possible, design programmes so as to provide basic requirements for all communities as quickly as possible, generally deferring the provision of improved services to a subsequent stage. Priority should be given to the provision of drinking water and sewerage services in areas where the quality and quantity of water supplied is inadequate, for instance, in rural areas and urban fringe areas populated by low-income groups;
- (f) Ensure that the allocation of funds, of other resources and of all forms of economic incentives to community water-supply and sanitation programmes reflects the urgency of the needs and the proportion of the population affected;
- (g) Promote the construction of facilities by granting low-interest loans or subsidies to communities and to other entities concerned with water supply and sanitation;
- (h) Provide, where needed, additional well-drilling capability or other equipment for the establishment of local drinking-water supply facilities;
- (i) Review the organizational infrastructure for community water supply and sanitation and set up, where it is considered appropriate, a separate department for this purpose;
- (j) Prepare long-term plans and specific projects with detailed financial implications;
- (k) Develop a financing system capable of mobilizing the resources needed for the implementation of the national programme for water supply and sanitation, as well as for the operation and maintenance of these services, for instance, by a system of revolving funds to ensure continued financial support for the execution of long-term programmes. This system should make it possible to bridge the gap between production costs and payment capacities;
- (l) Provide mutual assistance in the transfer and application of technologies associated with these programmes;
- (m) Carry out special water-supply and waste-treatment programmes as national or regional undertakings or as activities of non-profit organizations, such as users' associations, where local resources do not make it possible to achieve the desired goals;
- (n) Adopt pricing policies and other incentives to promote the efficient use of water and the reduction of waste water, while taking due account of social objectives;
- (o) Seek to promote in rural areas with low population density, where it seems appropriate, individual water-supply and waste-water disposal systems, taking account of sanitary requirements;

(p) Carry out a programme of health education, parallel with the development of community water supply and sanitation, in order to heighten the people's awareness with respect to health;

(q) Establish, at the national level, training programmes to meet immediate and future needs for supervisory staff;

(r) Provide inventory and protection of water-supply sources;

(s) Provide additional facilities and possibilities for drinking water supply during natural hazards;

(t) Use water effectively, reduce losses, equalize water prices by purposes for which the water is used over wide areas and reduce water costs due to reorganization models of some countries' water-supply arrangements so as to strengthen the financial management basis of supplies in metropolitan, urban and rural areas. Develop new concepts, such as the use of advanced water-treatment techniques, the utilization of low-quality sources and the re-use of waste water. These trends (reorganization and the use of new concepts) need to be encouraged where they are found to be necessary and desirable. Rural water-supply projects and programmes for implementing them on a priority basis are being undertaken in some countries and should be encouraged in others to achieve the targets in the field of community water supplies set by Habitat: United Nations Conference on Human Settlements.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Provide technical assistance to countries in the preparation of long-term plans and specific projects;
- (ii) Consider adapting their criteria for financial assistance in accordance with the economic and social conditions prevailing in the recipient countries;
- (iii) Promote research, development and demonstration projects for reducing the costs of urban and rural water-supply and waste-disposal facilities;
- (iv) Promote public health education;
- (v) Support research, development and demonstration in relation to predominant needs, particularly: (a) Low-cost ground-water pumping equipment; (b) Low-cost water and waste-water treatment processes and equipment, with emphasis on the use of materials and skills likely to be available to rural communities for installation, operation and maintenance;
- (vi) Strengthen the exchange of information, *inter alia*, by arranging expert meetings, and development of a clearing-house mechanism.

#### *Agricultural water use*

**The increase of agricultural production and productivity should be aimed at achieving optimum yield in food production by a definite date, and at a significant improvement in total agricultural production as early as possible.**

**Measures to attain these objectives should receive the appropriate high priority. Particular attention should be given to land and water management both under irrigated and rainfed cultivation, with due regard to long-term as well as short-term productivity. National legislation and policies should provide for the properly integrated management of land and water resources. Countries should, when reviewing national policies, institutions and legislation, ensure the co-ordination of activities and services involved in irrigation and drainage**

development and management. It is necessary to expand the use of water for agriculture together with an improvement in efficiency of use. This should be achieved through funding, providing the necessary infrastructure and reducing losses in transit, in distribution and on the farm, and avoiding the use of wasteful irrigation practices, to the extent possible. Each country should apply known techniques for the prevention and control of land and water degradation resulting from improper management. Countries should give early attention to the improvement of existing irrigation and drainage projects.

In this context, countries should:

(a) Bear in mind principles of integrated land and water management when reviewing national policies, administrative arrangements and legislation, and pay heed to the need to augment present levels of agricultural production;

(b) Undertake or continue studies on the relationship between land use and the elements of the hydrological cycle at the national and international levels;

(c) Consider appropriate incentives such as safeguarding water rights for farmers and encourage holders of irrigated land to adopt management practices compatible with long-term resource management requirements;

(d) Plan and carry out irrigation programmes in such a way as to ensure that surface and subsurface drainage are treated as integral components and that provision of all requirements is co-ordinated with a view to optimizing the use of water and associated land resources;

(e) Provide financial resources and qualified manpower services for better water-use and management practices, proper maintenance, control and operation of distribution systems, and joint use of surface and ground water and eventually waste water, paying due attention to the needs of small-scale agriculture;

(f) Intensify work on determining crop-water requirements, integrate schemes for swamp reclamation and drainage in schemes for comprehensive river development, bearing in mind their effect on hydrological régime and the environment; give due attention to problems of salinity intrusion, particularly in coastal areas, and integrate measures for salinity control;

(g) Give attention to problems of soil and water conservation through good management of watershed areas which includes a rational crop distribution, improvement of pastures, reforestation, avalanche and torrent control, as well as the introduction of appropriate agricultural soil conservation practices, taking into account the economic and social conditions existing in the respective watershed areas;

(h) Adopt appropriate pricing policies with a view to encouraging efficient water use, and finance operation and maintenance costs with due regard to social objectives; ✓

(i) Adopt appropriate measures for instructing and encouraging water users in efficient animal or farm husbandry and farm management. Particular attention should be paid to groups not reached by formal education;

(j) Take steps to complete irrigation and drainage projects currently under construction as expeditiously as possible, so that benefits on past investment accrue without delay;

(k) Take related health and environmental aspects into account in the planning and management of agricultural water use.

To this end it is recommended that:

(a) The institutional machinery responsible for water management should possess sufficient means and powers for the management of water for agricultural purposes, bearing in mind the physical interdependence of surface and ground water and in accordance with all its uses;

(b) Measures should be adopted for the supervision and control of water distribution and use, taking into account livestock and irrigated crop farming needs in keeping with the type of crop, soil and zone, the level of agricultural technology which can be attained, and the risk of soil erosion and salination of the soil and water, with the adoption, as far as possible, of arrangements to measure the amount of water supplied;

(c) The main cause of waste in the use of water should be identified and corrected, but also the limitations on the adoptions of sophisticated - even if more efficient - irrigation methods should be taken into consideration;

(d) Steps should be taken to increase the efficiency of water use in existing irrigation systems by improving watercourses, land levelling and improving water management on farms and in distributaries;

(e) Irrigation plans should be formulated (preferably by stages) which coordinate the implementation of the infrastructure with rural development and the promotion of suitable technology, *inter alia*, control of water-associated disease; the improved management of soils; the introduction of new species; and provision for the training of personnel and the use of the necessary technical assistance;

(f) Agricultural practices that will regulate the run-off in humid areas should be promoted, particularly where periods of heavy rains alternate with periods of drought, with a view to improving the efficiency of measures against flooding and achieving better organization and regulation of water supplies;

(g) Irrigation projects should be based on detailed soil investigations and consequent land classification;

(h) More attention should be given to procedures for more effective utilization of water at the village level, such as through better irrigation practices, the appropriate use of mulch for kitchen gardens as well as cash crops, and where feasible, the use of companion cropping. These and other measures can extend the responsible use of water, improve agricultural production and nutrition, and ease the onerous conditions of agricultural labour of special importance to the rural women, on whom so many burdens fall;

(i) In the strategy for the development of new irrigation facilities, a judicious combination of major, medium and minor schemes would be desirable;

(j) A more efficient use of water per unit of agricultural product is desirable;

(k) In the execution of schemes to combat salinity and waterlogging, economic and policy issues need to be taken into account in the planning procedures and the affected farmers need to be involved in the planning and implementation of schemes;

(l) High priority should be given to the adoption of urgent measures for soil and water conservation within the framework of integrated land and water management in order to increase agricultural production without destroying those resources.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Assist countries in the preparation of master plans and programmes and definitive project reports on the use of water in agriculture, including land use, irrigation, dry farming techniques, drainage, flood control, salinity intrusion, swamp reclamation and soil and water conservation;
- (ii) Strengthen the exchange of information, *inter alia*, through the organization of expert and other meetings.

#### *Fisheries*

**Plans for the use of water resources and for territorial development should take into account the use of water for fisheries, in order to increase the supply of proteins to the world population.**

To this end it is recommended that countries should:

- (a) Protect, conserve and exploit rationally their fisheries resources, avoiding the effects of natural or human pollution and co-ordinating the relevant regulations with interested countries sharing water resources;
- (b) Develop research and information dissemination programmes concerning fisheries;
- (c) Promote intensive fisheries activities including aquaculture by establishing the needed additional infrastructures and facilities, at the same time avoiding the introduction of unsuitable species into the local ecosystem;
- (d) Where a reasonable cost-benefit ratio is expected make provision for fish passage facilities and other actions needed to avoid damage to aquatic systems, as initial elements of project design and funding;
- (e) Regulate, restrict or prohibit the use of certain polluting substances, especially toxic and organoleptic substances, to prevent their entry into waters. These measures are required to protect human health and the aquatic ecosystems upon which life is dependent.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Assist countries in preparing plans, programmes and facilities for the protection, development and utilization of fishery resources in connexion with water resources development in order to augment world protein supplies;
- (ii) Assist countries in research and information dissemination programmes in support of increasing fishery production;
- (iii) Assist countries in controlling toxic and other pollutants damaging to aquatic systems and to human health.

#### *Industrial water use*

**In many countries problems associated with the use of water in industry need to be studied in greater depth and in a more systematic and comprehensive manner than hitherto, in both their quantitative and their qualitative aspects, including questions of input and output quality, level of treatment required, if any, and recycling of water. These matters may be crucial to the attainment of industrialization targets in the developing countries.**

To this end it is recommended that countries should:

- (a) Initiate studies on the present and potential use of water by specific industries, including such aspects as recycling, substitution for and reduction of water inputs and use of low-quality waters for cooling and waste management;
- (b) Make an assessment of factors relating to the quality and quantity of water and industrial wastes as important criteria in decision-making on industrial locations within the framework of land-use planning;
- (c) Evolve appropriate procedures for economic methods of re-using and recycling water, including corrective treatment for industries, and explore the possibilities for using waters of qualities commensurate with the purposes for which they are needed;
- (d) Take into account the water requirements of industries in the planning and formulation of water-development projects, paying due attention to the necessary safeguards against adverse health and environmental impacts arising from industrial activities and to the needs of small-scale and rural industries;
- (e) Include waste treatment or other appropriate measures to eliminate or reduce pollution as an integral part of municipal and industrial water-supply systems;
- (f) Provide stimulating investments and other economic incentives and regulations to use water efficiently, to treat wastes at their source and, where advantageous, jointly with domestic waste;
- (g) Adopt the necessary measures to ensure that the use and disposal of effluents is consistent with the requirements of health and environmental quality;
- (h) Carry out a policy aimed at promoting research and the establishment of industrial technologies that use little water and produce little or no waste and also of technical processes for the recovery of usable substances in waste waters;
- (i) Take note of the targets and recommendations of the Lima Declaration and Plan of Action on Industrial Development and Co-operation evolved at the Second General Conference of the United Nations Industrial Development Organization in 1975, which should greatly expand use of water by industry in certain countries.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Assist countries in making an assessment of water requirements for industrial purposes in the different countries, subregions and river basins, and evolve economical methods for the re-use and recycling of water, where necessary;
- (ii) Strengthen programmes for the exchange of information, *inter alia*, by arranging expert and other meetings;
- (iii) Support or arrange research and study programmes, particularly in relation to pricing policy and also methods of water and waste-water treatment which are conducive to a reduction in cost of treating effluents;
- (iv) Evolve a common international statistical data base that will relate water use, particularly the effects of water quality available, to process technologies, and the degree of re-use and recycling.

*Hydroelectric power generation*

**In the formulation of plans for the development of the electricity sector, it is necessary to give attention in all cases to the advantages offered by multi-purpose hydroelectric projects, including pumped storage, that ensure the continued enjoyment of this renewable resource without serious damage to health and the environment.**

To this end it is recommended that countries should:

- (a) Make national inventories of potential hydroelectric projects to be promoted and supplemented with a view to determining which projects, because of their characteristics, can satisfy electricity and water-flow demands on a long-term basis;
- (b) Undertake studies on the multiple and integrated development of the water resources in watersheds with hydroelectric potential;
- (c) Integrate plans for the development of hydropower generation with the over-all development plans for both the energy and water sectors, taking into account the potential savings in foreign exchange which can accrue therefrom;
- (d) Evaluate the impact of the non-consumptive use of water for power generation on other consumptive uses in order to harmonize the two aspects of water use;
- (e) Prepare detailed project reports for specific projects to facilitate their financing;
- (f) Collect data on the present and future use of water for power generation, so that this aspect of power development can become an integral component of multipurpose river basin development;
- (g) Include in studies on the assessment and feasibility of hydroelectric projects potential tourism, recreational, ecological and psychological benefits, for commercial and social purposes, as well as their multiplier effect on the national economy;
- (h) Encourage small-scale hydroelectric installation to meet local energy needs, whenever economically, environmentally and socially acceptable;
- (i) Give consideration to pumped storage hydroelectric projects as a source of peaking power;
- (j) In addition to the undertaking of new hydropower projects, optimize power generation from existing hydro-projects by improved reservoir regulation.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Assist in preparing long-term plans for utilizing the potential for power development in river basins in the different countries;
- (ii) Assist in preparing definite project reports to help Governments in seeking investment finance for specific projects;
- (iii) Promote the elaboration of detailed load surveys at the national and subregional levels and in individual river basins.

