STRATEGY FOR IMPLEMENTATION OF ICID'S CONCERNS EMANATING FROM THE SECTOR VISION
ON
'WATER FOR FOOD AND RURAL DEVELOPMENT
(As updated after approval in Cape Town in October 2000)

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Strategy for implementation of issues of ICID's concerns emanating from the sector vision

on

'WATER FOR FOOD AND RURAL DEVELOPMENT'

PREAMBLE

The International Commission on Irrigation and Drainage (ICID) is a constituent member of the World Water Council (WWC). The WWC presented a global "Long Term Vision for Water, Life and Environment in the 21st century" to the world community at the Second World Water Forum held at The Hague, The Netherlands from 17 to 22 March 2000. In the framework of the vision preparation process, three major sector visions were developed: Water for People, Water and Nature and Water for Food and Rural Development. ICID made a significant contribution to the Sector Vision on Water for Food and Rural Development.

A proposal to prepare an ICID "Strategy for Implementation of Sector Vision", based on the discussion in the Task Force set up for the purpose, was vetted in the Permanent Committee for Strategy Planning and Organisational Affairs (PCSPOA) and the Permanent Committee for Technical Activities (PCTA), among others through the preparation of 43 Country Position Papers and the hosting of regional meetings in the Americas, Europe, South Asia and South-East Asia. It was further considered and adopted by the International Executive Council of ICID at Granada. The draft strategy to reflect ICID's specific ideas, positions and plans (as a key association of professionals in the Sector) was prepared in the Central Office, was vetted by the Task Force and then circulated to ICID's National Committees for concurrence. Suggestions received were incorporated and the draft "Strategy Paper" was finalised for presentation at the Second World Water Forum. It consisted of the following:

- steps to disseminate the country position papers widely within each country;
- actions to fill up the gaps in the position papers;
- identification of what ICID would undertake on its own and what would be done in co-operation with other institutions or organisations;
- allocation of various actions to different Work Bodies within ICID;
- selection of topics from identified actions for future workshops, conferences and congresses of ICID;
- help in mobilisation of funding for implementing actions;
- establishment of mechanisms to monitor and evaluate progress on implementation of actions;
- establishment of awards/prizes to recognise National Committees making significant progress on implementation under this Strategy;
- promotion of ICID's WatSave Awards and wide dissemination of the information contributed.

The draft strategy was presented by the President ICID during the subject session at The Hague. A 500-page ICID publication comprising the "Draft Strategy" and the Country Position Papers was released at that time, when very useful discussions took place during the session. The Central Office of ICID, many of the ICID office bearers and representatives of National Committees and experts made significant contributions to the whole process of formulation of the Vision during the earlier 6 months. During the Second World Water Forum, discussions relevant to ICID concerns were held in several other sessions as well. After the Second World Water Forum, the Central Office of ICID accessed/procured several proceedings of these sessions and culled out issues for consideration of ICID work bodies at Cape Town in consultation with their Chairs. Some of the

critical issues have been included in the revised "Strategy". As a result of deliberations in the Task Force, in the open consultation, in the Work Bodies at Cape Town, the draft Strategy was improved and presented to IEC for adoption by the Chair of Permanent Committee for Technical Activities (PCTA).

In parallel with the preparation of the revised Strategy for Implementing the Sector Vision, the Country Position Papers were edited. Vice President Hon Tom Anstey readily and enthusiastically helped Central Office with meticulous editing of several Country Position Papers. The National Committees also responded to the request call and sent the revised versions of their papers wherever possible. The revised Country Position Papers have been published separately on a CD-ROM and hard copies are available for those who are interested.

During the process of development of the Country Position Papers, the Policy Dialogue Model (PODIUM) developed by the International Water Management Institute (IWMI), Colombo, Sri Lanka was presented. It was deployed by a few National Committees. Discussions held earlier about PODIUM in Granada led to the organisation of a special workshop at New Delhi, India by ICID in collaboration with the Indian National Committee on Irrigation and Drainage (INCID) during December 1999 to verify the country data, the basin wide irrigation efficiency and the problems experienced while using the PODIUM. For this purpose, representatives of five National Committees accounting together about 60% of the world's irrigated area, viz. China, Egypt, India, Mexico, and Pakistan were invited. A group of PODIUM experts from IWMI interacted with the representatives of the National Committees as well as a few independent experts in the field of hydrology, ground water, irrigation and agriculture from India. Mr. Fernando Gonzalez from the World Bank participated and guided the proceedings. As a result of this workshop, IWMI took up modification of the PODIUM so as to enable its use by the large countries like China and India. Both these countries plan to use the revised version and sharpen their focus on the Sector Vision. The contributions made by INCID for fine-tuning of PODIUM in association with IWMI experts are indeed noteworthy. A follow up to the New Delhi workshop was held at HR Wallingford UK during February 2000, where presentations about PODIUM were made by Dr. David Seckler and Dr. Upali Amarsinghe of IWMI for the designated experts of ICID viz. Mr. Bob Rangeley, Dr. M.G. Bos and Mr. Frederiksen.

The Strategy depicts what, ICID considers of importance, for the implementation of the vision by all the actors. ICID's input in this integrated process is formulated in line with this background. It is clear that especially in the developing countries, huge efforts are required to:

- feed the still growing population;
- improve the standard of living in the rural area;
- develop and manage land and water in a sustainable way during the coming decades.

In respect to this process, ICID recognises basically three climatic zones, viz. temperate humid, arid/semi-arid and humid tropics. In addition, in principle, four cultivation practices are distinguished, viz. rainfed area with or without drainage, and irrigated area with or without drainage. Dependent on local conditions, different types of water management with different levels of service will be appropriate.

ICID has participated in the whole vision process with keenness and recognises its own responsible position as an international apex body in the sector that is responsible for about 70% of the water use in the world. ICID therefore appreciates the necessity to support full but justified water use in the sector. As enunciated in the Granada statement, "ICID encourages all stakeholders to irrigate and drain arable lands to their optimum efficiency, maximise food production and assure that water not used is recycled to the extent that is reasonably possible. Basin wide, the use of water will be optimised. Where applicable, it will be shared amongst States and regions and pollution affecting water quality for use in irrigation, will be controlled to an acceptable level".

The document lays down a strategy for implementation of ICID's findings from the Sector Vision. The "Strategy" basically charts out its own Agenda for the future. The compilation of Country Position Papers available separately will help a reader to get a good overview of the developments and positions in irrigation and drainage at country level amongst ICID membership. The Strategy includes in brief, ICID's concerns on various issues that have become more apparent due to the vision process. It does not necessarily agree with the findings of the 'Vision" which are summarised in the document. Some of the ICID concerns, which are not included in the Vision are brought up in the `strategy'. In fact the document clearly spells out what ICID believes as necessary and important for future water management, to support the required increase in food production, in light of sustainable and equitable rural development with efficiency and economy.

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NEW DELHI, July 2001

STRATEGY FOR IMPLEMENTATION OF ISSUES OF ICID'S CONCERNS EMANATING FROM THE SECTOR VISION ON 'WATER FOR FOOD AND RURAL DEVELOPMENT'

I. INTRODUCTION

Human habitats spread out on the earth's surface initially wherever food could be gathered and later where it could be produced. Survival and growth of mankind in the face of adverse environment was due to man's ingenuity in meeting with the food requirements. Forests were cut, lands were protected and reclaimed, and cultivation was started. Early civilizations grew along major rivers of the world, with agriculture as the focal point around which, the nomadic mankind gravitated. But towns, cities, metros and mega-cities grew out of needs of people for more organised life through co-ordination, defence, governance, and later with the industrial revolution. The original small habitats remained 'rural'. Rural populations remained agriculture-centric though benefiting from the industrial revolution. The urban ones got differentiated according to the needs of centralisation. The rural areas continued to grow food and feed the urbanites. Collection, process, storage to take care of lean seasons, transport, distribution, trade, market etc. for food gradually got centralised and concentrated in urban areas. But the process triggered infrastructure development in rural areas. Such activities with spread at both locales together, constitute rural development and well being.

