0809

UNITED NATIONS

ECONOMIC AND SOCIAL COUNCIL

Distr.
LIMITED

E/ECWA/NR/CONF.3/10
7 December 1978

Original: ENGLISH

ECONOMIC COMMISSION FOR WESTERN ASIA

Second Regional Water Meeting
30 December 1978 - 3 January 1979
Riyadh, Saudi Arabia

Item 4.7 of the Provisional Agenda

ASSESSMENT OF WATER RESOURCES

ECONOMIC COMMISSION FOR WESTERN ASIA

Second Regional Water Meeting
5-9 June 1978
Beirut, Lebanon

ASSESSMENT OF WATER RESOURCES

This paper was prepared jointly by the World Meteorological Organization and the United Nations Educational, Scientific and Cultural Organization.

1. INTRODUCTION

1.1 No water-resource management or development, whether it be for the purpose of water supply to the population, to agriculture or to industry, or for energy production, is possible without an assessment of the quantity and quality of the water available. The nature of any specific assessment depends on the stage of planning or execution of the particular water-resource management or development project, but a continuous basic assessment is a prerequisite for all such project-oriented assessment activities.

1.2 The objective of water-resource assessment is to determine the sources, extent and dependability of water supplies and to define characteristics on which an evaluation of the possibilities for their utilization and control is to be based. Different socio-economic and natural environmental conditions, and the range of development targets set in different regions, exert specific and changing requirements on the accuracy of the planning data required. Therefore, overall water-resource assessments are usually supplemented by the more detailed and accurate assessments required by development plans.

1.3 The evaluation of the water resources of a basin or a country should not be regarded as a "one-time" undertaking. The level of assessment to be obtained depends on the existing and planned development within the hydrological unit concerned, and so assessments have to be refined with increasing economic development.

1.4 The ultimate goal is for all countries to develop and maintain such programmes for the assessment of their water resources as will provide adequate hydrological information for water-resource development planning, specific project planning and current water-resource management. The water-resource assessment programme should be considered as part of a general resources development and management programme within the framework of national economic and social planning.

1.5 The water-resource assessment programme should be kept flexible enough for it to be adaptable to changes in development strategies and objectives. However, there are limits to the flexibility with which water-resource assessment can respond to such changes. The time length of hydrological statistics is to be measured in decades if they are to yield adequate information, whereas concrete development plans only exceptionally extend beyond a 10-year horizon. In order for a water-resource assessment programme to be valid even if the development plans change, the basic assessment programme should cater for a multitude of development alternatives and will for this reason be fairly independent of any concrete short-term or medium-term water-resource development plans.

1.6 The fact that rapid assessment of water resources is of immediate use and a necessity for urgent current projects should not obscure the need for a long-term, continued programme of hydrological assessment. Failure to recognize the value of hydrological time series has resulted, in the past, in some spectacular misinvestment. Water supply intakes that fail to supply water during dry seasons, groundwater depletion and saline encroachment, irrigation reservoirs that remain unfilled for many years, flooding, dam failure and inefficient power plants are just some of the possible consequences of rash assessment.

1.7 The UN Water Conference in its Resolution I "Assessment of Water Resources"

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.

1.8 The purpose of this document is to review what action might be taken by individual countries in response to Resolution I of the UN Water Conference and to outline proposals for the implementation of the resolution at regional and international levels in order to assist countries in developing and maintaining adequate programmes for the assessment of their water resources. The implementation involves two related activities executed concurrently: the first concerns the evaluation of the present status and future needs of water-resource assessment in countries; the second relates to the development and strengthening of assessment programmes in countries so that they adequately meet these needs.

1.9 The requirements for manpower and equipment, especially in the second of the above activities, are considerable and will only be met by a major investment of funds, including multilateral and bilateral technical assistance to developing countries.

1.10 The diversity in natural environmental, socio-economic and development conditions in the countries of the world is so large that no general methodology will be applicable to a majority of countries. But for groups of countries which have similar hydrologic and development characteristics, a common methodology can be developed and applied.

2. BACKGROUND AND OBJECTIVES

2.1 As is said in the report of the United Nations Water Conference, in most countries there are serious inadequacies in the availability of data on water resources. The report also states that the processing of data has serious gaps. Many countries in this situation can improve matters by their own efforts, others need some assistance to do so, but several countries need assistance both in the determination of their needs and in the execution of their water-resource assessment activities.

2.2 The ultimate goal is the assessment of water resources in each country to a level which will satisfy all needs of planning and management. As regards the actual assessment technologies, both Unesco and WMO have, for many years, had large-scale programmes to develop methodologies and to assist their Member States in implementing water-resource assessment activities.