*Inland navigation*

**Plans for the use of water resources and for territorial development should take account of the use of water for inland navigation consistent with other objectives of multipurpose development and with special regard to the needs of land-locked countries.**

To this end it is recommended that countries should:

(a) Carry out studies which include the use of rivers and the modernization of port installation and shipping equipment as an integral part of combined regional land and water transport systems, taking into consideration the needs of the land-locked countries;

(b) Ensure in programmes of comprehensive and integrated multipurpose river basin development, the design and maintenance or improvement of navigation systems which are based upon consideration of the special hydraulic and other technical requirements necessary to efficient inland navigation;

(c) Maintain programmes for the collection of hydrometeorological data in river basins used for navigation in order to provide adequate systems for prediction of water levels;

(d) Adopt regulations which make it compulsory to instal equipment in ships to avoid the discharge of untreated organic and chemical effluents into the water and to construct installations in ports to receive and treat tank and bilge wastes. Furthermore, the dumping of radio-active wastes should be prohibited;

(e) Ensure that all vessels transporting oil or hazardous substances comply with the highest safety standards so that accidental spills may be avoided to the greatest extent possible. Severe penalties for non-compliance are necessary.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Assist countries in preparing plans, programmes and projects for inland water transport, especially taking into consideration the needs of the land-locked countries;
- (ii) Assist countries in the construction of basic facilities such as navigation channels and locks and the maintenance of waterways, mapping, navigation charts, etc.;
- (iii) Assist countries in building up the requisite technology within the countries.

*C. Environment, Health and Pollution Control*

Large-scale water-development projects have important environmental repercussions of a physical, chemical, biological, social and economic nature, which should be evaluated and taken into consideration in the formulation and implementation of water projects. Furthermore, water-development projects may have unforeseen adverse consequences affecting human health in addition to those associated with the use of water for domestic purposes. Water pollution from sewage and industrial effluents and the use of chemical fertilizers and pesticides in agriculture is on the increase in many countries. It is also

recognized that control measures regarding the discharge of urban, industrial and mining effluents are inadequate. Increased emphasis must be given to the question of water pollution, within the over-all context of waste management.

*Environment and health*

**It is necessary to evaluate the consequences which the various uses of water have on the environment, to support measures aimed at controlling water-related diseases, and to protect ecosystems.**

To this end it is recommended that countries should:

- (a) Review the implementation of the recommendations of the 1972 United Nations Conference on the Human Environment relating to the water sector (recommendations 51-55)\* and take such action as is necessary to accelerate the pace of their implementation;
- (b) Arrange for scientific, systematic and comprehensive studies of the environmental impact of water projects as an integral part of the process of preparing project reports for water development;
- (c) Ensure an interdisciplinary approach to such studies so that the full and all-round impact of the water projects can be assessed in a more comprehensive, effective and co-ordinated manner than would otherwise be possible;
- (d) Promote research and systematic measurement of the effects that development projects have had on the environment and on other natural resources;
- (e) Develop suitable procedures to evaluate the qualitative and quantitative environmental impacts of water projects;
- (f) Investigate the possibility of the spread of diseases related to water as a result of large-scale water projects as the project is formulated and take appropriate action in conjunction with the implementation of the project so that no untoward health hazards result from its implementation;
- (g) Ensure that due consideration is given to fisheries, wildlife protection and preservation and water-weed control in the planning and construction of water projects;
- (h) Develop and regulate the establishment of facilities for tourism and recreation in conjunction with all natural and man-made reservoirs, taking special precautions in the case of drinking-water supply reservoirs;
- (i) Promote rational methods of treatment and management of surface watersheds and their vegetation cover so as to avoid erosion and the consequent sedimentation in reservoirs, watercourses and river banks, and to normalize run-off patterns;
- (j) Take into account the need for improvement of catchment areas of the national hydrological basins which generate the water resources to be used, in keeping with their degree of degradation and provide for the costs of such measures;
- (k) Improve institutional arrangements for the observation and control of the impact that public and other works may have on water resources and the environment; and promote the participation of all governmental agencies responsible for health and environment from the earliest stages of planning, both

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\**Report of the United Nations Conference on the Human Environment* (United Nations publication, Sales No.: E.73.II.A.14), chap. II, sect. B.

during the implementation and the subsequent monitoring of any socio-economic development scheme and in the formulation and application of relevant legislation and regulations;

(l) Identify, protect and preserve superlative examples of unique and scenic lakes, rivers, springs, waterfalls, wildlife and natural areas which embody inspirational national heritage values, and provide opportunities for international tourism;

(m) Recognize that fresh-water and coastal wetlands are among the most vital and productive of ecological systems because of their values for flood-water storage, as breeding grounds for fish and wildlife, and for their recreational and scientific use. Nations are encouraged to develop plans to ensure that important wetland areas are not indiscriminately destroyed;

(n) Recognize that while monetary values are often difficult to assign to the benefits of water as a recreational, cultural, aesthetic and scientific resource, the benefits are none the less real and substantial, and should be taken into consideration in the environmental assessment of development projects;

(o) Recognize that water planning and management should be based on ecological knowledge. Every water project must have as one of its goals to eliminate negative effects on public health and minimize the negative environmental impact; new water-supply projects must be linked with hygienic excreta-disposal practices, in order to provide the community with safe drinking water;

(p) Study and investigate water-related diseases in general and the influence of water as a working environment on those working in it;

(q) Recognize that the range of environmental considerations at present receiving attention in relation to water projects needs to be expanded in order to become more comprehensive and include not only physical, chemical or biological changes, but also the resulting social and economic changes;

(r) Recognize that to mitigate adverse environmental repercussions of water discharge from thermal and atomic power stations, cooling systems and hydro-technical design practices and procedures need to be improved to reduce potential hazards;

(s) Recognize that environmental planning is being undertaken not only at the national or river-basin level but also at the level of specific geographic regions such as estuaries, coastal zones, etc., wherever such an approach is warranted by the nature of the problems inherent in such regional development. This should be done not only in relation to water projects in isolation, but in close liaison with other related activities like town and country planning or regional development;

(t) Recognize that in dealing with problems of public health, a careful evaluation is needed of potential conflict situations such as the chlorination of sewage effluents and the chlorination of drinking-water production so that epidemiological consequences are avoided.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Strengthen the exchange of information;
- (ii) Support research and studies on the techniques for carrying out ecological surveys and on conditions affecting the incidence of diseases associated with aquatic environments;

- (iii) Implement the recommendations of the 1972 United Nations Conference on the Human Environment relating to the water sector (recommendations 51-55);\*
- (iv) Make an assessment of the environmental impact of water projects and help to take suitable action to prevent undesirable consequences;
- (v) Identify and protect waterscapes of international significance within the framework of the UNESCO Convention for the Protection of the World Cultural and Natural Heritage.†

*Pollution control*

**Concerted and planned action is necessary to avoid and combat the effects of pollution in order to protect and improve where necessary the quality of water resources.**

To this end it is recommended that countries should:

- (a) Conduct surveys of present levels of pollution in surface-water and ground-water resources, and establish monitoring networks for the detection of pollution;
- (b) Establish, where necessary, laboratories for the systematic and routine analysis of water samples, including physical, chemical, bacteriological and biological analysis;
- (c) Regulate the discharge of industrial, urban and mining wastes into bodies of water by the establishment of the necessary control measures in the context of an over-all water management policy, taking account of qualitative and quantitative aspects;
- (d) Apply such legislation and regulatory measures and such systems of incentive charges as to the discharge of pollutants that certain quality goals will be reached within certain periods of time. The discharge into the aquatic environment of dangerous substances that are toxic, persistent and bio-accumulative should be gradually eliminated;
- (e) Devote careful attention to the availability of water and the effects of environmental pollution when deciding on the location and selection of facilities;
- (f) Conduct research on and measurement of the pollution of surface and ground water by agricultural fertilizers and biocides with a view to lessening their adverse environmental impact;
- (g) Adopt the general principle that, as far as possible, direct or indirect costs attributable to pollution should be borne by the polluter;
- (h) Increase the number and improve the operation and establish comprehensive monitoring of facilities and technologies for the treatment of waste water, giving greater attention to alternative (especially low-energy) methods of waste treatment and land application or other economic use of wastes;
- (i) Encourage the development and use of substances which minimize hazards to human health and the environment, taking into account in particular toxicity, biodegradability, bio-accumulation and eutrophication;

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\**Ibid.*, chap. II, sect. B.

†Adopted by the UNESCO General Conference on 16 November 1972.

- (j) Increase efforts to monitor and assess the effects of the deposition of airborne pollutants in water from distant sources and reduce the total emission of such pollutants, i.e. by applying the best available technology that is economically feasible;
- (k) Harmonize and use, where possible, uniform criteria, methods and standards for assessing and monitoring water quality, compiling data and classifying waters with regard to their use;
- (l) Prepare and continuously update a list of water pollutants and a harmonizing terminology in the field of water pollution control, in collaboration with existing international organizations engaged in similar work;
- (m) Promote the use of infiltration techniques when the nature of the effluents and the terrain makes it possible to do so without endangering surface and ground-water resources;
- (n) Set up adequate institutions, where necessary with appropriate co-ordinating machinery, and strengthen those that already exist, to enable them to be more effective in the fight against pollution;
- (o) Apply appropriate land-use planning as a tool for preventing water pollution, especially in the case of ground water;
- (p) Establish quality standards for the various beneficial uses of water, whenever possible, taking into account the degree of development and the social and economical conditions of each region;
- (q) Ensure fast decontamination of water pollution during natural and man-made hazards;
- (r) Counteract with all appropriate measures the introduction into water of toxic substances likely to result in environmental hazards such as DDT, polychlorinated biphenyl (PCB), mercury and cadmium, taking into account the special requirements of developing countries;
- (s) Where practical, seriously encourage and conduct biological control research where chemicals are used in the control of water-related organisms;
- (t) In combating industrial pollution, undertake a careful analysis of the cost-effectiveness ratio of the different measures proposed for pollution control and priority accorded to the method entailing the least cost;
- (u) Recognize that studies need to be undertaken to evaluate the best possible approach to controlling pollution on an industry-by-industry or pollutant-by-pollutant basis, in accordance with national requirements in the light of the nature and level of industrial development;
- (v) Recognize that techniques like simulation, parametric modelling and computerized analysis need to be developed to facilitate solutions to problems in the field of pollution control;
- (w) With relation to the long-distance transportation of airborne pollution, especially acid precipitation, recognize that the different approaches to the control of the emission of relevant pollutants should be considered, bearing in mind the available range of technical solutions;

International organizations and other supporting bodies should, as appropriate and on request, assist developing countries by providing equipment, funds and personnel to enable them to determine quality levels and to face the problems posed by water pollution.

#### *D. Policy, Planning and Management*

Increased attention should be paid to the integrated planning of water management. Integrated policies and legislative and administrative guidelines are needed so as to ensure a good adaptation of resources to needs and reduce, if necessary, the risk of serious supply shortages and ecological damage to ensure public acceptance of planned water schemes and to ensure their financing. Particular consideration should be given not only to the cost-effectiveness of planned water schemes, but also to ensuring optimal social benefits of water resources use, as well as to the protection of human health and the environment as a whole. Attention should also be paid to the shift from single-purpose to multipurpose water resources development as the degree of development of water resources and water use in river basins increases, with a view, *inter alia*, to optimizing the investments for planned water-use schemes. In particular, the construction of new works should be preceded by a detailed study of the agricultural, industrial, municipal and hydropower needs of the area concerned. Water-management plans may be prepared using systems analysis techniques and developed on the basis of already adopted indicators and criteria. This analysis would take into account the economic and social evolution of the basin and be as comprehensive as possible; it would include such elements as time horizon and territorial extent, and take into account interactions between the national economy and regional development, and linkages between different decision-making levels. National policies must provide for the modernization of existing systems to meet the requirements of the present day.

#### *National water policy*

In a number of countries, there is a need for the formulation of a national water policy within the framework of and consistent with the over-all economic and social policies of the country concerned, with a view to helping raise the standard of living of the whole population.