Up to the 19th century, the rural folks remained employed on agriculture related activities, the urbanites getting employed more and more in manufacturing and services sectors catering to production of consumer goods of higher value. Agriculture production remained farm and family oriented in many countries, under-organised, lowly valued, contributing a lower proportion to the Gross Domestic Product (GDP) of a nation, as compared to a smaller population remaining engaged in other sectors producing a larger share of GDP. The rural populations largely remained relatively poorer as compared to the urban people. Due to increasing pressure on land, landless people grew in numbers. Due to lack of jobs and deficit in availability of water and food for the growing populations, migration towards urban habitats grew, providing labour force but also causing growth of impoverished pockets in urban areas. Poverty, hunger, malnutrition and unemployment both in rural and urban areas got intricately associated. A poor person often remained unemployed, hungry, undernourished and unhappy, even when at times adequate food was available globally, simply for want of buying capacity and accessibility to food. But due to extreme variability in availability of water, people continued to suffer hunger and at times starvation due to famines. This picture changed significantly during the 20th century due to rapid spread of irrigation, drainage of water logged farmlands and improved flood management in cropped areas. The ill effects of landlessness, unemployment, malnutrition and poverty were reversed. They, however continue to stalk many societies even at the beginning of the 21st century, where irrigation and drainage are neither developed nor managed adequately.

Food consumed by mankind comes from agricultural crops or from birds, fish and animals - meat and milk, which constitute livestock products. Crops are used for providing cattle feed mostly by way of using grains in case of developed countries and/or mainly crop residue itself in case of developing countries. Cropped foods are relatively economical and are mostly poor peoples' foods. Meat and dairy foods are secondary, derived from products of crop foods; they consume more water and are on the whole more expensive. Proportion of consumption of meat and milk, normally grows with economic well being i.e. affordability. But growth of both types of food requires proper water management, especially during the critical growth period of crops, by either water application in the right dose and at the right time through irrigation where necessary, or by removal of excess water by drainage.

Irrigation increases productivity and value of land, which brings prosperity, which in turn facilitates installation of infrastructure. But conversely, good infrastructure helps improve the land productivity. Not long ago, the Green Revolution increased the global food production dramatically. Water availability being variable in space and time; the rural well being is intimately dependent on its supply, use, disposal and reuse. Like any socio-economic activity utilising finite natural resources, growth and sustained yield from agriculture per unit of water and land, calls for adequate financial and human investments. At the same time, a farmer is encouraged to invest in farming if he is assured of irrigation to overcome vagaries of natural availability of water. Survival, development, growth of rural economy and well being thus become synonymous with water, food and agriculture. Besides planning another green revolution or an evergreen revolution to increase land productivity and impart sustainability, a blue revolution tied up with maximising crop production while minimising water consumption is now advocated. Irrigation and drainage coupled with flood management indeed can promote sustainable rural development. A balance however is to be found between the requirements of the society, and acceptable side effects while aiming at sustainable development.

Water in the form of rain and snow is made available by nature in the yearly hydrological cycle. An appreciable part of it gets lodged in snowcaps and natural lakes and is utilisable subsequently in case of the former, through snowmelt reaching a river system. A sizeable part is retained in surface soils and used up through evapotranspiration for biomass generation. Another part seeps into the ground feeding natural aquifers. A major part appears in the river system downstream and is drained through streams and rivers into seas, unless captured in man-made storages or artificially diverted from natural streams. Water is recycled continuously through transpiration through biomass and evaporation from land, river systems and oceans, besides precipitation through condensation, rain and snow. A river basin is a natural entity for planning beneficial uses of available waters from precipitation, which are highly variable in space and time. Where available precipitation is excessive, land has to be drained to get beneficial uses out of it.

Often, some parts of a basin are surplus in availability, while some others face deficit. Intra and inter-basin transfer of water to remedy such imbalances has been practiced by mankind for a long time. It may involve construction of storages for impounding runoff of floodwaters generated over a few storms sometimes spanning a few days in a year, enabling its use round the year. Diversion structures involving little or no storage may be constructed for withdrawals through canals and by pumping, where the river flow quantum is adequate. Storages wherever constructed always absorb and reduce flood peaks downstream, enabling better flood management.

Presently, irrigation covers more than 260 million hectares (Mha) i.e. about 17% of world's arable land, but is responsible for around 40% of crop output and employs nearly 30% of population spread over rural areas. It uses about 70% of waters withdrawn from global river systems, 60% of which gets used consumptively, the rest predominantly returning to the river systems enabling its reuse downstream. Thus 30% of water withdrawn is put to other uses like drinking, municipal, industrial, hydropower generation, and recreation. Only a small part of this quantity is used up consumptively, while a large unconsumed part either treated or untreated is returned to the river systems and reused. Drainage systems cover about 150 Mha i.e. about 10% of world's arable land, of which 130 Mha is rainfed and the rest irrigated. As river basin boundaries normally don't match with national or State administrative boundaries, basin wide development may be affected by conflicts and competing demands for sharing of available waters between regions or peoples for various beneficial uses. Plans would therefore invariably have to aim at integration of uses, demands, supplies, size of structures required, other available resources and institutional arrangements.

The world population is likely to grow for another 50 - 60 years and will then probably stabilise. However, the growth in population will be mainly in developing countries especially in Africa, South America, Central Asia, while population of the developed world may continue to

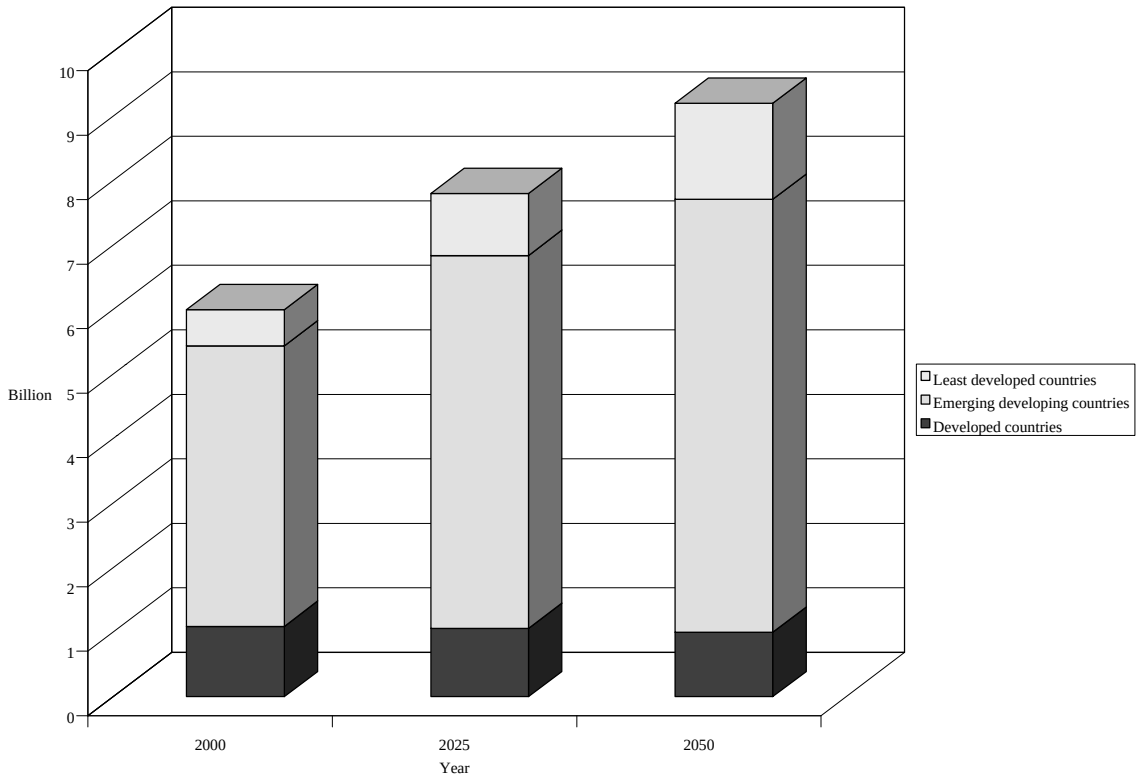

Figure 1 World population and growth in least developed countries, emerging developing countries and developed countries

decrease. So will the food demands. The mix of foods consumed - cereals, pulses, oils, fruits, vegetables, nuts, meat, dairy products, fish - and the level of calorie intake with a balanced nutritional diet is expected to undergo change with increase in the standard of living. Food needs will exceed projections, which are in proportion of growth in population alone. It is estimated that while the population will grow from 6 billion to 8 billion in next 25 years, the present food production shall have to be doubled. From the graph, (Fig.1) it is seen that population growth will take place predominantly in the least developed and developing countries. Presently also, majority of world's population lives in emerging developing countries, comprising Asia (excluding Japan), Latin America, the Caribbean and some other small regions. Demands for water for growing more food will increase causing shortages in regions, which are hitherto comfortable with availability. The growth in shortage could be avoided only by developing the unharnessed potential or by decreasing the withdrawals and simultaneously increasing water use efficiency. Large populous countries would continue to strive for maintaining self-sufficiency in food production, because their shortfalls in case of droughts, will be too large to be covered by world trade which remains at around 10% of total production and which shows signs of reduction. As developed world only has surplus food for trade, there is also a possibility that producers in developed world may move away from food production. Nevertheless, every country would attempt to increase productivity of cropped lands with water that could be made available by improving water use efficiency and by bringing additional lands under irrigation, employing better irrigation technology and through increased withdrawals where potential is yet available.