2.3 WMO, through its Operational Hydrology Programme, assists countries in activities pertaining to:

(a) Measurement of basic hydrological elements from networks of meteorological and hydrological stations; collection, transmission, processing, storage, retrieval and publication of basic hydrological data;

(b) Hydrological forecasting;

(c) Development and improvement of relevant methods, procedures and techniques in:

(i) Network design;
(ii) Specification of instruments;
(iii) Standardization of instruments and methods of observation;
(iv) Data transmission and processing;
(v) Supply of meteorological and hydrological data for design purposes;
(vi) Hydrological forecasting.

2.4 Unesco, since the start of the International Hydrological Decade in 1965 and now within the framework of the International Hydrological Programme, assists countries in studies concerning the assessment of water resources and the determination of water balances and their elements at global, continental, regional and basin level, executes hydrological and hydrogeological surveys and provides assistance in the field of education and training of hydrological personnel at all levels and in the fields of research and institutional strengthening.

2.5 Since the UN Water Conference both Unesco and WMO have been intensifying their regular programme activities in the field of water-resource assessment technology and have been keying them to the targets set by the Conference.

2.6 In order to support proposals for an increase in the technical and financial resources that are allocated by countries for the assessment of their water resources and to promote international technical assistance in this field, it is necessary to define the needs as clearly as possible, this definition being based on an evaluation of the present status of water-resource assessment in each country. These national evaluations are primarily the responsibility of the individual countries who can define their needs, including those for technical co-operation and technical assistance.

2.7 It is proposed that an international project be developed to assist those countries which require and seek assistance in the determination of their needs and the evaluation of their assessment programmes.

3. NATIONAL EVALUATION OF THE PRESENT SITUATION REGARDING WATER-RESOURCE ASSESSMENT AND DETERMINATION OF NEEDS AND CONSTRAINTS

3.1 Assessment programmes

3.1.1 As stated in the introduction to this document, water resources can be neither developed nor managed rationally without an assessment of the quantity and quality of water available. The recommendations of the UN Water Conference, and in particular its Recommendation A on Assessment of Water Resources, contain a number of proposals as to what countries could do in order to strengthen and co-ordinate their assessment programmes. A description of what might be included in such programmes is presented below in 3.2, the word programme being taken in a very broad context to include not only identification of water resources, data collection and processing, but also related education, training and research, and the establishment of an appropriate legal and organizational structure within which to carry out the work.

3.1.2 Three stages can be identified in the implementation of programmes for the assessment of water resources. During the first stage the aim is to collect and process existing hydrological and hydrogeological data to permit a preliminary assessment to be made of available water resources on which to found national or regional long-term plans for overall water-resource development based on or keyed to present and future water needs. As regards surface water, it is possible to define minimum requirements concerning network densities and lengths of record. However, groundwater requirements depend on, inter alia, geological conditions and for this reason cannot be defined so easily.

3.1.3 The second stage of assessment it characterized by extension of networks and more detailed investigations. This stage will yield water balances and water master plans in which the development of resources is often incorporated. The emphasis is on the collection and processing of data for the design of projects using surface and groundwater. Another important aspect at this stage is the augmentation and strengthening of the manpower and support services entrusted with the work.

3.1.4 Assessment reaches its third stage when, in order to avoid over-exploitation, all those measures must be taken which are necessary for the management and control of water abstraction, its use and disposal. To some extent the data and services required are specific to each project and, although the greatest demand arises in the years immediately preceding and following the implementation of any project, a continuing demand for monitoring purposes will exist over its entire active life.

3.1.5 The costs involved in the development and operation of hydrological networks and in associated activities such as data processing training and administration are considerable. Some indication of their magnitude is given in the document "Assessment of Water Resources: Networks, Surveys, Services and Related Facilities; Present Status and Requirements by 2000" (E/CONF.70/1) prepared jointly by WMO and Unesco for the UN Water Conference. For example, the average costs of installing and operating an ordinary raingauge were estimated to be $1,000 and $500 per annum respectively. For a full hydrometric station, including sediment and water-quality observations, the figures were $6,000 and $2,000 per annum respectively. The actual costs will vary widely from country to country and from region to region and will depend on a multiplicity of factors, so they will need to be evaluated individually for any proposal. When consideration is given to the cost of any proposal for the strengthening of assessment activities, it is important to note the value to future development projects of the information on water resources that will be collected and to relate this to the costs involved in the development projects themselves.