**Each country should formulate and keep under review a general statement of policy in relation to the use, management and conservation of water, as a framework for planning and implementing specific programmes and measures for efficient operation of schemes. National development plans and policies should specify the main objectives of water-use policy, which should in turn be translated into guidelines and strategies, subdivided, as far as possible, into programmes for the integrated management of the resource.**

To this end it is recommended that countries should:

(a) Ensure that national water policy is conceived and carried out within the framework of an interdisciplinary national economic, social and environmental development policy;

(b) Recognize water development as an essential infrastructural facility in the country's development plans;

(c) Ensure that land and water are managed in an integrated manner;

(d) Improve the availability and quality of necessary basic information, e.g. cartographic services, hydrometry, data on water-linked natural resources and ecosystems, inventories of possible works, water demand projections and social cost;

(e) Define goals and targets for different sectors of water use, including provision of safe water-supply and waste-disposal facilities, provision for

agriculture, stock-raising, industrial needs and transport by water, and development of hydropower in such a way as to be compatible with the resources and characteristics of the area concerned. In estimating available water resources, account should be taken of water re-use and water transfer across basins;

(f) Develop and apply techniques for identifying, measuring and presenting the economic, environmental and social benefits and costs of development projects and proposals. Decisions can then be based on these factors, appropriate distribution of costs can be determined, and the construction and operation of projects can be carried out in such a way that these matters receive continuous consideration at all stages;

(g) Undertake the systematic evaluation of projects already carried out, with a view to learning lessons for the future, particularly in relation to social benefits and ecological changes, which evolve slowly;

(h) Formulate master plans for countries and river basins to provide a long-term perspective for planning, including resource conservation, using such techniques as systems analysis and mathematical modelling as planning tools, wherever appropriate. Projects arising out of the national plans should be well investigated and appropriate priorities should be assigned to them;

(i) Maintain in the planning and management of national water resources as a fundamental aim and as a high priority the satisfaction of the basic needs of all groups of society with particular attention to the lowest income groups;

(j) Periodically review and adjust targets in order to keep pace with changing conditions. Long-term guidelines for water management might be prepared for periods of 10 to 15 years and should be compatible with master plans. Planning should be considered a continuous activity and long-term plans should be revised and completed periodically - a five-year period seems advisable in this respect;

(k) Undertake the training of personnel specializing in planning principles and methods as well as farmers and other users of water so that they are involved at every stage of the planning process. This should include training to improve the expertise in economic analysis so as to ensure that proper cost-allocation studies are undertaken;

(l) Evaluate water-tariff policies in accordance with general development policies and direct any readjustment and restructuring that may be found necessary, so that they may be effectively used as policy instruments to promote better management of demand while encouraging better use of available resources without causing undue hardship to poorer sections and regions of the community. Water charges should as far as possible cover the costs incurred unless Governments as a policy choose to subsidize them;

(m) Document and share their experience in planning with others.

International organizations and other supporting bodies should, as appropriate, and on request, assist countries to:

- (i) Evolve and formulate national water policies;
- (ii) Strengthen the existing institutions at the national level and existing intergovernmental organizations at the subregional level, and create new institutions where needed;
- (iii) Prepare national master plans and, where necessary, river-basin plans and identify projects;

- (iv) Prepare feasibility reports for projects identified in such general planning studies, which have some prior assurance of financing by interested donor countries or agencies;
- (v) Prepare definitive project reports where feasibility studies have been established;
- (vi) Actively promote planning techniques and procedures by arranging information exchange, convening working groups and roving or country seminars, as appropriate, and by disseminating the results of relevant case studies and research studies;
- (vii) Give urgent attention at the national, regional and international level to developing national expertise in the application of planning techniques by all appropriate means;
- (viii) Promote various available measures and techniques in public participation and pay particular attention to ways of adapting appropriate techniques to the particular circumstances of countries.

*Institutional arrangements*

In many countries, water interests have been divided among numerous agencies without adequate co-ordination and without adequate links to other aspects of national planning.

**Institutional arrangements adopted by each country should ensure that the development and management of water resources take place in the context of national planning and that there is real co-ordination among all bodies responsible for the investigation, development and management of water resources. The problem of creating an adequate institutional infrastructure should be kept constantly under review and consideration should be given to the establishing of efficient water authorities to provide for proper co-ordination.**

To this end, it is recommended that countries should:

- (a) Adapt the institutional framework for efficient planning and use of water resources and the use of advanced technologies where appropriate. Institutional organization for water management should be reformed whenever appropriate so as to secure adequate co-ordination of central and local administrative authorities. Co-ordination should include the allocation of resources with complementary programmes;
- (b) Promote interest in water management among users of water; users should be given adequate representation and participation in management;
- (c) Consider, where necessary, the desirability of establishing suitable organizations to deal with rural water supply, as distinct from urban water supply, in view of the differences between the two in technologies, priorities, etc.;
- (d) Consider as a matter of urgency and importance the establishment and strengthening of river basin authorities, with a view to achieving a more efficient, integrated planning and development of the river basins concerned for all water uses when warranted by administrative and financial advantages;
- (e) Secure proper linkage between the administrative co-ordinating agency and the decision-makers.

*Legislation*

Legislation in many countries, though often complex, lags behind modern water management practices and techniques and perpetuates an undesirable fragmentation of administrative responsibilities. Provisions which regulate water management are often contained in different laws and regulations. This may make it difficult to know and apply them. In some instances there are cases of incompatibility between legal provisions of a national character and regulations emanating from regional or local authorities, or between traditional rights and the State's role in controlling water resources.

**Each country should examine and keep under review existing legislative and administrative structures concerning water management and, in the light of shared experience should enact, where appropriate, comprehensive legislation, for a co-ordinated approach to water planning. It may be desirable that provisions concerning water resources management, conservation and protection against pollution be combined in a unitary legal instrument, if the constitutional framework of the country permits. Legislation should define the rules of public ownership of water and of large water engineering works, as well as the provisions covering land ownership problems and any litigation that may result therefrom. It should be flexible enough to accommodate future changes in priorities and perspectives.**

To this end, it is recommended that:

- (a) An inventory and a critical examination of rules (whether written or unwritten), regulations, decrees, ordinances and legal and legislative measures in the area of water resources and development should systematically be carried out;
- (b) A review of existing legislation be prepared in order to improve and streamline its scope to cover all aspects pertaining to water resources management; protection of quality, prevention of pollution, penalties for undesirable effluent discharge, licensing, abstraction, ownership, etc.;
- (c) Although legislation should generally be comprehensive, it ought to be framed in the simplest way possible, and be consistent with the need to spell out the respective responsibilities and powers of governmental agencies and the means for conferring rights to use water on individuals;
- (d) Legislation should allow for the easy implementation of policy decisions which should be made in the public interest, while protecting the reasonable interests of individuals;
- (e) Legislation should define the rules of public ownership of water projects as well as the rights, obligations and responsibilities and emphasize the role of public bodies at the proper administrative level in controlling both the quantity and quality of water. It should appoint and empower appropriate administrative agencies to carry out this controlling function and to plan and implement water-development programmes. It should also spell out, either in primary or subordinate legislation, administrative procedures necessary for the co-ordinated, equitable and efficient control and administration of all aspects of water resources, and land-use problems as well as the conflicts which may arise from them;
- (f) Legislation should take into account the administrative capacity to implement it;

(g) Countries should document and share their experience so as to have a basis for possible improvement of their legislation;

(h) Priority should be accorded to the effective enforcement of the provisions of existing legislation, and where necessary, administrative and other arrangements should be strengthened and rendered more effective to achieve this objective.

International organizations and other supporting bodies should, as appropriate, and on request, assist countries to:

- (i) Improve and streamline existing legislation and prepare new draft legislation; *inter alia* to establish professorships and institutes in water law;
- (ii) Arrange the exchange of information and disseminate the results and experience of selected countries for the benefit of others.

#### *Public participation*

It is commonly acknowledged that decisions should be made in the light of the expressed views of those likely to be affected by the decision.

**Countries should make necessary efforts to adopt measures for obtaining effective participation in the planning and decision-making process involving users and public authorities. Such participation can constructively influence the choice between alternative plans and policies. If necessary, legislation should provide for such participation as an integral part of the planning, programming, implementation and evaluation process.**

To this end, it is recommended that:

(a) Countries should develop adequate legislative provisions, educational programmes and participatory activities that will increase public awareness and encourage public participation, as well as emphasize the value of water and the danger of its relative scarcity or abuse;

(b) Countries employing such measures and techniques should document and share their experience;

(c) Every effort should be made to convince the public that participation is an integral component in the decision-making process, and there should be a continuous two-way flow of information;

(d) In the field of community water supply and sanitation special emphasis should be given to the situation and the role of women.

#### *Development of appropriate technology*

In many developing countries efforts are being made to hasten and develop local and appropriate technologies using local experience and raw materials; to hasten economic development these efforts require encouragement, expansion, and financial and institutional support.

**The concept and content of appropriate technology related to water-resource development and management should be perceived in the context of each particular socio-economic situation and its available resources. Developing countries need to build up technological capability at the national and regional levels. Priority should be given to technologies of low capital cost, and the**

**use of local raw materials and resources taking environmental factors into account. Developed countries should accelerate the process of transfer of experience and know-how, technical assistance and training to developing countries. The developed countries should encourage and improve the conditions for the transfer of information and know-how. There is also a need for transfer of technology among the developing countries themselves.**

In this context, the following considerations are pertinent:

- (a) Results of research programmes may not be readily and immediately transformed into applicable technologies; a transitional phase of experiment and adaptation is often needed to evolve the required technologies;
- (b) Imported technologies for the management of water resources may require — as an intermediate phase in the transfer of technology — further study and experiment concerning the suitability of their adaptation to available resources and prevalent socio-cultural, economic and environmental conditions.
- (c) Water scarcity will often have a decisive influence on the development of appropriate technology. It may require in some cases a shift from traditional to relatively complex technologies;
- (d) Self-reliance has become an objective in many developing countries. Efforts should be made to promote indigenous abilities and to develop appropriate technologies that use to the full local experience and resources. These efforts require institutional and financial support.

To this end it is recommended that countries should:

- (a) Review the adequacy of existing institutional arrangements for the development of appropriate technologies in water resources management, and provide support for their development;
- (b) Provide every possible encouragement and support to national institutions concerned with the development of appropriate technologies in water resources development;
- (c) Provide the resources to enable professionals to observe what has been achieved in their field of expertise in other countries and to acquaint themselves with possible improvements in the technologies they are using at present;
- (d) Encourage the widest possible diffusion of acquired knowledge on the development of appropriate technology; establish and expand enterprises and productively apply the appropriate technologies that have been developed;
- (e) Review the extent of public participation in the planning, construction, operation and maintenance of water projects and take steps to ensure a greater level of participation, through consultations and the transfer of knowledge starting at the village level;
- (f) Make the fullest use of labour in water projects, keeping in view the need to strike a suitable balance between labour-intensive and capital-intensive technologies, emphasizing the need to reduce unemployment and underemployment particularly for unskilled labour;
- (g) Promote attempts to manufacture such items as pumps, engines, steel, polyvinyl chloride (PVC), asbestos cement and pre-stressed concrete pipes and water treatment reagents, from locally available resources. In the promoting of this idea the use of local materials with advanced technology should be encouraged. Appropriate precautions should be taken in the manufacture and use of potentially dangerous materials such as PVC and asbestos;

- (h) Develop facilities for the servicing and maintenance of installed hydraulic equipment, including the manufacture of spare parts;
- (i) Promote the standardization of equipment to help solve operational problems resulting from shortages of spare parts;
- (j) Promote the standardization of specifications, design and plans of equipment and hydraulic work;
- (k) Promote subregional and regional arrangements for the planning, design and construction of water projects and the exchange of information with other regions where similar conditions prevail;
- (l) Promote intraregional technical co-operation to even out the prevalent disparities in technological development among countries while encouraging technological innovation in planning, instrumentation and equipment and the exchange of information with other regions;
- (m) Ensure that water facilities to be manufactured from local resources do not create health hazards;
- (n) Develop emergency programmes to supply water to areas affected by drinking-water shortage;
- (o) Make all efforts to improve the cost-benefit ratio while taking into regard the requirements of environment and health protection and local and socio-economic aspects involved.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Make a review of the adequacy of existing constitutional arrangements for the development of appropriate technology in the water resources field;
- (ii) Support national efforts to manufacture construction materials, to service imported equipment, to manufacture spare parts and to manufacture the equipment itself;
- (iii) Evolve standard designs and plans, wherever possible;
- (iv) Strengthen subregional, regional and interregional arrangements for the planning, design and construction of water projects, through the provision of personnel and other such facilities;
- (v) Provide funds to enhance the transfer of technologies and to adapt these technologies to local needs;
- (vi) Support and strengthen institutions for the promotion of appropriate technology, at the village level, *inter alia*, by organizing workshops, seminars, and appropriate consultations.

It is further recommended to the Economic and Social Council that the relevant recommendations and resolutions of the United Nations Water Conference be transmitted to the Preparatory Committee for the United Nations Conference on Science and Technology for Development at its second session in order to ensure that water-management problems and the problems of appropriate water technologies be given priority attention in the preliminary national and regional analysis undertaken in the preparatory process for the Conference as well as by the Conference itself.

*E. Natural Hazards*

There are extensive areas of the world where severe hydrometeorological phenomena frequently occur and cause great damage, leading to loss of life and setbacks in development. Experience shows that, with appropriate combinations of engineering works and non-structural measures, damages can be substantially reduced. It is necessary to plan ahead and co-ordinate the measures that need to be taken to avoid and reduce the damage produced by severe hydrometeorological phenomena. These should be studied and the losses in the most affected areas should be evaluated, taking into account their physical, economic and social characteristics, in order to forecast the likely nature and frequency of damage.

*Flood loss management*

Floods are major hazards for many countries because flood plains of large rivers are invariably densely populated and properties of considerable value are located on them. The flood losses can be decreased by comprehensive structural and non-structural precautions and by the organization of emergency services, including expanding the hydrological services to aid in forecasting floods and related events.

**There is a need in many countries to strengthen programmes to reduce the losses associated with floods within the framework of programmes for land and water management and for disaster prevention and preparedness generally.**

To this end it is recommended that countries should:

- (a) As part of general land and water management programmes:
  - (i) Provide the maximum feasible scope for flood mitigation in reservoir design and operation, having regard, however, to the main function of the particular reservoir;
  - (ii) Take into consideration the effect of catchment use on the amount and timing of run-off;
  - (iii) Make provision for the zoning and management of flood-prone lands with due regard to the economic and social consequences of the different uses;
  - (iv) Plan well in advance and provide effective flood protection by structural and non-structural measures proportionate to the magnitude of the risk;
  - (v) Provide adequate financial resources to improve catchment areas for the retention of flood waters and soil erosion control and encourage local participation in the implementation of such measures;
  - (vi) Provide adequate funds for satisfactory maintenance of flood protection works;
- (b) Develop flood forecasting and warning systems as well as flood-fighting and evacuation measures to minimize loss of lives and property in case of flooding. Disaster assistance which includes preventive health services should be included in developmental processes;
- (c) Improve the collection of data on damage caused by floods so as to provide a better basis for the planning, design and management of measures for the mitigation of flood loss, and to evaluate the performance of measures taken;

(d) Develop flood-risk maps as a basis for public information programmes and action by Governments to regulate development in flood-prone areas;

(e) Give appropriate consideration to structural measures such as dikes and levees and also to non-structural measures like flood-plain regulations, flood zoning, the preparation of flood-risk maps, flood insurance, etc. and integrate measures for up-stream watershed management into over-all flood control plans.