Such effort should lead to maintaining or achieving food security. The concept of security encompasses not only food production, but relates to its storage, preservation, supply at reasonable and affordable prices, and adequate size of buffer stocks to take care of natural disasters. The aim of food security for Governments means co-ordination of effort of several Ministries/Departments, which include: water resources, irrigation, public works, agriculture, rural development, environment, health, commerce and trade, industry, chemicals and fertilisers. Realisation of targeting of food security round the world would call for commitment of stakeholders and political will of the country's leadership.

It is expected that more people either landless or otherwise would move away from the agriculture sector to the manufacturing and services sector to escape unemployment and poverty in rural areas. This shift could trigger consolidation of land holdings, and improved productivity from the landmass, which in turn could cause faster economic growth. Increased productivity could mean growing required cereal food from lesser area, release some of the area for higher value crops thus ensuring poverty alleviation for poor and marginal farmers. Making water available to achieve food sufficiency and security will also lead to rural well being through better livelihood, health, employment, stabilisation of rural populations, education, transportation, communications and human productivity. It will help insure societies against natural disasters and provide a more sustainable livelihood. Irrigation, drainage and flood management will no longer remain options but will fulfill the core needs of society as well as ensuring protection of environment. As everybody lives downstream of somebody, the national planning shall, nevertheless, have to ensure availability of requisite quantities of water with right quality, down the streams in a river basin.

II SUMMARY OF THE WORLD WATER VISION, SECTOR VISION OF WATER FOR FOOD AND RURAL DEVELOPMENT AND DELIBERATIONS IN THE SECOND WORLD WATER FORUM, THE HAGUE, MARCH 2000

II.1 VISION COMPONENTS AND THE SECOND WORLD WATER FORUM

The World Water Council (WWC) had appointed the World Commission on Water (WCW) to advise the Vision Management Unit (VMU) of the WWC about formulation of the vision through mobilisation of global effort. The VMU prepared a Staff Report comprising background information and analysis of the three main sector reports, viz. Water for Food and Rural Development (WFFRD)., Water for People, and Water and Nature. ICID was deeply involved with the first sector vision, which looked into food needs and production through irrigated and rainfed areas leading to sustainable rural development The second sector vision related to water for drinking, domestic and industrial needs besides that for sanitation. The third sector vision was related to water for ecological purposes including flora, fauna, forests, biodiversity, wetlands, etc. The WCW considered the Staff Report and made a Vision Report. All these reports record the views of the authors, which are not necessarily leading from one to the other, nor shared by all the participants in the effort. What is reported, for example, in WFFRD is not necessarily the position of each of the participating organisations say like ICID. Also WFFRD conclusions are not necessarily accepted in the Staff Report and in turn what is said in the Staff Report is not completely recorded and summarised in the WCW report. To some extent therefore, a reader of one report gets only a partial glimpse of the vision. The Central Office has taken up with the WWC, such important deviations of concern to ICID. They are reflected in the succeeding paragraphs.

All these reports were presented and discussed in mainly four groups of sessions viz. Water Use Presentations, Regional Presentations, Special Subjects and Major Groups. In each of these groups, there were 11, 22, 29 and 22 sessions on wide ranging issues. The presentations and discussions at these sessions covered ground much beyond what is reported in the sector vision reports. Some conclusions were attempted in the sessions, but they were not necessarily discussed and agreed to by the participants. The following paragraphs attempt to draw and present from the Vision Reports and from the Second World Water Forum deliberations, what is

useful for ICID. Essentially the Forum provided a platform for all the stakeholders to air their views, to meet with, listen to, convince them or get convinced from people with different shades of opinion.

II.2 FINDINGS OF THE SECTOR VISIONS FOR ICID

The sector vision WFFRD comprises: a world of healthy people with adequate nutrition and secure livelihoods through agriculture in irrigated, rainfed and drained areas operating on a sustainable basis with an equitable access to resources in a fair price environment, using water efficiently; vibrant rural communities living in a secure environment for education, social services, employment, access to food, transportation and communication, market and economy. The formulation of the vision took into account the driving forces of growing population, shift in composition of cropped and livestock based foods, urbanisation and industrialisation, falling energy costs, advancements due to biotechnology, genetically modified foods, remote sensing, information technology, market based economies, world trade, ecosystem approach, and impacts of likely climate change.

The sector vision for 2025 envisages decline in the rate of increase of cereal yield by 1%, increase in cereal area annually by 0.25%, additional water supply for agriculture by 15 to 20% from investments on new large and small besides ground water storages, special strategy for rainfed areas. It also envisages improved water management practices, improved water and power pricing, utilisation of return flows, increase in water productivity, better management of shared river basins, setting up of basin organisations, agro-processing industry in high yield agricultural areas; research and development support for use of poor quality waters - productivity - improved crops to resist drought, salinity, impacts of agricultural chemicals, etc.

The sector vision for people dwells upon harnessing peoples' energy and creativity, advocates a holistic approach, environmental sustainability, governance and leadership. The sector vision for nature dwells upon economic security through environmental and social security; highlights ensuring survival and continuance of intrinsic values of eco-systems, by way of providing goods and functions which are difficult to replace, envisages reversal of degradation indicated by desertification, drying of rivers, falling ground waters, loss of wetlands and biodiversity. It also advocates an ecosystem based approach, empowerment of people, raising of awareness and good governance.

Findings such as these, from the sector visions have been considered by the Work-Bodies of ICID at Cape Town.

II.3 ANOMALIES BETWEEN REPORT FOR SECTOR 'WATER FOR FOOD AND RURAL DEVELOPMENT" AND REPORT BY 'WORLD COMMISSION ON WATER' AND STAFF REPORTS

The WFFRD and WCW reports recognise at philosophical level, freshwater as a scarce commodity, a basic need with access to the poor; advocate a holistic, systemic, integrated approach for Water Resources Management (WRM) while accounting for ecosystems integrity; emphasise need for participatory, innovative institutional mechanisms involving youth and women; full cost pricing, new subsidy programs and bridge financing; suggest role for Governments as facilitators or enablers; and need for strong and quality databases.

On detail however, the WCW report reverses WFFRD findings and envisages: -limit on expansion of irrigated agriculture, -full cost pricing, -scales down need for additional withdrawals from sector vision figures from 15 - 20 to 6 - 9%, storages from 13 to nil % and additional irrigated area from 31 and 17.5 to nil %, -pegs annual funding requirement for agriculture at the level of US$ 30 billion at both 2000 and 2025, while sector vision WFFRD envisaged much higher level of funding.

The scale of investment on water for agriculture is brought down in the WCW report from present 45 to 18% only in 2025 without giving the reasons. The reasons for the reversal of various findings of sector WFFRD as indicated above are not mentioned. ICID has been a party to the WFFRD process and largely supports its findings, but does not understand and hence can't support the reversal of those findings by the WCW.