3.2 The evaluation of assessment programmes and the determination of needs

3.2.1 The first step to be taken by any country in the implementation of Resolution I of the UN Water Conference is an evaluation of the country's present programme for surface and groundwater resource assessment.

3.2.2 It is necessary to establish criteria or reference levels for use in judging the extent to which a water-resource assessment programme satisfies the requirements for the first, second or third stages of implementation, as defined in 3.1 above. With regard to the first stage, guidance on minimum network densities and related matters is included in the WMO Guide to Hydrological Practices. Additional information, including that relevant to the second and third stages, is presented in the WMO/Unesco document referred to in paragraph 3.1.5 above. It is important that the information on present assessment programmes be presented in a form compatible with the established criteria. For example, the information on precipitation stations should state the density of each type of station within various topographically and climatologically homogeneous regions.

3.2.3 The evaluation of assessment programmes should be undertaken on a rational basis. For this purpose, it would be valuable to divide the country into appropriate areas based on climatic, topographic and socio-economic factors and to present the results accordingly. It will often be sufficient to use just three factors: mean annual rainfall, topographical elevation and population density. Conclusions can then be drawn concerning the extent to which the programme satisfies the requirements of the first and second stages in each region. Evaluation with regard to the third stage would need to be undertaken more on a project-by-project basis, but it is anticipated that the results could still be compiled and presented for each region.

3.2.4 An evaluation such as is described above requires that detailed information be collected. Water-resource assessment must provide the information necessary for national development planning, but at the same time should be based primarily on a strong physical, scientific background so that the assessment remains valid and useful should the national plan be adapted to changing circumstances. This means that an assessment programme should not only be based on the requirements of an existing plan, but also take into account the possibility of changes in the plan, which requires a certain amount of information on national legislation and planning in general. The following paragraphs present proposals as to what information might be collected for this purpose. The amount and detail of information to be collected depends on the peculiarities of each case. This information applies to both surface and groundwater and encompasses quantity and quality inputs, including consideration of water-borne diseases and other environmental factors.

3.2.5 Checklist for the evaluation of assessment programmes

3.2.5.1 Management of water-resource assessment activities

(a) Institutions

Identification and description of agencies and institutions dealing with water-resource assessment (quantity and quality), including rainfall, river stage and discharge, groundwater, snow and ice, and lakes; budgetary situation and plans for future development; institutional arrangements for international basins; plan for institutional re-arrangements, if any.

(b) General structure of water-resource planning

Situation concerning legislation and guidelines followed for water-resource management; role of water in national economy; constraints and needs from a national point of view; global and sectorial water-resource policy (agriculture, industry, urban and rural water supply, floods, etc.); water development and management plans; funds for water-resource programmes; long-term plans for water-resource assessment and comparison with UNWC goals.

(c) International co-operation

Bilateral and multilateral co-operation in water-resource activities, in particular concerning strengthening of operational services, research and training centres; participation in international programmes dealing with water resources.

3.2.5.2 Basic data collection, processing, storage and retrieval and related services

(a) Observational networks and data collection

Collection of time-independent data (physiographical, boring descriptions, well logs, etc.); inventory of stations for collection of time-dependent data (rainfall, evaporation, river stage and discharge, groundwater, sediments, chemical and biological water quality, snow and ice); plans for future expansion of networks; availability of personnel for operating networks; plans for increases in staff at different levels; availability of measuring and recording instruments and ancillary equipment; hydrological equipment of national manufacture; distribution of stations and adequacy of networks in relation to development projects; whether observations (units, frequency) conform to international standards or recommendations.

(b) Data processing, storage and retrieval

Availability and adequacy of data-processing facilities and software; availability of trained personnel; data banks for time-dependent data (rainfall, water stage and discharge, hydrochemical, etc.) and time-independent data (physiographical, geological boring descriptions, well yields, etc.); plans for expansion of facilities and improvement of software; training requirements at different levels; data dissemination, how data are made available to users.

(c) Workshops, laboratories and related services

Premises, facilities and staff of maintenance and repair workshops for hydrological and hydrogeological equipment and instruments; facilities and staff for water-quality laboratories; plans for future expansion of facilities and personnel.

3.2.5.3 Areal assessment of water resources

(a) Areal assessment of surface water

Topographical maps and areas covered by aerial surveys; relevant hydrometeorological and hydrological studies performed in the past (average rainfall, rainfall intensity, surface water yield, regional flood frequency, etc.); existing hydrological maps; application of remote sensing and models to water-resource assessment; use of national and foreign consultants for areal assessment studies; plans for future specific areal assessment studies; whether assessments are periodically revised as additional data become available.