*Drought loss management*

In the recent past droughts of exceptional severity have caused major hardships in many areas of the world. Such disasters can arise again at any time. In consequence, steps to mitigate the effects of drought in such areas is a top priority. In order to remedy the situation, structural and non-structural and emergency measures should be adopted and for this purpose the development and management of water resources as well as drought forecasting on a long-term basis should be viewed as a key element.

**There is a need to develop improved bases for planning land and water management in order to make optimum use of land and water resources in areas subject to severe drought. Comprehensive programmes should be formulated for the progressive implementation of the development of water resources for the benefit of drought-affected areas: specific short-term and long-term objectives, as well as targets, should be outlined. There is also a need to study basic meteorological processes with a view to formulating long-term forecasts in weather behaviour in any given area.**

To this end, it is recommended that countries should:

(a) Undertake studies on climate, hydrometeorology and agronomy and on local management techniques in order to define the best means of extending and intensifying rain-fed cultivation while incurring a minimum of risk from scarcity of rain;

(b) Make an inventory of all available water resources, and formulate long-term plans for their development as an integral part of the development of other natural resources, and within this framework prepare medium-term and long-term plans for the development of these water resources. These activities may require co-ordination with similar activities in neighbouring countries;

(c) Consider the transfer of water from areas where surplus in water resources is available to areas subjected to droughts;

(d) Intensify the exploration of ground water through geophysical and hydrogeological investigations and undertake on a regional scale large-scale programmes for the development of wells and boreholes, to be explored in groups where appropriate for water for human and livestock consumption, taking into account the needs of pastures while preventing overgrazing and avoiding over-exploitation of underground aquifers;

(e) Determine the effect of drought on aquifers and in the assessment of the response of ground-water systems to drought, basing such assessment on concepts such as storage/flow ratio in order to characterize ground-water flow regions in periods of drought;

(f) Arrange to complete as expeditiously as possible feasibility reports for well-defined surface water projects and for the implementation of projects deemed to be feasible;

(g) Make arrangements for the proper maintenance of existing wells and the development of new ones, using the resources and energies of the affected

population in rural areas on the basis of self-help, supplemented by State assistance and external resources;

(h) Undertake studies on technologies geared to the improvement of water pumps, efficiency of uses and the reduction of losses from evaporation, seepage, transpiration, etc;

(i) Develop drought-resistant plant species;

(j) Set up systems for the observation and control of the processes of desertification and carry out research on the basic causes of drought;

(k) Strengthen institutional arrangements, including co-operation among various agencies, for the preparation and dissemination of hydrological, hydro-meteorological and agricultural forecasts and for the use of this information in the management of water resources and disaster relief;

(l) Wherever possible, institute a deliberate policy for the transfer of population from drought-prone areas to other suitable regions with the view of reducing harmful effects on the ecosystem and promoting long-term rehabilitation programmes;

(m) Evolve contingency plans to deal with emergency situations in drought-affected areas;

(n) Study the potential role of integration of surface and underground phases of water basins utilizing the stocks of water stored in ground-water formations in order to maintain a minimum supply under drought conditions.

#### *Management of flood and drought loss*

International organizations and other supporting bodies should, as appropriate, and on request:

- (i) Further the development of hydrologic models as a basis for flood forecasting and river system management generally;
- (ii) Study risk evaluation and other aspects of flood-plain zoning and management and disaster prevention;
- (iii) Provide technical and other assistance in implementing flood control and flood protection works as well as the management of the catchment areas;
- (iv) Arrange an initial programme of information exchange on drought loss management and long-term weather forecasting through expert meetings and subsequently take appropriate follow-up action.

#### *F. Public Information, Education, Training and Research*

##### *Public information and extension service*

In order to ensure maximum attention to the proper utilization, protection and conservation of water, it is of decisive importance that all citizens be made aware of fundamental matters relating to water. For that reason education and research have to be efficiently supplemented by the provision of broad information to the public. Effective public information aims at the creating of a general as well as personal responsibility for the crucial water issues. It is considered an essential task for Governments to motivate the citizens to adopt a sound view on matters concerning their daily handling of water. Given a general feeling of responsibility for the local resources, people will be aware of the importance of the protection and conservation of water.

Countries should accord priority to conducting programmes for national information campaigns directed to all people concerning the proper utilization, protection and conservation of water.

In this context it is recommended that countries should:

- (a) Direct information to all citizens, first of all through the normal channels offered by primary and adult education and in connexion with regular health programmes and information schemes for parents;
- (b) Initiate special information campaigns conducted by the use of brochures, newspapers, radio and television, and other forms of popularization;
- (c) Prepare people for the consequences of changed life patterns which could be the effect of improved water availability in areas where water shortage formerly restricted various activities;
- (d) Provide information in a simple manner and adapted to local conditions concerning land-use, social traditions, climate, geology and infrastructure;
- (e) Inform people of the negative ecological, hydrological and sanitary consequences of misuse of water;
- (f) Emphasize the risk for the spreading of water-borne diseases in connexion with pollution of water;
- (g) Carry out programmes for broad public information repeatedly and make a continuous review of the results.

#### *Education and training*

Many countries share problems in educating, training and retaining properly qualified and experienced personnel at all professional and subprofessional levels. There is uncertainty as to the precise extent of these problems and an urgent need to isolate and remedy them. A number of national and subregional training establishments have been doing useful work in the training of middle-level subprofessionals, particularly in the subjects of hydrology, hydrogeology, water desalination and hydrometeorology. A number of fellowships offered by the United Nations system and other bilateral and multilateral agencies have been used for the training of professionals. Nevertheless, the total impact of all this effort has not been such as to remove the element of the shortage of trained manpower as a critical constraint.

**Countries should accord priority to conducting surveys to determine national needs for administrative, scientific and technical manpower in the water resources area. Law-makers and the public in general should be informed about and sensitized to this problem.**

**Training programmes should be implemented to give water management planners an understanding and appreciation of the various disciplines involved in water resources development and utilization; to provide professional, technical and skilled manpower in hydrology, hydrogeology, hydraulics, social, biological and health sciences and water desalination; and to provide managers for water resources systems, operators for water distribution and for treatment plants and monitors for water quality installations. Extension services at the farm level should also be organized.**

In this context, the following considerations are pertinent:

- (a) Education and training are necessary for all levels of personnel dealing with water resources development, such as professionals, subprofessionals, water users, village level workers, etc.;

- (b) Programmes should provide for refresher and in-service training for existing staff to disseminate new developments in methods and techniques;
- (c) Incentives must be developed to induce staff to remain in work areas where the training they have received is relevant;
- (d) Management training should be provided for senior staff on a variety of matters, including techniques of project negotiation and administration;
- (e) Available training at both the professional and subprofessional levels often requires substantial qualitative rather than quantitative improvement as a first priority;
- (f) Countries, in particular those offering fellowships of training for overseas students or acting as hosts to regional training centres, should be sensitive to the "brain drain" from developing countries and should co-operate in reducing its incidence;
- (g) Regional educational and training centres for administrative and sub-professional staff should be encouraged, but attention is drawn to the fact that suitable persons for subprofessional posts will often not possess a common regional language; smaller countries cannot afford to develop individual programmes and some economical means must be devised of sharing such programmes;
- (h) A balance must be struck between the employment of international expertise and developing indigenous experience in planning and executing water development projects.

In this context it is recommended that countries should:

- (a) Ensure that the contemplated manpower surveys cover all aspects of water resources management, including the appraisal of water resources, various water uses, water associated diseases and related methods such as computer technology, application of instruments, modelling and management techniques.
- (b) Make a comprehensive assessment of the requirements of manpower in the professional and subprofessional, senior, junior and middle-level categories of personnel;
- (c) Conceive manpower surveys for water development as integral components of over-all surveys of the need for trained manpower in all sectors of economic development in the nation, so as to provide really effective instruments for policy planning and project implementation;
- (d) Improve the working and living conditions for national professional experts to facilitate and encourage them to teach and to develop research in their own countries;
- (e) Make an inventory of cadres who emigrate abroad and create conditions that would encourage their return to their own countries.

Further, in connexion with training programmes, countries should:

- (a) Take steps to strengthen and expand the facilities and existing institutions, universities, colleges, polytechnics and training centres by providing more teachers, teaching materials, etc., so that the quantity and quality of their output can be increased;
- (b) Review the curricula of the existing institutions and training centres and expand them to include subjects pertaining to water resources development, the conservation of land and water resources, the teaching of basic anti-pollution measures for lessening pollution and other waterborne diseases in

rural communities, the training of farmers in the practice of irrigated agriculture, and the training of technicians in community and industrial water supply and sanitation;

(c) Take steps to establish training programmes, on-site training and training centres for water and sewage-treatment plant operators and water distribution operators as well as training in other areas where a special need exists;

(d) Consider the establishment of special training schools attached to colleges and schools or to national water-development agencies on a permanent basis;

(e) Encourage intraregional co-operation to establish training institutions as joint ventures by interested countries in the training of professional and subprofessional personnel, *inter alia*, by the provision of teaching staff from water-development organizations within the region;

(f) Make provision for scholarships of long duration for graduate courses in subjects pertaining to water resources development as distinct from short-term fellowships included in specific projects;

(g) Make an inventory of regional institutions concerned with sanitary engineering and strengthen them by providing adequate personnel, funds and equipment;

(h) Consider the establishment of water resources development training centres on a subregional or regional basis to train specialists in various aspects of technology in the development of water resources at the post-graduate level for the benefit of graduates in engineering from existing universities or polytechnics, with provision for on-site training and refresher courses for engineers, including special courses in water resources management. In cases where these centres already exist they should be strengthened and no new ones should be established;

(i) Accord to scientists and engineers working in water resources development a status similar to professionals in other sectors of the national economies in order to ensure their retention;

(j) Establish, in co-operation with regional and international organizations, personnel exchange programmes to provide for experts and technicians from developing countries to serve in other countries which suffer from personnel shortages and to provide work experience for persons engaged in the operation of water management schemes at existing successive schemes in other countries, and to further encourage students engaged in graduate research to conduct their investigations in their own countries on topics appropriate to their countries' needs;

(k) Publish technical manuals and other guidance material in water-project design and construction, with particular relevance to local conditions;

(l) Ensure that university teachers and technical education institutions have enough practical experience and multidisciplinary training to improve their teaching and research;

(m) Take steps to encourage operational managers and supervisors to play their part, both individually and collectively, as non-professional and part-time trainers and instructors of their own subordinate staff.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

(i) Conduct surveys on available manpower and needs in the field of water resource management and utilization;

- (ii) Strengthen and expand the existing educational and training institutions at all levels including vocational training and improve the course content in subjects pertaining to the development of water resources;
- (iii) Establish new training centres, as and when requested by countries;
- (iv) Provide scholarships for undergraduate and graduate courses;
- (v) Establish water resources development training centres in Africa for postgraduate specialization with special courses in the management of water resources and sanitary engineering;
- (vi) Undertake regional studies in consultation with the countries concerned to identify the incidence of problems relating to the education and retention of staff. Thereafter, as appropriate, steps should be taken to formulate proposals to countries and to international agencies to meet identified needs. Countries are meanwhile urged to share their expertise and to offer appropriate training programmes as part of their own aid programmes.

#### *Research needs*

Properly planned research and its appropriate application play an important role in the resolution of water problems, and while the diversity of circumstances within the regions calls for specific programmes in most countries, there is also scope for the co-ordination of efforts. Considerable research is being carried out in research institutes, governmental and intergovernmental organizations and universities on problems related to the development of water resources. There is a need to review and evaluate the work carried out so far and to outline areas in which further research should be undertaken.