II.4 FINDINGS OF INTEREST FROM DELIBERATIONS DURING THE SECOND WORLD WATER FORUM

The more than 80 sessions held in the Forum covered vast ground related to all facets of water. Although ICID is not directly dealing with some of these subjects, following issues of consensus which emerged are of importance to ICID for future charting of the course of actions and hence are recapitulated:

- assessment, monitoring and preparations for facing likely impacts of climate change on water availability - increase in floods and droughts - sea level rise - melting of snow and glaciers - desertification; water scarcity indicators as recently expounded by IWMI;

- need for integration of water resources development and management; need for both supply and demand management according to level of development - growing needs due to economic development and population growth of countries; need for different sizes of dams in a basin and in case of very large river basins - a sub-basin approach; scheme efficiency vis-à-vis basin efficiency and its optimisation;

- basinwide ecosystem approach; ensuring sustainability of human systems with ecosystems; sustainability is equivalent to durability and or resilience in face of natural vagaries and disasters; reclamation of waste lands; increasing water and land productivity by structural and non-structural measures;

- the crucial role played by large dams; critical role of dams in generation of hydro power and flood control; besides regeneration of ecosystems in hostile environment; need for inter-basin transfer of waters; need for resolution of problems related to water sharing within countries and between countries sharing rivers, interdependence of surface and ground waters and need to harness them optimally and conjunctively; artificial recharge of ground water where cost-effective;

- need to improve both surface and groundwater quality from both point and non-point sources of pollution; adoption of 'user pays', 'polluter cleans or pays' and 'equitable cost allocations' principles according to level of economic development and poverty level;

- level of cost recovery, balancing of prices of food- subsidies- water pricing keeping in view the need to support poor and marginal farmers; Integrated Water Resources Development and Management (IWRDM) and linkage with poverty alleviation; need for social audit;

- disallowing diversion of water from food crops to high value crops at the cost of food self sufficiency; limits of world trade in food; stakeholder participation, involvement of youth and women, lesser role for Governments as providers.

III. ICID'S CONCERNS

ICID's mission comprises 'Managing Water for Sustainable Agriculture' and ICID is dedicated to enhancing the worldwide supply of food and fibre for all people and productivity of irrigated and drained lands, by improving water and land management besides management and control of flood affected lands. The WFFRD and the entire vision process went far beyond ICID's

field of work and hence everything that has been summarised in Section II does not necessarily fall in the ambit of ICID's concerns. For instance 'Rural Development' encompasses a very large scope, of which 'Water for Agriculture' is no doubt a core concern. Similarly 'Poverty Alleviation of Rural People' is a vast subject but everybody agrees that the contribution of sustainable agriculture through irrigation and drainage to poverty reduction is substantial. The Section III therefore attempts to focus attention through following sub-sections on ICID's concerns as distinct from Vision outputs and provides a brief list of issues at the end of each sub-section.

III.1 WATER AVAILABILITY

Fresh-water is a finite, naturally renewable resource received by way of precipitation, but is significantly unevenly distributed in time and space. Hydro-climatological conditions of a region therefore set the limits for its availability. It is estimated that between 2000 and 2025, the global average annual water availability per capita will fall from 6600 m^3 to 4800 m^3 and due to uneven distribution of water resources, some 3 billion people will live in countries - wholly or partly arid or semi-arid having less than 1700 m^3 per capita water availability. Countries or regions are broadly considered water stressed when the annual per capita availability is between 1000 - 2000 m^3. With availability below 1700 m^3, a country is deemed 'water scarce' and with less than 1000m^3, it becomes `severe'. In 1990, eighteen countries in the world were 'severely water scarce', a number that could swell to 30 by the year 2025. Most of these are located in Asia and Africa, and are already facing food shortage. Further, there are 12 countries with availability less than 500 m^3. This number too is likely to increase to 19 by 2025. More than 1 billion people including one third of the population of China and India live in arid regions facing water scarcity. Similarly, 350 million people mostly in Sub-Saharan Africa face severe scarcity, and can't do without embarking upon massive water development projects to meet with their water needs.

These criteria of classification are however based on water quantity flowing down in rivers. Such bases indicate the potential availability. But they don't consider how much proportion of the potential is useable, developed and how much is put to beneficial use, especially due to inability of some countries to impound it. If such quantum is considered and developed, the present assessment would change significantly.

IWMI had for the first time in 1998, studied water requirements and withdrawals anticipated in 2025, against the availability status, for a sample of 116 countries. Assuming significant increase in water use efficiency in irrigation, the study computed the need for facilities enabling additional withdrawal of water resources for these countries, which were clubbed into five groups. The study indicated significant need for additional withdrawal of waters in country groups I to IV, while indicating a need for attending to water management for all the groups. China and India, together accounting for the world's 40% of population were not included in this grouping. They being very large and having highly variable water availability in time and space, were planned to be studied by IWMI in greater detail.

In a subsequent study, IWMI considered 45 selected countries and grouped them into 3 basic categories of projected water scarcity.

Group I : Consists of countries that face physical water scarcity, i.e. these countries do not have sufficient water resources to meet their agricultural, domestic, industrial and environmental needs in 2025, even if highest feasible efficiency and productivity of water use is ensured. Indeed, many of these countries can not even meet their present needs. This category includes countries in Middle East, South Africa, and drier regions of western and southern India, and north China, covering 33% of total population. The only option available for these countries is to invest in expensive desalinisation plants/or reduce the amount of water used in agriculture transfer to other sectors and import more food.

Group II : Represents countries that do have sufficient water resources to meet 2025 needs, but which will have to increase water supplies through additional storage, conveyance and regulation systems, by 25% or more over their 1995 levels to meet their 2025 needs. 45% of the total population live(s) in these countries.

The countries of Groups I and II together will account for 78% of the world population in the year 2025.

Group III : Consists of countries that need to develop less than 25% more water supplies to meet their 2025 needs, which will not be a problem as most of these countries are developed countries and cover 22% of the population.

Asia has a large variability in water availability due to the monsoon climate, which creates significant seasonal and spatial variations. Mongolia, Northern China, and Northwest and South India are some of the most water short regions of the world. Though some countries like Laos, Myanmar are water rich, on 'per capita' basis, many regions of Asia are already experiencing water stress. Central Asia is already using 85%. South Asia 48%, Northern China and Mongolia 25% of available water resources. Groundwater is also being used at places excessively both for drinking water and irrigation. Dependence on ground water supplies has reached about 35% in Bangladesh, 32% in India, 30% in Pakistan, and 11% in China.

The Americas contain some of the world's largest rivers and the countries sharing these rivers are generally "Water Rich". Canada, USA, and a few other countries of the Americas as per IWMI, belong to the group, where available water resources are adequate. However, regional and temporal variations make even parts of these countries suffer from droughts, while on an annual basis, only 1% of the total volume of water is withdrawn in South America.

United States has some of the highly productive rainfed lands in East and Mid West. Irrigation is extensively practiced in the three regions – California, the Pacific Northwest and the Great Plains. While the 1st two regions depend upon surface water withdrawals from rivers, the Great Plains are underlain with vast reserves of groundwater, which have been extensively exploited for extending irrigation. Throughout North America, ground water accounts for a significant portion of freshwater withdrawals. Mexico and USA are particularly reliant on ground water, which accounts respectively for one third and one fifth of freshwater abstractions. However, over exploitation of ground water in United States, is now giving rise to some concern as well.

Europe has, in general, sufficient water resources to satisfy the needs of different users. The major part of the European continent is situated in the temperate humid zone. The mainland of Europe is blessed with precipitation throughout the year, although with decreasing quantities from west to east. However, far North and South do show a negative water balance. Irrigation management in South, Central and East Europe holds a dominant role within the group of water users.

Most of the Middle East and North African countries have an arid or semi arid climate. Availability of fresh water per capita is decreasing as population grows and water resource development has reached a ceiling in many countries. Fresh water resources vary from a low of 220 m^3 per capita in Jordan and 330 m^3 per capita in Palestine to 2000 m^3 for Turkey and Iran. The last two countries, however, contain regions with severe shortage. The region has four major international rivers – The Nile, Euphrates, Tigris and Jordan, on which major irrigation development is based. International cooperation shall be required for equitable development and sustainable management.

In case of East and South Africa, the region's withdrawal is only 4% of its total renewable water resources. The rainfall is highly unreliable due to its spatial and temporal variability

resulting in frequent crop failure. The entire region can be classified as economically water scarce with the exception of South Africa, which is physically water scarce. The region has number of important shared rivers, which would require massive investment for development with international cooperation. The West African region also be classified as economically water scarce, suffering from extreme variability of availability which is getting reduced on per capita basis, due to rising population.

The increase in population and continuous change in water use patterns causes increase in demand for water, resulting in decreased per capita annual water availability. While per capita availability indicates a country's potential, the state of its utilisation indicates the level of development achieved and efficacy in its use. Even where water is available, the level of withdrawal depends upon the technological capability, the state of economy and the level of investment in the water sector. Most countries with limited availability, suffer from serious handicaps of economic development in general and food production in particular, making them dependent on import of food to feed the often large and rapidly growing population. Demands by rapidly growing industry and urban sectors, on the other hand, are causing reduction in availability for agriculture. This is particularly true for countries of East and South Asia where urban population is likely to increase by 50% by 2025. These countries have a climate dictated by monsoons, where significantly high and intense precipitation during limited rainy days in a year, results into heavy runoff, which can't be used. The global climate change is being studied by the Intergovernmental Panel for Climate Change (IPCC). The UN agencies are also keeping track of desertification processes and ways to combat them. The likely increase in variability in precipitation will cause increased need for storages - large and small. Also the possible increased snow melt and sea level rise will need close monitoring and call for simultaneous advance plans for mitigation.