(b) Areal assessment of groundwater

Hydrogeological, geological and topographic maps and areas covered by aerial photographs; regional and local, geological geohydrological and geophysical studies performed; application of remote sensing; geophysical and modelling techniques; use of national and foreign consultants for geohydrological areal assessment studies; plans for future areal assessment studies; studies concerning mineral and thermal waters.

3.2.5.4 Education and training

(a) Training at professional level

National universities and institutions offering training programmes in hydrology, hydrogeology, water chemistry and limnology; fellowship programmes and training abroad.

(b) Training at technician and observer level

Past experience with technician observer training; national institutions providing training; present training requirements and programmes; policies and views regarding technician training; participation in regional and overseas training programmes.

3.2.5.5 Research and development

Existing and planned research programmes related to water-resource assessment in a broad sense, as for instance hydrological, geological, hydrobiological, geophysical, morphological and hydrochemical research; research facilities such as water quality, isotope, biological and hydrological laboratories and institutes and the availability and use of computers; the relevance of research to assessment goals; the available specialized manpower both as regards scientists and laboratory technicians; dissemination of recent scientific developments through refresher courses and international contacts; participation in international scientific programmes and exchange of knowledge and experience.

3.3 Bilateral and regional co-operation

River basins may provide a rational basis for the division of a country into regions when undertaking the evaluation of water-resource assessment activities. In a number of instances these basins will form part of a wider international basin with an established inter-governmental river basin commission. In such cases, the countries concerned may consider it appropriate to undertake projects for the evaluation and augmentation of their assessment activities in the international basin as a joint exercise. For similar reasons, two or more countries may choose to co-ordinate all such work. Where such co-ordination involves a number of countries, it would be appropriate for it to be established in co-operation with the UN regional commissions. This bilateral or regional co-ordination will be particularly valuable if requests are made for external assistance in undertaking the evaluation or in implementing subsequent proposals for the strengthening of water-resource assessment activities. Advantages could also be gained from the international co-ordination of the evaluation of assessment programmes. This is discussed in part 4 of this document.

4. PROPOSED INTERNATIONAL PROJECT

4.1 Description of the proposed project

4.1.1 In accordance with the aims of Resolution I of the UN Water Conference, it is proposed that an international project be undertaken, consisting of surveys, studies and projects, the purpose of which would be to increase the capability of countries to evaluate their achievements and to determine their needs and, in addition, to provide a general framework for technical assistance in this field.

4.1.2 To this end the following parallel lines of action are proposed:

(i) The determination of the needs and constraints of countries, in particular developing countries, in the field of water-resource assessment.

(ii) The development of methodologies for the evaluation of the present status of water-resource assessment, past achievements and the determination of needs for further activities. These methodologies, although having global similarities, have to be specified by region and by groups of countries having similar natural environmental and development characteristics and/or sharing river basins or aquifers.

(iii) The promotion of technical co-operation, both in the form of co-operation between countries and in the provision of technical, multilateral or bilateral assistance in the field described above.

4.1.3 The primary aim of these proposals is to provide guidance and practical help, if requested, to countries which, for a variety of reasons, require external assistance in implementing the Mar del Plata Action Plan in this field. In part 2 of this document reference is made to the fact that a number of countries may experience difficulties in evaluating their present assessment activities and in developing and implementing plans for overcoming any deficiencies that are brought to light. It is precisely to such countries that the proposed international project will be of greatest benefit. It is proposed that the project be executed jointly by Unesco and WMO in close co-operation with the Economic Commissions of the UN and with other UN agencies as necessary.

4.1.4 It is proposed that the methodologies referred to in 4.1.2(ii) be developed and then tested in pilot studies which would be undertaken in developing countries representative of a variety of local conditions. It would be appropriate for at least one of these pilot studies to be undertaken in the West Asian Region and it has been suggested that it could be located in the Yemen Arab Republic. However, a final selection of the sites for the pilot studies would have to be made on the basis of invitations received from countries ready to co-operate in their execution.

5. ACTION PROPOSED

5.1 The meeting is invited to consider the information contained in this document concerning possible action that would be undertaken at national, regional and international levels on the implementation of Resolution I of the UN Water Conference. Particular attention is drawn to the list of activities which comprise a water resources assessment programme, as presented in section 3.2, and the proposal for an international project which is presented in part 4. With regard to the latter proposal, the meeting may wish to express its views concerning the value of such a project and the location of one of the pilot studies within the Region.