**It is recommended that countries evolve, within the framework of national science policies, a particular policy for research work in the development, management and conservation of water resources. High priority should be accorded to research programmes that provide the knowledge necessary for the sound management of water resources. Suitable institutional forms should be developed to promote co-operation between water research and administration and to ensure that research endeavours respond first to priority problems as designated in national plans for the development of water resources. Research endeavours should first respond to important problems, by ensuring that duplication and overlapping are minimized and that results are disseminated in forms that can be readily interpreted and applied by other countries. Encouragement should be given to regional co-operation in hydrometeorological research and monitoring and to research promoting greater efficiency in water use, particularly in agriculture and industry. The results of long- and short-term basic and applied research should be adopted and utilized in order to solve specific problems and thus forge a closer relationship between research and development.**

To this end it is recommended that countries should:

- (a) Set up national steering committees comprising all relevant interested parties to make an inventory of problems in water resources development on which research has been, or is now being carried out, including research of subregional and regional organizations dealing with problems pertaining to water development;
- (b) Co-ordinate research programmes at the national level by means of a systematic and scientific evaluation of the work carried out on those problems with a view to locating gaps in knowledge, avoiding overlap of research efforts and identifying areas in which further research is needed to advance the future development of water resources;

(c) Strengthen existing institutions, where gaps exist, and establish new ones, wherever necessary, for the specific purpose of conducting water resources research on problems closely related to developmental needs;

(d) Adopt and utilize the results of research to solve specific problems and thus forge a closer relationship between research and development;

(e) Make more use of existing institutional mechanisms and promote additional ones, where necessary, for continuous consultation and co-ordination among research workers in the field so that solutions will emerge to suit the water problems of the countries in particular regions;

(f) Promote research into problems of methodologies for the assessment of supplies of surface and ground-water resources, and for their use, development and management. Research organizations should use their resources first for applied research and application of research results already available to solve some of the most urgent national problems. As scientific personnel and equipment become available, more basic research may be undertaken and also research into high-technology fields;

(g) Promote research in areas related to their respective needs including where relevant:

Weather modification (should not be contrary to General Assembly resolutions 3475 (XXX) and 31/72)

Climatology and agroclimatology

Weather forecasting

Remote sensing

Possible effects of climatic change on water availability

Artificial recharge of aquifers

Soil-erosion and sediment control

Methods of increasing efficiency of water use in irrigation and rain-fed agriculture

Conservation of water in reservoirs and methods of operation of multi-purpose reservoirs

Physical modelling

Application of systems analysis techniques for water resources, planning and management

Desalination, with particular reference to the treatment of brackish water

Recycling of water

Water and waste treatment

Water pollution and water quality modelling

Water-associated diseases and health effects of water schemes

Use of brackish water in agriculture

Contamination of ground waters

Crop water requirements

Salt-tolerant crops

Aquaculture

Methods of increasing efficiency of flood control and drought mitigation

Prevention and mitigation of the effects of natural hazards like earthquakes, hurricanes, volcanic eruptions on water resources

Use and control of water in humid areas, or areas of large amounts of rainfall;

(h) Encourage multidisciplinary research in co-ordination with training programmes within the fields of water assessment, utilization, protection, conservation and management;

(i) Encourage the participation of national research institutes and the scientific community in international programmes and institutions, and the exchange of relevant information with other countries.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) Conduct a review and evaluation of the research work done so far with a view to outlining the directions of future research work needed;
- (ii) Strengthen the existing research institutions and set up new ones, wherever needed, by offering technical assistance, funds, equipment and expertise;
- (iii) Exchange information and experience and disseminate research results;
- (iv) Prepare research projects, including global studies of environmental trends;
- (v) Standardize methods of processing relevant data;
- (vi) Investigate the possibilities of new technologies such as weather modification (in accordance with General Assembly resolutions 3475 (XXX) and 31/72), long-term weather forecasting, desalination and remote sensing to augment water availability.

*G. Regional Co-operation*

*' Development of shared water resources\**

In the case of shared water resources, co-operative action should be taken to generate appropriate data on which future management can be based and to devise appropriate institutions and understandings for co-ordinated development.

**Countries sharing water resources, with appropriate assistance from international agencies and other supporting bodies, on the request of the countries concerned, should review existing and available techniques for managing shared water resources and co-operate in the establishment of programmes, machinery and institutions necessary for the co-ordinated development of such resources. Areas of co-operation may with agreement of the parties concerned include planning, development, regulation, management, environmental protection,**

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\*This term has been used only for the uniformity of the text and its use does not prejudice the position of the countries supporting the terms "trans-boundary waters" or "international waters" in any of the problems involved.

**use and conservation, forecasting, etc. Such co-operation should be a basic element in an effort to overcome major constraints such as the lack of capital and trained manpower as well as the exigencies of natural resources development.**

To this end it is recommended that countries sharing a water resource should:

- (a) Sponsor studies, if necessary with the help of international agencies and other bodies as appropriate, to compare and analyse existing institutions for managing shared water resources and to report on their results;
- (b) Establish joint committees, as appropriate with agreement of the parties concerned, so as to provide for co-operation in areas such as the collection, standardization and exchange of data, the management of shared water resources, the prevention and control of water pollution, the prevention of water-associated diseases, mitigation of drought, flood control, river improvement activities and flood warning systems;
- (c) Encourage joint education and training schemes that provide economies of scale in the training of professional and subprofessional officers to be employed in the basin;
- (d) Encourage exchanges between interested countries and meetings between representatives of existing international or interstate river commissions to share experiences. Representatives from countries which share resources but yet have no developed institutions to manage them could be included in such meetings;
- (e) Strengthen if necessary existing governmental and intergovernmental institutions, in consultation with interested Governments, through the provision of equipment, funds and personnel;
- (f) Institute action for undertaking surveys of shared water resources and monitoring their quality;
- (g) In the absence of an agreement on the manner in which shared water resources should be utilized, countries which share these resources should exchange relevant information on which their future management can be based in order to avoid foreseeable damages;
- (h) Assist in the active co-operation of interested countries in controlling water pollution in shared water resources. This co-operation could be established through bilateral, subregional or regional conventions or by other means agreed upon by the interested countries sharing the resources.

The regional water organizations, taking into account existing and proposed studies as well as the hydrological, political, economic and geographical distinctiveness of shared water resources of various drainage basins, should seek ways of increasing their capabilities of promoting co-operation in the field of shared water resources and, for this purpose, draw upon the experience of other regional water organizations.

#### *Recommendations for particular regions*

The Conference took note of all the specific regional recommendations emanating from the regional commissions in Africa, Asia and the Pacific, Europe, Latin America and Western Asia and referred them to the regional commissions concerned for appropriate action in the light of the other relevant recommendations approved by the Conference. These recommendations are reproduced in the annex to this section of the present chapter.

The Conference also took note of the valuable contributions provided by the regional commissions. These formed part of the material on which the consolidated action recommendations (E/CONF.70/9) had been based.

#### H. International Co-operation

##### *Development of shared water resources*

It is necessary for States to co-operate in the case of shared water resources in recognition of the growing economic, environmental and physical interdependencies across international frontiers. Such co-operation, in accordance with the Charter of the United Nations and principles of international law, must be exercised on the basis of the equality, sovereignty and territorial integrity of all States, and taking due account of the principle expressed, *inter alia*, in principle 21 of the Declaration of the United Nations Conference on the Human Environment.\*

**In relation to the use, management and development of shared water resources, national policies should take into consideration the right of each state sharing the resources to equitably utilize such resources as the means to promote bonds of solidarity and co-operation.**

**A concerted and sustained effort is required to strengthen international water law as a means of placing co-operation among states on a firmer basis. The need for progressive development and codification of the rules of international law regulating the development and use of shared water resources has been the growing concern of many governments.**

To this end it is recommended that:

(a) The work of the International Law Commission in its contribution to the progressive development of international law and its codification in respect of the law of the non-navigational uses of international watercourses should be given a higher priority in the working programme of the Commission and be co-ordinated with activities of other international bodies dealing with the development of international law of waters with a view to the early conclusion of an international convention;

(b) In the absence of bilateral or multilateral agreements, Member States continue to apply generally accepted principles of international law in the use, development and management of shared water resources;

(c) The Intergovernmental Working Group of Experts on Natural Resources Shared by Two or More States of the United Nations Environment Programme be urged to expedite its work on draft principles of conduct in the field of the environment for the guidance of States in the conservation and harmonious exploitation of natural resources shared by two or more States;

(d) Member States take note of the recommendations of the Panel of Experts on Legal and Institutional Aspects of International Water Resources Development set up under Economic and Social Council resolution 1033 (XXXVII) of 14 August 1964 as well as the recommendations of the United Nations Interregional Seminar on River Basin and Inter-basin Development (Budapest, 1975).

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\*Report of the United Nations Conference on the Human Environment (United Nations publication, Sales No.: E.73.II.A.14), chap. I, sect. II.

(e) Member States also take note of the useful work of non-governmental and other expert bodies on international water law;

(f) Representatives of existing international commissions on shared water resources be urged to meet as soon as possible with a view to sharing and disseminating the results of their experience and to encourage institutional and legal approaches to this question;

(g) The United Nations system should be fully utilized in reviewing, collecting, disseminating and facilitating exchange of information and experiences on this question. The system should accordingly be organized to provide concerted and meaningful assistance to States and basin commissions requesting such assistance.

*Financing arrangements for water development*

A persistent and recurring problem in many countries is the mobilization and the obtaining of adequate financial resources to implement necessary improvements in the numerous aspects of water resources planning, development and management.

**A better and increased flow of funds on the best possible terms can assist in achieving the goals associated with water resources planning, development and management. Arrangements should be made to provide adequate and timely financing for project planning, formulation and implementation on a sustained and long-term basis on easy and liberal terms.**

**States which command surplus financial resources may establish joint or inter-governmental ventures as their constitutional regimes permit in the field of water management and development with developing countries. This may be done voluntarily on a country-by-country basis but should preferably be handled on a combined regional basis.**

To this end, it is recommended that countries should:

(a) Examine the various possibilities of mobilizing internal resources;

(b) Develop by 1980 an inventory of investment needs in the field of water resources and determine the relative priorities of these needs;

(c) Investigate the possibilities of making water projects, as far as possible, self-sustaining;

(d) Attempt to reduce project costs by greater involvement of the people, more extensive use of local labour, material and technology, more economic designs and the preparation and adoption of standard designs for structures, establishment of joint ventures for manufacturing pumps, gates, pipes, valves, etc., and formation of national consultancy firms, etc.;

(e) Improve the economic viability and the social effectiveness of projects by making them more efficient;

(f) Support where appropriate the work of non-governmental organizations engaged in the promotion of water management projects, particularly those which are low-cost and self-help based.

International agencies and other supporting bodies, particularly international financing agencies such as the World Bank, regional and subregional development banks, national development banks and other bilateral and multilateral

agencies for development financing, should, where appropriate and within their respective areas of responsibility:

- (i) Co-ordinate their policies and activities in the matter of financing projects and plans for water resources development;
- (ii) Review their financing criteria and give sufficient weight to the socio-economic effects of the projects, including direct, indirect and social benefits;
- (iii) Adopt flexible methods of project execution in order to encourage effective participation of national capacities and to promote regional co-operation;
- (iv) Enunciate well-thought-out, comprehensive and realistic policies for financial assistance, which will pave the way for the formulation of long-term programmes for the implementation of water projects;
- (v) Strengthen existing institutional arrangements at the subregional and regional levels through the provision of equipment, personnel and funds;
- (vi) Undertake such co-operative studies or joint action for the development of international river and lake basins as may be requested by basin countries;
- (vii) To the extent possible, provide appropriate opportunities for tenders to be offered on an international basis for goods and services, entrusting the recipient countries with the responsibility of executing projects financed by these agencies provided cost-effectiveness is achieved;
- (viii) To the extent possible, agree to the retention of local consulting firms capable of undertaking entire projects or project elements, channel foreign expertise into such firms while advising on specific aspects of the project at the request of the Governments concerned.

#### *Technical co-operation among developing countries*

The promotion of technical co-operation among developing countries will supplement, upgrade and give a new dimension to the traditional forms of bilateral and multilateral development co-operation to help the developing countries achieve greater intrinsic self-reliance. The development of water resources in developing countries provides a promising area where technical co-operation among developing countries can be achieved. Many developing countries have expertise and capacity which they can share with other developing countries. Alternate appropriate technologies have been developed and many developing countries have reached the stage of self-reliance in water-resource development to enable them to apply the more appropriate techniques using the latest know-how and promote better understanding among the countries concerned. This can be adapted to the needs of other developing countries by means of technical co-operation among developing countries.

**Governments of developing countries should pursue, explore and build mechanisms in order to promote to the fullest extent, technical co-operation among themselves with a view to achieving collective self-reliance in the development of their water resources.**

**Technical co-operation among developing countries will also facilitate the selection of appropriate technologies for each country and region according to local socio-economic and physical conditions.**

In the light of these considerations it is recommended that where appropriate countries should at the national, regional and subregional level:

(a) Develop an adequate information base so that the capabilities and requirements for technical co-operation in water resources development are known, and put to good use on a continuing basis;

(b) Co-operate in the preparation and upgrading of a register of experts and consultant services on a subregional/regional basis having particular knowledge of the problems confronting the development of water resources for that sub-region/region, and who can be called upon as and where required by member Governments;

(c) Determine priority areas in water resources development, and identify institutes having facilities, capabilities and expertise in these areas to develop technologies appropriate for developing countries;

(d) Develop pilot projects for the region/subregion by mutual agreement among the countries concerned to comprise a group of engineers and experts in the field of water resources from the region/subregion who would travel from country to country to collect detailed information on the available resources and the need for mutual exchange of technical resources in the region to promote technical co-operation among developing countries in the water sector;

(e) Identify programmes for water resources development that can be achieved through technical co-operation among developing countries in specific sectors such as community water supply, irrigation, drainage, hydroelectric generation, the development and management of transboundary water resources, ground-water development, and means for the prevention and reduction of losses due to floods and droughts and pollution control, water legislation and training, transfer of technology suited to the requirements of the developing countries and the general development of such technology;

(f) The countries of the regions of Africa, Asia and Latin America are especially urged to study the possibility of research development and production of low-cost equipment and technology so as to achieve the objectives of a better and more comprehensive assessment of their water resources within the shortest possible time and at the least cost and to promote the exchange of information at the regional level.

International organizations and other supporting bodies should, as appropriate, and on request, take the following action:

- (i) The Administrator of the United Nations Development Programme (UNDP) in close consultation with the whole United Nations system, should make a study on the feasibility of establishing an information referral system on the capacities available in the developing countries for technical co-operation with each other by means of the utilization of key water resources institutions in the developing countries. This system should form an integral part of the UNDP information referral system. It should be based on information supplied by Governments and by the United Nations system from institutions within each sector and should be managed by UNDP on behalf of the United Nations system as a whole;
- (ii) Assistance should be given in the initiation and implementation of joint programmes and institutions for research and training in water-related activities on a regional or subregional basis, as well as for financing of pilot projects and field studies as and where appropriate;
- (iii) Consideration should be given in the preparatory process for the United Nations Conference on Technical Co-operation among Developing Countries to the provision of assistance, as necessary, to appropriate institutions concerned with water management to allow them to attend the Conference.