SUMMARY: Water Availability

Regionwise estimate of water availability is to be fine-tuned in light of the latest work by IWMI through PODIUM. Ideally basin approach would be desirable. Inter-basin transfer will ease regional shortages in several cases. Surface and ground waters are inter-dependent and constitute total water availability. They have to be assessed and planned for conjunctive use. Artificial recharge of depleting groundwater storage is required where surface availability exists and where it is cost-effective. Likely changes in global climate could affect availability in different regions. Also they could affect variability in availability and incidence of floods and droughts. Preparations to meet with such eventualities are necessary.

III.2 NEED FOR INCREASING WITHDRAWALS TO BRIDGE MISMATCH BETWEEN DEMAND AND SUPPLY

The present global water use for agriculture is about 70% of the total. As demands rise in all the sectors, the proportion would change. The potential water resource available in various regions and countries to meet the requirement of 2025 is extremely varied. Many people argue for transfer of irrigation water to other sectors by improving water use efficiency. They also claim that demand management instead of supply management will solve the problems. What has become apparent during the vision study for WFFRD is that supply and demand management has to go hand in hand for removing the mismatch.

According to IWMI, as compared to 1995, 31% more gross irrigated area would have to be brought under cereal cultivation. The IWMI study quantifies as indicated in the previous section perhaps for the first time, the need for increasing withdrawals ranging from 20% - 25% for most of the countries of the developing world. Globally, water supplies used in agricultural would have to be augmented by 15 - 20% over the next 25 years, even under favourable assumptions regarding improvements in irrigation efficiency and agronomic potential to meet food requirements. The assumption of about need of just 17% increased withdrawals itself is an idealistic assumption without considering the fact that there are severe limitation in the capacity of

developing countries to achieve maximum efficiency in irrigation schemes at present level of financial inputs in modernization and improvement of the scheme. The need for doubling the food production will call for more gross area to be brought under cereal cultivation by accelerating the rate of development of storages of water resources wherever potential is yet untapped. Such withdrawals with the help of storages, basin by basin, could help remove the mismatch between variable in-stream availability and demand besides meeting soil moisture crop requirement for crops round the year. Links may have to be provided between reservoirs to transfer water to cater to needs of deficit areas within a basin or across the basin boundaries.

Though considerable scope for exploitation of ground water still exists especially in surplus surface water areas, it would need substantial investments on energy. A large component of groundwater is derived from surface water and hence both need to be considered conjunctively as renewable resource for optimising availability and use. Where surplus surface water, which can't be stored, runs off to seas, catching it and using it for artificial recharge of ground waters can be adopted in cases where such a storage is required and reasonably possible. Watershed development is a relatively economic option, but its efficacy about quantities of water that can be recharged is severely limited.

A discrete mix of mega to micro-scale surface water storages in addition to insitu conservation measures are called for to augment availability in a cost-effective manner. The in-stream availability and need for storages varies for countries within a climatic zone viz. arid/semi-arid, temperate humid and humid tropical. In each of these zones the strategy has to be different for rainfed and irrigated areas.

Besides developing storages, augmentation of availability has to be achieved by improving efficiency of application in irrigated agriculture. Availability can also be augmented by recycling the used and wastewaters after due treatment.

SUMMARY: Need for increasing withdrawal.

There is an expected need for global increase of withdrawal of 15 - 20% of waters from surface and ground for providing irrigation to larger areas during the next 25 years. Assessments for regions and basins based on water and salt balance approaches are required. Availability is to be augmented by new storages, by increasing water use efficiency, by recycling otherwise wasted waters and by deploying poor quality waters. For rainfed areas, better watershed management may assist augmentation, but the effects are expected to be only marginal.

III.3 FOOD SECURITY, RURAL DEVELOPMENT AND LIVELIHOOD THROUGH IRRIGATION, DRAINAGE AND FLOOD MANAGEMENT

The rise in population in developing countries is much more rapid as compared to the developed world. For instance in 1960, out of the world’s 3 billion populations, 67% was concentrated in the developing world. The rising trend has been maintained as more than 80% are expected to live in developing world in 2025. The majority of these people will live in flood prone areas. This has critical implications for food requirements, labour supply, and per capita land availability besides fresh water availability. With nearly the same water and land resources base, we shall have to grow enough food to additionally feed 2 billion people, considering the increased demand resulting from expected increase in the standard of living, there will be need to double the level of food production. In addition, this calls for flood control, flood protection and drainage measures to a significant extent.

Bulk of the population in the developing world lives in rural areas. The proportion is reducing gradually. Also, the proportion of population employed in agriculture will gradually reduce due to its shift to the manufacturing and services sector. This also would cause greying of people engaged in agriculture. Still, the thrust of these sectors will continue to be towards agriculture. A small minority of the rural people in the developing world owns large farms. Majority

has small land holdings. Others are landless and work as labourers in farm related activities. But the rural population is predominantly poor, unlike in the developed world, where the rural areas have developed fast by adoption of advanced technology in agriculture early on due to the industrial revolution and provision of irrigation and/or drainage facilities wherever needed and possible. Many countries equate poverty only with calorie intake through food for adequate nutrition. Rural development and a secured livelihood for rural populations of today, therefore, are synonymous with eradication of poverty through employment generated from agriculture and related activities. Extension and modernisation with replacement of ageing systems to maintain sustainability of irrigation, drainage and flood protection alongwith other concomitant inputs are essential for this purpose.

Agriculture needs water, which is provided by rainfall fully at some places or in excess in some lands. In these cases, drainage of land is required to enable agriculture. In the latter cases where needs are partially met with by rainfall, supplemental irrigation would have to be provided through wells, canals, ponds, and tanks either by gravity flow or by pumping. Moisture in the soil profile being essential for dry food crop production, its availability has to be maintained at a desired level by replenishment either through local conservation measures or by irrigation, otherwise moisture stress leads to not only reduction in yield but sometime even to complete loss. For paddy cultivation generally a water layer of certain depth has to be maintained on the field. For rainfed agriculture, where failure of rainfall or long gaps between consecutive spells of rain ruin a crop, measures to increase moisture retention capability like tillage, mulching, etc. are often deployed. Supplemental irrigation however becomes necessary for survival of crops even in humid tropics in winter and summer if rains fail. For the arid and semi arid areas, irrigation is an essential input for farming, even during the rainy season. The provision of irrigation facilities which can make all the difference to a good harvest and watershed development of rainfed areas, together make the agriculture in a river basin sustainable and productive.

Irrigated agriculture provides 40% of world's food production from 17% of cultivated land. In regions of water shortage, yield of irrigated land often is more than 2 to 3 times that of rainfed agriculture. The critical role of irrigation for food security in arid and semi arid areas is evident from the fact that almost one third of the globe area is accounted by arid and semi arid areas and yet the world has been able to largely feed its billions. Even in temperate and humid zones, although crops can be grown, timely irrigation during critical periods of growth, when plant is most sensitive to soil moisture deficit, yield of crops may double or even treble. In case of rainfed cropped areas, if assured or even supplemental irrigation is provided, it can make significant contribution to food production. The World Food Summit in 1996, estimated that 60% of extra food required to sustain the world in future must come from irrigated agriculture, which needs more investments and sustained efforts at expansion and improvements. The vision WFFRD also has similarly estimated increase in irrigated area even after assuming significant increase in water use efficiency. The challenge of improving the lot of poor rural population hinges on the success of these efforts. Rainfed areas with favourable soil moisture regime are already producing good yield of food crops. Rainfed areas which are water rich can grow additional food crops only with installation and improvement of drainage systems. Water deficit rainfed areas need exogenous water supplemented to a possible extent by rainwater harvesting.