*Annex*

SPECIFIC REGIONAL RECOMMENDATIONS

*Africa: Institutional Problems*

Institutional inadequacy has been one of the major constraints on the effective development of water resources in the past: increasing attention has been paid to this problem during the last decade and a number of measures have been taken to strengthen existing institutions, to create new ones where needed and to provide for co-ordination; however, much remains to be done by way of streamlining the organizations and providing effective mechanisms for implementation and co-ordination at the national, subregional and regional levels.

**The problem of creating an adequate institutional infrastructure should be kept constantly under review at the national, subregional and regional levels, in order to streamline the existing organizations and create new ones, where necessary, in order to deal effectively with the problems of water development as they emerge from time to time.**

To this end it is recommended that countries should:

(a) Consider strengthening existing subregional organizations according to their individual needs, in consultation with the organizations concerned;

(b) Consider the creation of regional teams of experts/consultants under either the Economic Commission for Africa or any other suitable African development agency; such teams should carry out similar tasks in adjacent African countries for ground-water assessment, studies on water demand, reconnaissance of dam sites, etc., so as to enable the countries to work together over an extended period of time under similar technical conditions;

(c) Encourage the formation of technical associations open to all who possess the necessary professional credentials to be organized regionally with annual all-African conferences focusing on specific problem areas and solutions;

(d) Consider the establishment of scientific institutes within the common river basins to promote scientific studies, to formulate basin-wide plans for integrated basin development and to promote manpower training and an institutional framework within the basin States so as to reduce progressively the dependence on foreign consultancy enterprises;

(e) Consider expanding the scope of various specifically African agencies, such as the Organization of African Unity or the Economic Commission for Africa, so as to encourage participation in water resources development programmes to a much greater extent than hitherto; such regional organizations are potentially the most effective for co-ordination at the regional level, and for the evaluation of the progress of projects and their implementation at specified intervals of time — such as every three to five years;

(f) Strengthen the secretariat of the Economic Commission for Africa in its water resources activities so as to assist in co-ordinating the activities of the United Nations bodies at the regional level and to follow up the recommendations for Africa in the field of water resources.

In connexion with the establishment of institutions to deal with drought management, the Economic Commission for Africa has recommended further that drought-affected or drought-prone countries should draw up programmes similar to those of the Permanent Inter-State Committee on Drought Control in the Sahel, and implement them as early as possible so as to mitigate human suffering and free African agriculture from its present almost total subjection to the vagaries of rain.

### *Europe*

In the case of transboundary river basins, and other shared waters, the active co-operation of riparian countries should be promoted, in particular in water pollution control.\* This international co-operation could usefully be established, *inter alia*, through regional conventions and the harmonization of different long-term national plans of riparian countries, and at a second stage, if necessary, take steps to develop a joint plan for the entire basin.

Co-operation at the regional and international levels should be developed along the following guidelines:

- (i) Exchange of scientific and technical information and documentation;
- (ii) Review and analysis of the existing situation and prospects concerning the use of water resources, including:

Improving forecasting methods of hydrological régimes and exchanging forecasts on a regional scale.

Research into water resources in transboundary river and sea basins to estimate the effects of human activity factors on water régimes and quality.

Intensification of research and development applied to water management, including the design and demonstration of new systems and instruments for measuring and monitoring water quality and quantity (remote sensing) as well as low cost, easily maintained and reliable technologies for use by all nations, and research on emerging technologies for non-conventional sources.

Intensification of national and international efforts designed to maximize the economic and social efficiency of all water inputs, including measures to heighten awareness, change attitudes and provide the technological means and incentives to conserve and protect available water.

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\*In the ECE region this co-operation is carried out in the spirit of the Final Act of the Conference on Security and Co-operation in Europe. See also, *Water Development and Management*, edited by Asit K. Biswas, Pergamon Press, Oxford, 1978.

*Latin America*

The work that the United Nations, its specialized agencies and other international bodies operating in the region have carried out or are carrying out has effectively contributed to the exploitation of water resources.

It is desirable that the work of the United Nations in the region should be continued, strengthened, co-ordinated with and complemented by the activities of other international bodies.

In particular it is recommended that:

(a) Co-ordination at the regional level among the bodies of the United Nations system, and co-ordination between them and the other international organizations operating in Latin America and the Caribbean should be strengthened;

(b) The Economic Commission for Latin America should continue its work on studies of the optimum and integrated use of water with appropriate and timely participation by professionals and technical experts from the countries involved; it should include in its programme projects dealing with the interaction between water and the other environmental components; and it should co-operate with national and international bodies in the training of human resources;

(c) The studies on water in relation to the environment begun by the United Nations Environment Programme, the Economic Commission for Latin America, and the United Nations Educational, Scientific and Cultural Organization should be continued and enlarged, and further topics of interest should be included among those specifically studied;

(d) The work carried out on similar subjects by the International Law Commission should also be continued and expanded;

(e) The Pan-American Sanitary Bureau and the World Health Organization should continue and strengthen their technical co-operation activities in the field of the supply of drinking water, waste-water disposal, and water quality generally;

(f) The Joint Inter-American Development Bank/Pan-American Sanitary Bureau project for the supply of water to small communities should be continued and strengthened;

(g) The Food and Agriculture Organization of the United Nations should attach special importance to the execution of drainage works in agricultural land;

(h) The Centre for Natural Resources, Energy and Transport, in collaboration with the Economic Commission for Latin America, should carry out a study of river transport systems, taking into account the interests of the countries which share navigable international waters;

(i) International agencies such as the Inter-American Development Bank and the World Bank should increase financing both for basic studies and for plans, feasibility studies, projects and the construction of necessary works for the exploitation of water resources, in view of the social benefits involved in such activities;

(j) Support should be given to the work of the Comité Regional de Recursos Hidráulicos del Istmo Centroamericano so that it can continue its activities on a permanent basis with an executive secretariat, and the United Nations bodies, especially the World Meteorological Organization and the Economic Commission for Latin America, can collaborate with the projects which that Committee may establish;

(k) Regional central American programmes for sanitary engineering and hydraulic resources in the Regional School for Sanitary Engineering in Guatemala City and the Chair of meteorology in Costa Rica should be strengthened and organizations of the United Nations should collaborate in their task through programmes of technical assistance, exchange with other similar regional centres and the granting of fellowships;

(l) An inventory should be made of the human resources in the countries of the region, while training in research and the development of water resources and exchange of personnel should be promoted in order to allow first-hand exposure to differing technologies and procedures;

(m) The Organization of American States should continue its technological efforts to help with the implementation of projects for the exploitation of water resources, in respect of which it provides regional technical co-operation, when so requested by the countries concerned;

(n) The Latin American Economic System (SELA) should be urged to give priority to its co-operation programmes for regional and subregional projects for the exploitation of water resources;

(o) The United Nations, availing itself of the experience of the Centro Interamericano de Desarrollo Integral de Agua y Tierra (CIDIAT), the Instituto Nacional de Ciencia y Técnica Hídricas (INCYTH) and other existing bodies specializing in the subject, to carry out research and the training of professional, subprofessional, technical and management staff in the various aspects of science and technology related to the development of water resources;

(p) Support should be given to the work being conducted by the institutional system of the River Plate Basin so that its activities may be continued and intensified with a view to attaining the objectives embodied in the River Plate Basin Treaty;

(q) The facilities of the programmes of the World Meteorological Organization, particularly the World Weather Watch, should be utilized with the view to supporting a better understanding of hydrometeorological phenomena in the region;

(r) Through appropriate action by the World Health Organization, the positive experience gained by the Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente (CEPIS) should be strengthened, increased and extended so that, through the establishment of similar centres, the developing countries of other geographical regions may enjoy similar benefits.

### *Western Asia*

Because of the extreme importance of water resources for the future of the region it is imperative that measures be taken now to conserve and develop this vital resource in the most efficient and economic manner for the highest and best use of all nations.

**It is recommended that there be formed a water resources council for Western Asia (hereinafter referred to as the council), composed of one representative from each of the following twelve states: Bahrain, Democratic Yemen, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates and Yemen; that each representative on the council be qualified to speak for his country on water-related matters; that such representatives be named as soon as possible in order that an initial meeting be held**

soon thereafter; that in order to implement the programme of the council certain committees, task forces and boards, as noted below, for example, may need to be established on a permanent or temporary basis; that such committees, task forces and boards maintain full co-ordination with United Nations agencies and governmental and private agencies now working in water programmes; that task forces be phased out after completion of their mission; that task forces, boards and committees be established initially for the following areas, with others to be formed as needed:

*Board for a water resources fund*

This Board would be set up for the purpose of establishing a new fund or establishing access to existing funds to be used in the form of loans or grants to the States members of the Economic Commission for Western Asia, at the national, subregional and regional levels in water-related programmes. The Board could establish an appropriate organizational structure to handle such funds. It could also be the responsibility of the Board, with the approval of the Council, to disburse aid or to assist countries in securing funds for use in efficient and worth-while water-related programmes. Such programmes could include, but need not be limited to, the broad categories of education, manpower training, research, consultant services, implementation of data-collection systems, development and management of water resources and economic analyses of water priorities. Specialists may be employed to determine eligibilities of need for assistance from the fund. Upon acceptance of this concept and formation of the Board detailed procedures would be developed.

*Task force for the establishment of the water resources technical training centre*

This task force could establish as soon as possible a training centre (with location to be determined by the task force and approved by the Council) for the training of technical personnel urgently needed in the field of water resources. The initial size of the training centre could allow for a minimum of 10-15 representatives from each country, the length of the training period to be determined after detailed analysis. Training at the subprofessional and technical levels could be given in many areas related to water resources, including but not limited to the following:

(a) Training in proper techniques for installing data networks and the evaluation and assessment of such data; the networks would include climatological stations, stream-gauging stations, ground-water observations, etc.;

(b) Fundamentals and principles of hydrology and hydrogeology at the sub-professional level;

(c) The operation and maintenance of water systems, including desalination plants, municipal and rural drinking-water systems, and water-treatment plants; training in laboratory analysis and testing for chemical and biological materials would also be included;

(d) The training of well-drilling crews in proper techniques for the drilling and development of well production, which would include electric logging and material analysis and the proper selection of pumps, well screens and other pertinent items.

*Task force on data collection networks*

This task force could be responsible for determining the components of and for implementing an adequate data-collection network for each country desiring assistance. Specialists trained in this field could be sent to any country desiring assistance to analyse and assess the situation, recommend components for the system and recommend necessary action to see that the programme is carried out.

*Committee for professional assistance*

This committee could see that teams of consultants or specialists of professional stature are made available to any nation requesting assistance in water-related matters. Such matters could include, but need not be limited to, assistance in developing national water policy, long-range planning, water legislation, rules and regulations for water use, studies and recommendations on governmental infrastructure related to water resources, economic evaluation of priority of water use, assistance in assessing the magnitude and quality of surface-water and ground-water resources, water management techniques and other areas as deemed appropriate. Such teams would be paid for by the country requesting assistance or by the Fund, as considered appropriate.

*Committee for applied research*

This committee could examine research facilities at present available for water-related matters and could recommend the establishment of any other facilities deemed necessary to cover fully the needs of all 12 nations on the Council. The committee could also establish a centre for compiling and disseminating research findings, both regional and international, to each of the 12 countries comprising the Council. Research findings and scientific articles could be published in technical periodicals and professional journals to give prestige to the research programmes of the area. The committee could also establish and maintain a reference library for use by the States members of the Council and could establish and operate a data bank, including data on water resources data for the members of the Council. The committee could investigate the need for a data bank on trained manpower.

*Committee on subregional streams and underground aquifers*

This committee could assist in initiating studies related to streams, wadis or underground aquifers common to two or more States members of the Council. This committee would co-operate with existing committees and groups in the gathering and analysis of basic data and the development of guidelines and compacts governing the use of such resources.

*Committee for environmental and health aspects of water resource development*

The committee is not intended to duplicate existing programmes in health-related fields but would ensure that water-resource development is in harmony with environmental and health factors. Close co-operation could be maintained with health organizations. Consultants or specialists could be employed as required to examine projects proposed for implementation in order to assess and evaluate the effects, both beneficial and adverse, of such proposed programmes on the environment and health of the country concerned. Special attention could

be given to the effects upon coastal and marine water from upstream development. This committee should investigate the desirability of requiring environmental impact studies for all water-resource projects.

*Committee on higher education at the professional level  
in water-related fields*

This committee would examine the facilities and curricula of existing higher educational institutions in Western Asia with a view to determining the adequacy of present quality and the coverage of courses relating to water resources and environmental fields at professional levels. Where deficiencies are noted, action could be taken to bring such schooling up to adequate and acceptable levels. It would not be expected that each country would provide such training, but somewhere in the region there should be sufficient institutional facilities to fill the needs of the region. This programme could be co-ordinated with existing educational and scholarship programmes within the region.

## RESOLUTIONS

### *I. Assessment of Water Resources*

*The United Nations Water Conference,*

*Recognizing* that for the plans of action adopted by the Conference for the intensification and improvement of water use and development in agriculture and for providing safe drinking water and sanitation for all human settlements by 1990, a proper assessment is necessary of water resources in all countries of the world, and in particular in developing countries,

*Considering* that this assessment can be achieved only if all countries strengthen and co-ordinate arrangements for the collection of data in accordance with the recommendations of the Conference,

*Resolves* that:

(a) All efforts should be undertaken at the national level to increase substantially financial resources for activities related to water-resources assessment and to strengthen related institutions and operational services as necessary and appropriate at the national and regional levels;

(b) Training programmes and facilities for meteorologists, hydrologists and hydrogeologists should be established or strengthened;

(c) National scientific infrastructure for water-assessment activities be strengthened or established, particularly in developing countries;

(d) International co-operation aimed at the strengthening of water-resources assessment, particularly within the International Hydrological Programme and Operational Hydrological Programme be keyed to the targets set by the United Nations Water Conference and appropriately supported by national and international governmental and non-governmental institutions.