While water is an essential input for agriculture, it also needs other inputs like fertilisers, pesticides, seeds, cold-storage, animal power, animal husbandry services, market, transportation, electric power, credit, agricultural implements and services for maintenance. Even when productivity is enhanced by different inputs such as mechanization, fertilizers and pest control, the potential benefits can not be attained under excess moisture or salt concentration in the root zone. Thus investment in drainage not only has its direct impact of increasing crop yield but also maximizes the benefits from other inputs. The irrigation and drainage schemes therefore not only play a critical role in increasing crop yield and improving rural household income, but also help in accelerating the pace of development of rural infrastructure through improved communications and road systems, better healthcare, education facilities for rural communities. Irrigation canals often serve as the only source of potable drinking water for the rural areas of the developing

world. Properly functioning drainage channels may improve sanitation and disposal of wastewater in rural areas, where applicable.

The planning for achieving the objective of food security in several countries must also focus on rural poverty alleviation, and generation of employment opportunities. Both have contributed to economic growth of such societies. Irrigation has played a major role in poverty alleviation and protection of rural people from natural disasters like droughts and famines. The poor landless segments have better employment opportunities in construction and maintenance works of irrigation schemes. The increased agricultural production mostly from irrigated areas and overall infrastructural improvements act as powerful magnets to attract investments in rural agro-based industries. The rural development has become synonymous with agricultural development. The close linkage becomes apparent every time drought strikes an agriculturally predominant area or a State, when the whole rural economy comes to a grinding halt due to set back in agricultural production. It has also been experienced that the lack of assured irrigation leading to unsatisfactory returns from agriculture, coupled with other handicaps, has caused growing tendency for switch over to non-agricultural occupations and migration from the rural to urban areas in search of better employment. The multiplier effect of irrigation arrests this tendency and helps improve even the urban environment because of reduction in pressure there, on the already dwindling water supply and other infrastructural facilities and helps maintain the ecological balance. In some water scarce areas, the available potential of water resources has still not been tapped due to several reasons including financial weakness. These causes have to be obviated. The absence of appropriate measures makes such areas more vulnerable to scarcity and growing demands due to population growth.

Among the world's poor, more than 800 million people do not have adequate access to enough food. This number would increase as the world population is set to reach 8 billions by 2025. With most of the increase occurring in developing countries, food needs in these countries would result in great pressure on the agricultural sector to increase overall production and yield. Though advances in bio-technology and genetic engineering may help to increase food production from available land and water resources, the irrigation and drainage expansion and modernisation shall have to play the pivotal role in increasing the food productivity per unit of land and water, as in past especially in the latter half of the 20th century. It is however necessary to ensure that irrigated agriculture remains a sustainable endeavour by addressing the problems of salinity, waterlogging, institutional deficiencies in ensuring equitable distribution of available water amongst all users and environmental sustainability. Such strategy would ensure that the production in food grains is not outpaced by the population growth. To maintain food security, sustainability or durability or resilience has to be ensured. One can look at sustainability: of infrastructure created; of resource base of land soil and water; of institutions created; of ecosystems and most importantly of people and their capacity to carry poverty or poverty alleviation.

SUMMARY: Food security, rural development and livelihood through irrigation, drainage and flood management

Ensuring global food security calls for priority for increased production at already cultivated land and to a significant extent for increase in withdrawals besides increase in water use efficiency, improved irrigation management, etc. The objective of 'Food self-sufficiency' is dominating planning and will continue to dominate it in the developing world for rural development. Ensuring sustainability of resources, facilities created, product of IWRDM, is central to the food security and in turn to poverty alleviation and protection from famines, etc. Adequate operation and maintenance, modernisation and where required replacement of old schemes and most importantly addition of infrastructure constitutes the core programme for the future.

III.4 STRATEGIES FOR IMPROVING WATER PRODUCTIVITY IN IRRIGATION

In the developing countries, while significant efforts are directed towards facilitating expansion of irrigated area through additional withdrawals by building storages and or diversion structures where practicable and through optimised use of ground water, attention is to be paid for improving the on-farm water management between desired water use efficiency and the one actually realised by improved technological interventions. Strategies have to be developed not only for ensuring maximum productivity per unit of water and unit of land but also to reduce the substantial gap between irrigation potential so far developed and utilised.

Some claim that water scarce countries should aim at only high value crops for export while importing low value food crops, thus meaning import of virtual water. On the face of it, the concept sounds good but it has to be considered in depth in context of poverty incidence in such countries.

Whereas increasing water productivity calls for considerable changes in crop varieties, adequate steps are necessary to transfer the already developed and tested irrigation and drainage technologies from the developed world to the developing countries. An IWMI study of 50 irrigation systems round the world shows a wide variance in productivity. Considerable improvement in productivity is possible in some large systems with well-designed inputs. For example, in India an average increase of yield from 2 to 4 ton/ha is achievable and would have to be achieved. It could make vast difference to the status of food sufficiency.

Some of the available options for improving the productivity of irrigated lands are listed below:

- establishing water users organisations for better involvement of farmers in management and collection of fees, reducing irrigation subsidies and/or introducing conservation oriented pricing, strengthening the training and extension services for dissemination of efficient technologies; in short deployment of technologies involving a discrete combination of structural and non structural measures is essential;

- improved operation and maintenance of irrigation and drainage systems. Using controlled groundwater table management to conserve water and improve the quality of drainage effluent;

- employing better techniques of water application like furrow irrigation instead of traditional flooding. Furrow diking techniques help promote soil infiltration and reduce runoff. Employing surge irrigation techniques even in furrows gives better results;

- adopting water conservation methods like tillage, to reduce evaporation from land or changing the planting dates to match with periods of low evaporation rates and improving drainage by surface or sub surface methods and recycling of drainage and tail water;

- increasing use of pressurised irrigation, sprinkler and micro irrigation systems, instead of open gravity flow to apply water more uniformly, taking advantage of already developed low energy - precision application – systems to cut evaporation and wind-drift losses. Adopting better irrigation scheduling and improved canal operation to ensure supply, when it is most crucial to crop's yield;

- involving private sector companies in developing cost effective technologies and their promotion particularly in developing countries;

- promoting and adopting results of agronomic researches like:

    * selecting crop varieties with high yield per unit of water;

* switching from crops consuming more water to those consuming less i.e. better matching crops to climate conditions and to quantity of water available;
* sequencing crops to maximise output under conditions of soil and water salinity;
* introducing water efficient crop varieties.

SUMMARY: Strategies for improving water productivity in irrigation

More crop per drop and per unit of land has to be the joint strategy. The gap between potential created and that utilised is to be narrowed down urgently through structural and non-structural measures. Shift from food crops to high value crops depends upon self-sufficiency needs of a country. It will be gradual with increase in productivity in cereal production. World trade in food is barely 10% of the total production and is showing signs of reduction. Achieving domestic higher productivity by shifting agricultural labour force to other sectors, by modernisation of agriculture and by land reforms is necessary. Establishment of Water Users' Associations and transfer of the operation and maintenance of distribution systems to them is necessary on a large scale.

III.5 BASIN PLANNING FOR INTEGRATED DEVELOPMENT AND MANAGEMENT OF WATER RESOURCES (IWRDM)

Water flows through river systems across political boundaries. There are several countries relying on flows arriving from upstream countries. For example Bangladesh, Egypt, Iraq, The Netherlands, Syria, Turkmenistan, and Uzbekistan depend on upstream countries for two thirds or more for their surface waters. Conflict often arises if water sharing between upstream and downstream user countries is not agreed to jointly and if excessive withdrawals are effected. In a growing number of shared basins, enough water to meet demands from basin countries is not available. In such situations, the option for them is to aim at integrated development on techno-economic and social considerations through dialogue both at governmental and non-government level. Similar situations do occur even in shared basins within countries. River basin conflicts in such cases can be tackled by the IWRDM approach through river basin authorities charged with adequate powers to adjudicate and implement decisions. For large basins, the approach can be even applied for sub-basins as has been shown successfully in countries like India and China. For the integrated development of water resources, a perspective plan for diverse uses of water at the river basin as well as sub-basin levels needs to be prepared. The plan would have to indicate availability of water on a short, medium and long term basis, and the allocations for various uses as per inter-sectoral priority within a political region. However this is a long-term strategy and the time horizon will be longer than what is implied in vision.

The question of low water use efficiency for individual schemes arises. The IWMI study has recently shown that maximisation of basin level water use efficiency is more important, because it varies scheme to scheme due to various reasons and as long as the excess water is reused in the basin, the objective is achieved. In a water short basin, a joint strategy has to be agreed upon for using water more efficiently, increasing its productivity, for adding high value crops to the crop pattern, and providing additional water for other non-consumptive sectors. Many in-basin or inter-country differences on sharing of water have caused problems in development of water resources. There are however several developments round the world in recent times, such as in the Danube, Indus, Nile, Mekong, Rhine and Ganges-Brahmaputra- and Meghana basins, which are encouraging. A recent UN convention on international watercourses, which is enshrined on the principles of equity, is under ratification.

While allocating requisite quantities of water, the basin authorities have to ensure that the quality is also of desired level. Where degraded, it is to be made good through identification and treatment of flows emanating from point and non-point pollution sources. Where practicable, beneficiation of low quality waters by means of fresh waters would have to be implemented. Most

of the non-consumptive uses are amenable to treatment, recycling and reuse. The twin principles viz. "**polluter cleans or pays**" and "**user pays in one form or the other**" if adopted, often pay rich dividends. Most of the pollutants eventually travel into the estuarine regions and often result into the demand for freshwater releases to flush them and take care of local eco-systems. Such releases often prove more expensive than treatment of pollutants at source. Also if done by depriving established utilities, social tensions develop. The pollutants sometimes degrade the ground water. These issues are best tackled through judicious basin plans. Along with IWRDM an eco-system based basin approach often helps.

Surface and groundwater basin boundaries in plains do not usually match. The groundwater resources have multiple tapping points, require pumping, are not transported over long distances like the former and hence are locally used. They however are interdependent and ought to be planned for use conjunctively in a surface basin. Over withdrawals of ground waters exceeding the natural recharge are unsustainable and may cause salinity ingress in coastal areas. In ultimate sense, ground water is expensive, as it requires energy inputs for pumping for supply at demand locations. Basin wide planning alone helps in judicious use of both these water resources.

Cultivated lands and standing crops in several countries round the world suffer damages because of floods arriving from upstream river basin areas, largely due to absence of adequate regulation facilities, by way of storages, lack or failure of flood embankments etc. Deltas and coastal lowlands of many countries face flooding, inundation and or congestion at outfalls into the sea. Some countries also face the fury of cyclones in the coastal areas. They would have to be protected where feasible and politically and environmentally acceptable. In many countries, reclamation of such lowlands has become necessary in view of shortage of arable lands. The schemes for construction of structural measures like dikes and drainage works, their modernisation, raising and strengthening where required would have to be implemented as an integral part of a comprehensive master plan which also provides for non-structural measures wherever feasible to reduce damage potential. The implementation of such plans would ensure integration of basin-wide flood control and drainage to protect the delta zones and coastal area against inundation and congestion of drains.

IWRDM like any other socio-economic activity has positive impacts and may have adverse impacts on the ecosystems. Basin plans would have to ensure that the positive impacts are maximised and negative ones minimised and have to strive for a proper balance between human and environmental/ecological needs. Such balance ensures sustainability of the IWRDM. Environmental issues related with ‘water for food’ are of recent origin. Adverse impacts on environment were there all through. But until recent past, the impacts were not projected. The concerns are many, for which a whole range of acts, laws, guidelines and policies have been or are being formulated and put in practice. They are still evolving and will evolve further during the next 25 years, as the impacts become more critical in some regions.

Lastly, where a mismatch between demand and supply can not be removed by basin approach, inter-basin transfers may be adopted. There were many such efforts made in the past and many more will be in pipeline, as within basin development reaches an optimum. In fact at several places, inter-basin transfers of water have been made for a long time, within sovereign countries and sometimes with co-operation between two countries. Such co-operative efforts will all the more be necessary in future.

SUMMARY: Basin planning for IWRDM

IWRDM within a basin in consultation with and with participation of stakeholders ensures speedy realisation of objectives of adequacy of water supplies in requisite quantity and quality. Conflicts on sharing of waters, costs and benefits of facilities also reduce. Maximisation of basin level water use efficiency is important. Integration of mega to micro level facilities, surface and ground waters, of consumptive and non-consumptive uses, of demands and supply is required at

basin level and where necessary across basin boundaries. Basin authorities would have to be set up to deal with total IWRDM.

III.6 GOVERNANCE, LEGAL AND INSTITUTIONAL ISSUES

Traditionally, the planning, development, withdrawal, uses and disposal of waters has mostly rested with governments of the individual countries particularly in the developing world. Irrigation of farms by means of water drawn through dams, canals and wells or drainage of waterlogged lands grew with active involvement of institutions and legal procedures set up on drainage by the governments. Functionaries of governments or institutions charged fees for the water supply and recovered them by way of land revenue or in kind, by way of levy in form of farm produce. Water disputes were heard by government or institution functionaries and resolved as per law of the land.

Irrigation, drainage and flood control of agricultural lands, which are all intricately related with 'water for food' are likely to be continued to be governed by governments in the countries of the developing world. Legal positions also might not undergo much change, excepting that the concepts of water rights will be debated along-with other rights on natural resources. But the main likely change will relate to basic human rights like right to food, water, employment and livelihood. All required changes in the institutions will flow from these changes. An overall change in complexion of the sector will occur as all shades of rural development activities are woven around 'water'. While centralisation at apex level because of the scale and range of activities involved will continue, there will be much more decentralisation lower down to facilitate the final use of water for rural development. Even in case of environmental concerns, a holistic view will be possible, if centralisation at national level exists. But it will need complete decentralisation, as one goes to local ground level. On the whole, a much more participatory process involving stakeholders will evolve, for not only the decision making, but also for implementation, operation and maintenance.

'Water for food' is a socio-economic proposition after its technological complexities are unravelled and accommodated in the vision. But in many cases, the complexities have hindered economical and efficient use of water. Therefore, institutional reform has become a central issue in the water sector in most of the countries. Following institutional and legal aspects are under debate:

- absence of a comprehensive water policy covering all types of consumptive and non-consumptive uses and institutional arrangements for implementation. A number of countries have accumulated a body of legislations, either in the form of comprehensive water codes or sector by sector legislations like irrigation acts drainage acts, etc. There is urgent need to enact a comprehensive water related land legislation, clarifying surface, and groundwater rights of land cultivators, establishing an appropriate administrative machinery for implementation, etc. This type of legislation is necessary for providing a framework for sound decision making;

- the need for the irrigation sector to not only overcome and face sectoral competition for water, but also to address social and environmental issues. For this purpose, it has to devise a viable policy, adopt appropriate technology packages and project management system and carry out institutional changes and reforms;

- putting in place an appropriate mechanism for conflict resolution both for intra basin and inter basin water sharing and transfers. Tackling equity issues providing for consideration of environmental impacts.

SUMMARY: Governance, legal and institutional issues

Reduction of governmental role in IWRDM from being a provider to be a facilitator, from planning to operation and maintenance, changing complexion of 'Water' as a social good gradually to an economic good. Water rights of people for both surface and ground water use; private or public good. Setting up of viable basin authorities, water users' associations, conflict resolution mechanisms, evolution of guidelines for equitable allocations - sharing of resources - costs and benefits of IWRDM. Water quality preservation acts, laws and guidelines covering policies like 'polluters clean or else pay for polluting waters', 'users in one form or the other', 'recycling and reuse'.

III.7 STAKEHOLDER INVOLVEMENT, YOUTH AND WOMEN'S PARTICIPATION

Irrigation, drainage and flood management works, were undertaken in many developing countries by the governments of the nations as public welfare activities. In many instances, they were started as famine and drought proofing protective measures and were considered as most important duties of the State. Due to this background and due to the complex nature of the issues involved, most of the water development projects in these countries have a 'top-down' planning process at present. In recent past, however, efforts have been made to introduce water management with involvement of the stakeholders in decision making. It is recognised that it will be necessary to strive for creating an environment, where the users are 'empowered' in management of water for the right level of productivity, through the most desired mix of crops, for the well being of the society. Stakeholders basically will be increasingly involved in decision-making processes, so that they also feel and can be responsible for the operation and maintenance of a system.

Women generally are not participating in the management of irrigation schemes, while they are equally dependent on irrigation water for their farms, where they put in lot of labour. They manage the domestic requirement of water including that for vegetable gardens as well as tending of livestock. They have to be provided a big say in water management through water users associations along-with other stakeholders.

User participation should be a central principle. Water users including women need to be involved in identification, planning, implementation, operation and maintenance, as well as monitoring and evaluation. User participation would need activating existing and setting up of necessary community based institutions. NGOs and women groups can be instrumental in organising water users in the process and ensure that they all share costs and benefits. User organisations, when formed, have to be strengthened by legal backing of 'Establishment' to permit transfer of functions as well as assets, and defined water rights.