## II. Community Water Supply

### *The United Nations Water Conference,*

*In view of* the course taken by the discussions and the aspirations of the countries represented at the United Nations Water Conference and in view also of what was proposed at Habitat: United Nations Conference on Human Settlements, and

#### *Considering that:*

- (a) All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs;
- (b) It is universally recognized that the availability to man of that resource is essential both for life and his full development, both as an individual and as an integral part of society;
- (c) To a significant extent similar considerations apply to all that concerns the disposal of waste water, including sewage, industrial and agricultural wastes and other harmful sources, which are the main task of the public sanitation systems of each country;
- (d) The fundamental challenge facing all mankind can be met only with full international co-operation in all its aspects, entailing the mobilization of physical, economic and human resources;
- (e) It is imperative to facilitate ways of achieving this essential co-operation, so that water is attainable and is justly and equitably distributed among the people within the respective countries;
- (f) Those countries which are in a position to provide assistance, as well as international or regional organizations, should undertake to do so until the objective is attained, seeking to simplify regulations and administrative arrangements;
- (g) Organizations of the United Nations system and other international organizations are making progress towards possible establishment of a consultative group mechanism on community water programmes.

#### *Recommends:*

- (a) That where human needs have not yet been satisfied, national development policies and plans should give priority to the supplying of drinking water for the entire population and to the final disposal of waste water; and should also actively involve, encourage and support efforts being undertaken by local voluntary organizations;
- (b) That Governments reaffirm their commitment made at Habitat to "adopt programmes with realistic standards for quality and quantity to provide water for urban and rural areas by 1990, if possible";
- (c) That with a view to achieving these ends, the nations which need to develop their systems for providing drinking water and sanitation should prepare for 1980 programmes and plans to provide coverage for populations and to expand and maintain existing systems; institutional development and human resources utilization; and identification of the resources which are found to be necessary;

(d) That the United Nations agencies should co-ordinate their work efforts to help Member States, when they so request, in the work of preparation referred to in subparagraph (c) above;

(e) That in 1980 the national programmes which have been implemented for that purpose, and the extent to which the countries concerned have succeeded in mobilizing local and national support should be reviewed by an appropriate mechanism to be determined by the Economic and Social Council and based on the use of existing machinery, with a view to attaining co-ordinated action toward agreed targets;

(f) That in accordance with the decisions of the existing structures of the Economic and Social Council, appropriate external assistance should be available in order to assist in building, operating and maintaining these systems;

(g) That the Plan of Action formulated below should be implemented in a co-ordinated manner at the national and international levels.

#### PLAN OF ACTION

In order to be able to reach the targets of Habitat recommendation C.12, drastic measures have to be taken. This will need firm commitment on the part of countries and the international community.

##### *A. Priority areas for action*

1. Action must focus on promoting (a) increased awareness of the problem; (b) commitment of national Governments to provide all people with water of safe quality and adequate quantity and basic sanitary facilities by 1990, according priority to the poor and less privileged and to water scarce areas; and (c) larger allocation to this sector from the total resources available for general economic and social development.
2. Action must be taken to remedy constraints of manpower shortage (especially at the intermediate and lower levels), inadequacies in institutions and organization, and lack of appropriate and cost-effective technology.
3. New approaches should be developed which will result in larger flows of national, international and bilateral funds on more favourable and flexible conditions, so as to enable countries to increase the speed of implementation and, more important, enable the more effective use of the additional resources.
4. Communities must be provided with effective education on domestic hygiene and must be motivated and involved as appropriate at every level of the programme, including the planning, construction, operation, maintenance and financing of services, and the monitoring and safeguarding of the quality of the water supplied.

##### *B. Recommendations for action at national level*

5. Each country should establish goals for 1990 which match as far as possible the global targets adopted. In order to attain these goals, each country should:

(a) Develop national plans and programmes for community water supply and sanitation, and identify intermediate milestones within the context of the

socio-economic development plan periods and objectives, giving priority attention to the segments of the population in greatest need;

(b) Immediately initiate engineering and feasibility studies on projects that are considered to be of the highest priority, and are based on a cost-effective technology appropriate to local conditions, with community participation, good management, and provision for operation and maintenance;

(c) Assess the manpower situation and, on the basis of this assessment, establish training programmes at the national level, to meet the immediate and future needs for additional professional staff, intermediate level technicians and, most important, village technicians;

(d) Promote massive national campaigns to mobilize public opinion regarding the provision of basic sanitary services, and develop appropriate procedures to ensure the active participation of communities in the programme;

(e) Establish appropriate institutions, if these do not exist, and assign to them specific responsibilities for the planning, implementation and monitoring of progress of the programme;

(f) Co-ordinate the efforts of all sectors active in rural areas, utilizing the manpower and other resources available, to ensure the provision of technically and socially acceptable sanitary facilities in rural areas;

(g) Develop a national revolving fund, in the first instance financed from substantially increased loans and grants from national and foreign sources, for water supply and sanitation which will encourage both the mobilization of resources for this sector and the equitable participation of beneficiaries; discourage wasteful consumption; and include a flexible combination of rates and, where necessary, explicit subsidies or other measures designed to achieve the economic and social objectives of the programme.

*C. Recommendations for action through international co-operation*

6. To achieve the Habitat targets, the international community must adopt new approaches to support increased national commitments with particular reference to the least developed and most seriously affected countries. It is, therefore, recommended that:

(a) Financial contributions be increased to strengthen the capabilities of international and bilateral agencies co-operating with Governments in the extension of community water supply and sanitation;

(b) At the request of national Governments, co-operation be extended to the formulation and implementation of high priority projects and programmes for community water supply and sanitation, with analysis of goals, methods and resources;

(c) Collaboration with the ongoing activity of the World Health Organization for monitoring and reporting on the status and progress of community water supply and sanitation be intensified.

7. The international community should give high priority to collaborating with Governments with regard to manpower surveys, the establishment of national training programmes (to meet immediate and future needs for professional staff, intermediate level technicians, and village technicians), research, and the promotion of community participation.

8. There should be even greater emphasis on social benefits. Multilateral and bilateral financing institutions should recognize the need for a higher level of grants and low interest-bearing loans to community water supply and sanitation programmes and, where this practice is already accepted, increase the proportion of such loans. They should be prepared to shoulder a higher proportion of local costs when financing community water supply and sanitation, increase their total allocations especially to rural water supply and sanitation, and complement local efforts in the rehabilitation and maintenance of systems.
9. Developing countries should foster co-operation among themselves, *inter alia*, in the establishment of intercountry training facilities; the development of appropriate technologies and of methodologies for training and management, and the exchange of experts and information, so that experience available elsewhere can be adapted to local conditions.
10. An effective clearing-house mechanism should be developed through international co-operation, by strengthening existing mechanisms if available, at the national, regional and international levels, to provide for the communication of selected information concerning all elements of community water supply and sanitation. An interrelated communication function should be included at every stage in all community water supply and sanitation projects.
11. Regular consultations should be held among Governments, international organizations, the international scientific community and relevant non-governmental organizations to ensure co-ordinated and accelerated action in the area of rural water supply and sanitation.
12. Co-ordination within the United Nations system should be improved at country level in order to ensure (a) a multidisciplinary approach in the development of community water supply and sanitation services; and (b) that rural water supplies and sanitation form part of integrated rural development projects.

### III. Agricultural Water Use

*The United Nations Water Conference,*

*Recognizing* that the enormous deficit of food and agricultural production identified by the World Food Conference of 1974 calls for solutions of similar magnitude,

*Accepting* the vital role of water in expanding and intensifying agricultural production and in providing improved livelihood for the populations of developing countries,

*Realizing* that the scale of action required is immense in terms of investments and manpower for land areas to be developed and improved,

*Considering* that considerable national and international resources have to be allocated for the development of institutional services and human skills to provide the technical, managerial, administrative and farming expertise to meet the future demands of agriculture,

*Recommends* that the Action Programme on Water for Agriculture formulated below should be implemented with high priority in a co-ordinated manner at the national and international levels.

## ACTION PROGRAMME ON WATER FOR AGRICULTURE

1. Faced with the enormous and continuing deficit in the production of food and of agricultural products revealed at the World Food Conference in 1974, and in recognition of the potential role of water development in correcting this deficit through activities proposed in the resolutions of that Conference, attention is drawn to the now urgent need for action to initiate a world-wide programme for the intensification and improvement of water development in agriculture.

2. Such a programme should in particular, though not exclusively, be directed at:

(a) The improvement of existing irrigation with the objectives of raising productivity with minimum cost and delay, improving the efficiency of water use and preventing waste and degradation of water resources;

(b) Developing efficient new irrigation for the further expansion of production;

(c) Improving and extending rain-fed agriculture and livestock production, through both better soil moisture management and the opening up of new land through the provision of water supplies to human settlements and livestock;

(d) The protection of agricultural land against the harmful effects of flooding and waterlogging and, where necessary, its reclamation;

(e) The introduction or expansion of fish rearing in conjunction with over-all rural development activities.

3. As an indication of a major programme component, that of irrigation and drainage development, the magnitude of a 15-year global programme is estimated at some 45 million hectares of improved and 22 million hectares of new irrigation development.

*A. Recommendation on phased action programmes*

4. It is recommended that national action, where appropriate with supporting assistance from the international community, be directed at formulating phased programmes for action in the development and use of water for agriculture, showing the activities required, the estimated costs and the timing, and that reports on progress made in this area should be regularly reviewed by the appropriate intergovernmental bodies.

5. It is therefore proposed that national programmes be prepared containing the essential elements for:

(a) Analysis and assessment of the problem, its magnitude and potential for development;

(b) Planning for agricultural water development within a co-ordinated framework for national development, agricultural and over-all water planning;

(c) Financing, with indications of the role of national finance and needs for external aid;

(d) Building-up of national advisory services in government and private sectors for project planning, design, construction, operation and maintenance within the framework of the programmes envisaged;

(e) Training, extension, research and strengthening of formal education to support the heavier technical demands;

(f) Establishing and improving institutions for management, administration and legislative support.

*B. Recommendations on financing*

6. It is recommended that national efforts be concentrated on the sound formulation and planning of attractive programmes for water use and development for agriculture, and that the mobilization of local sources of finance be encouraged. It is further recommended that, within two years of the United Nations Water Conference, phased programmes of financial requirements be available for presentation to the appropriate intergovernmental bodies.

7. It is recommended that the attention of international financing agencies be drawn to the need to adapt to the intensified programme, in recognition in particular of the severe constraints imposed by current methods of project financing for the development of water in agriculture. This calls for a shift in the apportionment of funds giving higher priority to water for agriculture. It also requires more flexibility in local currency financing and in introducing integrated programme financing in addition to traditional project financing, together with the development of new evaluation criteria and methodologies. Finally this requires greater use of national and regional financing facilities and of local human and material resources.

*C. Recommendations on training, extension and research*

8. It is recommended that, in conjunction with the formulation of agricultural water development programmes, and immediately following the United Nations Water Conference, the present and future needs for trained manpower should be assessed. These requirements should not be limited only to directly water-related activities, but should include supporting disciplines in agriculture and associated subjects and the development of necessary interdisciplinary skills. The manpower needs for the three distinct components of technical training, extension services and research must be evaluated at the national level. Additionally, where necessary, attention must be given to the improvement of basic levels of formal education to facilitate subsequent training.

9. Co-ordinated research programmes should be undertaken to meet selected complex research requirements of the global water-development programme. A report should be prepared for presentation to the appropriate intergovernmental bodies on world training and research facilities and activities. This report should be available within two years of the United Nations Water Conference, and should include proposals for mobilizing and expanding such resources, and for the establishment of new facilities and programmes as and where appropriate. The report should also include the continual review of progress of all training and research programmes in the field of water resources to ensure their adequacy and appropriateness in support of development. The potential role of the United Nations University should also be considered.

*D. Recommendations for the promotion of national advisory services*

10. With the objective of building up technical and administrative capabilities to cope with the large-scale programmes envisaged, the full use of national manpower potential and material resources should be encouraged in the planning,

design, construction, operation and maintenance of water-development programmes. It is further recommended that immediate action be taken to develop the appropriate services, utilizing the skills and resources available in both public and private sectors. This would include consulting and supply services as well as development of local industries geared to the agricultural sector.

11. International aid for professional and technical training should give highest priority to the acquisition of skills in support of this specific objective, and organizations providing financial or material resources should clearly indicate their preference for the employment of local goods and services, as appropriate. The national advisory services should give particular attention to, and should be supported in the development of, technologies and the adaptation of methods and material most appropriate to local needs in the over-all aim of deriving optimal benefits from available investment, expertise and manpower.

*E. Recommendations on international programme support*

12. Recognizing the importance of international co-operation and support for implementing the proposed actions at the national level, it is recommended to co-ordinate international support programmes for the mobilization, planning, co-ordination and monitoring of international financial and technical assistance in the field of water development and use for agriculture. For this, it is proposed that support be given to:

(a) The co-ordination of international financial assistance to the activities of the programme;

(b) The co-ordination of technical assistance and backstopping of the programme, including analysis and assessment of the problem, planning for agricultural water development and establishing and improving institutions;

(c) Reporting to the appropriate intergovernmental bodies on progress made on the implementation of the programme on water for agriculture.

*IV. Research and Development of Industrial Technologies*

*The United Nations Water Conference,*

*Bearing in mind* the need to adopt rational water management methods,

*Considering* that rational water management entails not only using it economically and in the manner best calculated to prevent wastage and squandering but also using it properly so as to avoid in so far as possible the deterioration of the resource, to facilitate recycling and to maintain its potential usability for all the purposes for which it is intended,

*Noting* that industrial water use is one of the factors which are most intensively conducive to the qualitative degradation of water and its quantitative reduction in terms of its over-all use, contributing not only to the deterioration of the resource considered specifically and in relation to its various uses but also to the general pollution of the environment,

*Recognizing* that technology can contribute decisively to minimizing these negative effects of industrial water use,

*Recommends* that both Governments and international bodies, to the extent their competence, include in their economic, environmental and technological policies measures to facilitate, promote and stimulate research and development of industrial technologies requiring the least possible use of water and to facilitate recycling and even the replacement of methods entailing the use of water or other liquids by the use of other non-polluting liquids or by dry methods, so as to eliminate environmental contamination in so far as possible.

#### V. *Role of Water in Combating Desertification*

*The United Nations Water Conference,*

*Bearing in mind* the recommendations of the United Nations Conference on the Environment held in Stockholm in June 1972,

*Taking into account* the urgent need for concerted action to combat desertification and the forthcoming United Nations Conference on Desertification,

1. *Urges* all Governments to support and participate fully in the United Nations Conference on Desertification and in its preparatory meetings, including the regional meetings, in order to ensure the achievement of the objectives of the Conference;

2. *Considers* that water is one of the main factors limiting production and settlement in dry lands; and that lack of water, lack of the development of, or wasteful uses of, this resource are fundamental causes of many problems of desertification and environmental degradation;

3. *Considers* that proper planning, adequate development and wise management of water resources should receive priority in the efforts to combat desertification, to prevent environmental deterioration and to promote economic and social development in arid and semi-arid regions;

4. *Recommends* that nations should formulate specific action programmes to be considered by the forthcoming United Nations Conference on Desertification;

5. *Recommends further* that in most countries facing problems of desertification, urgent action is necessary to:

(a) Clearly define water policy in the current efforts to combat desertification and to formulate a comprehensive programme for the development and management of water resources, outlining both short-term and long-term specific objectives and targets for the future;

(b) Intensify and improve the arrangements existing for the assessment of water resources - surface as well as ground water;

(c) Consider, on the basis of prior environmental and health impact studies, a programme of surface and ground-water use and conservation with intensive mobilization of public participation on the basis of self-help. Such a programme should provide for the construction and maintenance of existing small dams or wells, with appropriate national and international assistance;

(d) Prepare feasibility studies for specific water projects expeditiously within the framework of over-all policies and programmes to combat desertification;

(e) Set up appropriate institutional arrangements at the national and regional levels in order that adequate attention be given to the problems of management and development of surface and ground-water resources in arid and semi-arid regions, including collation of related policies, promotion of efficient use of water by developing appropriate technologies, including the application of water-saving technologies;

(f) Promote research into all aspects of water-resources technology, with special reference to the problems and needs of arid and semi-arid areas;

6. *Urges* that international assistance be given to assist member Governments in the formulation of specific plans and projects for the development and management of water resources to combat desertification, the location of sources of financing for the implementation of projects for use in combating desertification, and the preparation and execution of training programmes at all levels.

VI. *Technical Co-operation among Developing Countries  
in the Water Sector*

*The United Nations Water Conference,*

*Recalling* General Assembly resolutions 3201 (S-VI) and 3202 (S-VI) of 1 May 1974, containing the Declaration and the Programme of Action on the Establishment of a New International Economic Order, 3281 (XXIX) of 12 December 1974, containing the Charter of Economic Rights and Duties of States, and 3362 (S-VII) of 16 September 1975 on development and international economic co-operation,

*Noting* the recommendations contained in the report of the *Ad Hoc* Group of Experts on Technical Co-operation among Developing Countries in Water Resources Development,\*

*Convinced* that the management and development of water resources provides a promising area where technical co-operation among developing countries can be achieved,

*Aware* that alternate appropriate technologies in the field of the water sector have been developed by some developing countries and may be usefully applied by other developing countries,

1. *Welcomes* the convening of the United Nations Conference on Technical Co-operation among Developing Countries in Argentina in 1978;
2. *Urges* that all Governments support and participate fully in the United Nations Conference on Technical Co-operation among Developing Countries, as well as in the preparatory process for this Conference;
3. *Invites* the Administrator of the United Nations Development Programme to formulate immediately, and in consultation with the Governments concerned, a pilot project in water-resource management\*\* and submit his proposal to the Governing Council of the United Nations Development Programme at its twenty-fourth session, if possible;

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\*E/CONF.70/12, see *Water Development and Management*, edited by Asit K. Biswas, Pergamon Press, Oxford, 1978.

\*\*Defined in document E/CONF.70/12, para. 54.

4. *Further recommends* that, at the request of the Governments concerned, the regional commissions put forward proposals for the strengthening or, where appropriate, the establishment of regional institutes for training and research in the water sector;

5. *Recommends further* that the United Nations Development Programme in co-operation with the regional commissions and the United Nations system assist in promoting programmes of technical co-operation among developing countries in the field of water-resources development, which may include such areas as surface and ground-water development, drainage and reclamation, hydropower development and inland navigation;

6. *Recommends further* that all Governments, particularly those of developing countries, and the relevant United Nations agencies submit information to the United Nations Conference on Technical Co-operation among Developing Countries indicating the progress made in implementing recommendations for technical co-operation among developing countries in the water resource sector as delineated at the United Nations Water Conference with a view to defining future action and specific objectives in this area.

#### *VII. River Commissions*

*The United Nations Water Conference,*

*Bearing in mind* the relevant recommendations of the United Nations,

*Recommends* to the Secretary-General to explore the possibility of organizing meetings between representatives of existing international river commissions involved that have competence in the management and development of international waters, with a view to developing a dialogue between the different river-basin organizations on potential ways of promoting the exchange of their experiences. Representatives from individual countries which share water resources but yet have no established basin-wide institutional framework should be invited to participate in the meetings. The regional commissions should be called upon to facilitate this task at the regional level.

#### *VIII. Institutional Arrangements for International Co-operation in the Water Sector*

*The United Nations Water Conference,*

*Recognizing* the imperative need for accelerated progress in the investigation and development of water resources, and its integrated management for efficient use,

*Aware* of the efforts being undertaken by the United Nations system at various levels to assist the countries in their endeavours to achieve these objectives,

*Recognizing* the difficulties in the area of co-ordination which affect the United Nations bodies in execution of their tasks,

*Further recognizing* the complementary roles of global and regional bodies in the United Nations system, and the role of the regional commissions as outlined in Economic and Social Council resolution 2043 (LXI) of 5 August 1976,

Deeply conscious of the fundamental importance of water for economic and social development,

Requests the Economic and Social Council, in particular in its consideration of the restructuring of the economic and social sectors of the United Nations system, to give priority consideration to the following recommendations:

(a) That at the intergovernmental level the Economic and Social Council, the Committee on Natural Resources and the regional commissions within their respective regions, should play a central role in the promotion of intergovernmental co-operation as a follow-up to the Plan of Action on integrated water resources development and management recommended by this Conference;

(b) That for this purpose, among other measures, steps be taken to intensify the work in the water sector of the Economic and Social Council and the Committee on Natural Resources through, *inter alia*, strengthening the secretariat support services to these organs by all United Nations organizations and bodies involved in the water resources sector and, if required, through the convening of special or subject-oriented sessions;

(c) That the proposals for interagency co-ordination presented to the Conference in the report of the Administrative Committee on Co-ordination and the Environment Co-ordination Board\* be examined by the Committee on Natural Resources at its fifth session with a view to submitting its recommendations to the Economic and Social Council at its sixty-third session for consideration and implementation;

(d) That the regional commissions should, taking into account the central role of the Economic and Social Council and the Committee on Natural Resources at the global level, and the special needs and conditions of the respective regions:

- (i) Assist the United Nations Development Programme and the United Nations specialized agencies and organizations, at the request of the Governments of developing countries concerned, in identifying intersectoral sub-regional, regional and interregional projects and preparing programmes;
- (ii) Intensify their efforts in the water sector, and, with the assistance of the competent organizations of the United Nations system and at the request of the Governments concerned, enlarge co-operation among the countries in the water field at the subregional, regional and inter-regional levels;
- (iii) Assign specific responsibility on water to an existing intergovernmental committee within the regional commissions, or if necessary, create a new one, and establish or strengthen, as appropriate, the secretariat units of the commissions dealing with water, which would serve as the secretariat of the intergovernmental committee referred to in this subparagraph;
- (iv) Establish *ad hoc* groups of experts, as and when necessary, who should preferably be drawn from the countries of the region concerned;
- (e) That, for the purposes outlined in the preceding paragraphs, the General Assembly should consider providing, as necessary, additional resources to the regional commissions and other relevant sectors of the United Nations within the budget of the United Nations;

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\*Present and future activities of the United Nations system in water resources development (E/CONF.70/CBP/4), see *Water Development and Management*, edited by Asit K. Biswas, Pergamon Press, Oxford, 1978.

(f) That at the country level, under the leadership of the United Nations Development Programme resident representatives, the United Nations system should intensify the co-ordination of projects and programmes undertaken at the request of the Governments of developing countries.

*IX. Financing Arrangements for International Co-operation  
in the Water Sector*

*The United Nations Water Conference,*

*Realizing* the gravity of the problem of water resources and the crisis that mankind may have to face unless timely action is taken to avert it,

*Recognizing* that the Action Plan recommended by the Conference is designed to promote activities at the national, regional and interregional levels to avert such a crisis,

*Further recognizing* that the implementation of the Plan will require, *inter alia*, mobilization of increased financial resources,

*Taking note* of the suggestion for the establishment of a voluntary fund for the development and management of water resources,

*Aware* of the need for additional resources required for the implementation of the Action Plan,

1. *Requests* the Secretary-General to prepare, on the basis of consultations with Governments and competent organizations within the United Nations system, a study of the most effective and flexible mechanisms to increase the flow of financial resources specifically for water development and management through existing organizations and proposed mechanisms and to present the study to the General Assembly at its thirty-second session, through the Economic and Social Council at its sixty-third session;

2. *Recommends* that additional financial allocations be made to existing:

(a) Organizations within the United Nations system, particularly the United Nations Development Programme, in order to increase the funds available to all developing and in particular the least developed countries to meet their needs in technical assistance and programmes related to water resources development;

(b) Bilateral, subregional, regional and international organizations and programmes, including the International Bank for Reconstruction and Development and the regional development banks, within their respective areas of responsibilities, and recommends that they review their terms and conditions in view of the economic and social implications of water development projects with the objective of providing the best possible terms, taking into account the results of the United Nations Water Conference;

3. *Recommends further* that priority be given to projects for the development and management of water resources based on co-operation among developing countries.

*X. Water Policies in the Occupied Territories*

*The United Nations Water Conference,*

*Recalling* General Assembly resolution 3171 (XXVIII) of 17 December 1973, entitled "Permanent sovereignty over natural resources", and taking into consideration the statements made by the representatives of the United Nations Council for Namibia and the Palestine Liberation Organization,

*Further recalling* General Assembly resolution 31/186 of 21 December 1976, entitled "Permanent sovereignty over national resources in the occupied Arab territories",

*Noting* with great concern the illegitimate exploitation of the water resources of the countries and peoples subject to colonialism, alien domination, racial discrimination and *apartheid*, to the detriment of the indigenous peoples,

1. *Affirms* the inalienable right of the people of the countries under colonial and alien domination in their struggle to regain effective control over their natural resources, including water resources;
2. *Recognizes* that the development of water resources in territories subjected to colonialism, alien domination, racial discrimination and *apartheid* should be directed for the beneficial use of the indigenous peoples who are the legitimate beneficiaries of their natural resources, including their water resources;
3. *Denounces* any policies or actions by the colonizing and/or dominating Powers contrary to the provision of paragraph 2 of the present resolution, and particularly in Palestine, Zimbabwe, Namibia and Azania.

OTHER RESOLUTIONS

*XI. Question of the Panama Canal Zone*

*The United Nations Water Conference,*

*Considering that:*

- (a) The sovereign use of natural resources, as a fundamental element of the economic, social and political development of peoples, is a principle recognized by the United Nations,
- (b) Both the system of ownership of water and jurisdiction over that resource are of special significance for the purposes of planning and development of water resources,
- (c) Those principles are closely linked to the objectives of the United Nations Water Conference,
- (d) The problem of the so-called Canal Zone of Panama constitutes one of the principal impediments to the full development of water resources in the areas surrounding the cities of Panama and Colón,

*Resolves* to express its earnest wishes that the negotiations being conducted by the Republic of Panama and the United States of America will culminate at the earliest possible time in a just and equitable solution that will permit the Republic of Panama fully to exercise its sovereign rights in the part of its territory known as the Canal Zone and, consequently, to formulate a national policy for the full development of water resources.

14th plenary meeting  
23 March 1977

*XII. Expression of Thanks to the Host Country*

*The United Nations Water Conference,*

*Recognizing* the importance of international co-operation aimed at improving the development of water resources for efficient use through an integrated approach,

*Convinced* that the United Nations Water Conference which took place at Mar del Plata from 14 to 25 March 1977 represents a significant contribution to the efforts of the international community to find appropriate means to improve the quality and supply of water for the use of mankind,

*Expresses* its profound appreciation to the Government and people of Argentina, of the province of Buenos Aires and, in particular, of the City of Mar del Plata, for making possible the holding of this Conference and for their generous hospitality and their great contribution to the successful outcome of its work.

16th plenary meeting  
25 March 1977

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