SUMMARY: Stakeholder involvement, youth and womens' participation

Evolution of guidelines for stakeholder involvement from basin down to a village level. Mobilisation of youth organisations from data gathering to acting as watchdogs or from acting as bare-foot engineers to creators of public awareness. Proportionate reservation for women at all levels of administration, policy formulation and financial management.

III.8. FINANCING INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT, MODERNISATION, REHABILITATION AND REPLACEMENT

Basin wide IWRDM calls for correct assessment of both surface and ground water resources at basin and sub-basin level, in terms of quantity as well as quality, their sharing, development, conservation, abstraction, recycling and reuse, in context of equity for users. The IWRDM thus encompasses formulation of a financing policy, from development of 'water master plans' to ensure optimum utilisation and implementation, to pricing, cost recovery, and ensuring adequate finances for operation and maintenance, safety, modernisation, and replacement. Financing is required at all stages of IWRDM. It covers institution building, capacity building,

decision support systems, information technology, automation, research and development, economic analysis, risk analysis and other aspects.

All these issues call for provision of adequate resources in the overall planning and be considered as an investment in future prosperity for which besides the national Governments, public participation and well-designed privatisation will help. Multilateral and bilateral funding although it concerns less than 10% of total investment may act as catalytic agent for resource mobilisation. While it is desirable that the whole irrigation and drainage sector be run as far as reasonably possible on economic lines, by way of generating revenue from the services provided to sustain the services and future development needs, this is not easily possible in developing countries due to prevailing socio-economic conditions. It is also necessary to note that most of the developed world has been blessed with favourable climatic conditions which allows them to grow crops under rainfed conditions. Further agriculture is also highly subsidised. As such the production from irrigated agriculture in developing countries if subjected to full cost recovery principles will be much costlier. The predominance of small landholders and a large force of unemployed landless make the problems more difficult to handle. There is a widespread fear that treating water as an economic good in these countries can result in cash-rich industrial sector purchasing as much water as possible regardless of the price of water, reducing its availability for agriculture and thus endangering food security. The issue of cost recovery or pricing is to a certain extent linked to the economic status of a country, though partial or preferably full recovery of the operation and maintenance component will have to be the objective. The concept of full cost pricing or recovery is to be seen also from the point of view of subsidised global food prices, their impact on poor and marginal farmers of developing countries and food sufficiency - security concerns of large countries. The approach will have to be extremely cautious.

Large scale funding is required to provide for projected additional withdrawals of water as well as for the requirements regarding drainage and flood protection. But on the water management side, again lot remains to be done. Lack of regular annual maintenance results in systems falling into disrepair, increasing thereby the likelihood of breaches, and silting of distribution channels and congestion of drains. There is urgent need for modernisation of several large irrigation schemes in Asia besides replacement of old schemes, which will not only improve efficiency of performance, but also result in water savings which can be used for bringing more areas under irrigation which were uncommanded earlier. Financing of such schemes has a great potential to increase agricultural production. Sometimes, relatively small outlays on modernisation for instance on head-works, distribution structures and drainage outlets, can help raise production substantially even in small irrigation schemes. Participatory approach whereby farmers get motivated to offer their services in kind, if not in cash, helps greatly in modernisation efforts and have to be attempted in a big way in future.

The vision WFFRD envisages need for a higher level of funding for the irrigation, drainage and flood protection sector in the next 25 years. One estimate calls for enhancement of present level of funding for irrigation by at least 40%, not only for new infrastructure but also for replacement, modernisation of ageing systems and imparting sustainability to them.

SUMMARY: Financing IWRDM, modernisation, rehabilitation and replacement

The water for food sector needs to enlarge withdrawals within the next 25 years by 15 - 20%. This calls for massive increase in investments from government and non-government sectors. Where high value crops are possible, private investment also will be viable. Basinwise assessment of requirement of funds needs to be made, especially for operation and maintenance, safety and sustaining serviceability of infrastructure. Especially in developing technologies, transition may be expected from government funding to stakeholder funding for operation and maintenance. However, for modernisation, replacements and new construction, a significant part of funding will still have to come from governments. Donor funding would have to be directed towards the support of these processes and developments.

III.9 EQUITY, EFFICIENCY AND ECONOMY

For IWRDM to become sustainable, it ought to have three important components, viz. equity, efficiency and economy in services provided. The three are interdependent. They bring in optimisation in use of natural resources, increase productivity per unit of land and per unit of water. They ensure that the fruits of IWRDM reach all stakeholders in an equitable manner when needed through supply of water when, where and in right quantity.

Low water use efficiency can be attributed to low level of on-farm irrigation technology, land management as well as deficiency of operation and maintenance. Lining of canals and distribution system or use of low pressure pipes for distribution wherever feasible as well as introduction of efficient on-farm facilities and practices can help achieve better efficiency. Adequate and efficient drainage is necessary to sustain high crop productivity and conserve land resources. It is also necessary to set up a system of real time monitoring of flows and water demand. Adoption of water saving sprinkler and drip irrigation systems may help to achieve not only better utilisation of scarce water resources, but also better output of crops due to application of the correct quantum of water at the critical stages of growth. Utmost economy in deployment of financial resources will therefore be a key word in the future. It would mean need for enhancement of productivity, water use efficiency, reversal of degradation of land and water resources already deployed. It also would mean enhancement of standards for new areas of irrigation and drainage and sustainable development of the rural area, for which financial resources ought to be earmarked.

IV ICID's STRATEGY FOR ACTION

Summaries provided at the end of each sub-section under Section III, have brought out issues, which are close to ICID's concerns. All of the ICID's concerns can't be taken care of by the membership and the workbodies of ICID alone. After-all, ICID provides a forum for deliberation, policy planning and action at membership level to the extent possible in the available setup in each country. The following paragraphs lay down what will be the strategy of ICID for enabling action on the issues identified during the next three years till the third world water forum. It will be a sort of an open-ended process for the Council to take a stock of and make mid-course corrections.

IV.1 ICID's GOALS AND OBJECTIVES

ICID was established in 1950 as a scientific, technical, voluntary, non-profit, non-governmental, international professional organisation, dedicated to enhancing world-wide supply of food and fibre for all people by improving water and land management. It encompasses assessment and deployment of appropriate techniques for irrigation, drainage and flood control/management for increasing productivity through natural resources, while taking care of environmental concerns. The activities are pursued in accordance with the ICID constitution and bye-laws last revised in 1996. The ICID mission comprises stimulating and developing application of arts, sciences and techniques of engineering, agriculture, economics, ecological and social sciences including research and development alongside capacity building for achieving sustainable irrigated agriculture.

ICID operates through over 97 strong network of National Committees, each having its own independent autonomous set-up. Active members from amongst these, make up the International Executive Council (IEC) which elects one President and nine Vice Presidents as honorary office bearers, besides the Secretary General who is a full time office bearer of the ICID. The business of the ICID is conducted by the Central Office located in New Delhi, India under the supervision, direction and control of the Secretary General. ICID's work is carried out through Permanent Committees, Committees, Working Groups, Task Forces etc. as authorised by the IEC. The Central Office facilitates work of the Work Bodies and National Committees, in

organising international meetings - conferences - congresses, seminars etc., and brings out various relevant publications.

IV.2 DISSEMINATION OF COUNTRY POSITION PAPERS IN EACH COUNTRY

Preparation of a global vision for water in the sector WFFRD was entrusted to a group of institutions viz. ICID, IWMI, IFPRI, IPTRID, ICARDA, FAO and others. ICID with its global network of National Committees undertook to build the global vision based on building blocks of country position papers, which were synthesised in eight regional visions. A Task Force led by Mr. Aly Shady, evolved guidelines to be used by National Committees for framing the Country Position Papers. About 41 countries accounting for about 75% of cropped area of the world, produced such documents on the basis of a consultation process evolved by the Task Force.

As most of the Country Position Papers were the best drafts that could be made in limited time frame that was available, further elaboration and local consultations would be required to bring the papers to such a level that they could be used as a basis for policy making. They will also need to be updated from time to time taking into consideration the changing local scenarios in IWRDM.

IV.3 CONSIDERATION OF SECTOR VISION AND FRAMEWORK FOR ACTION IN WORK-BODIES OF ICID

Some of the ICID work bodies are working on these aspects of the Sector Vision. They will be regionally holding consultations, based on the feedback received from the Country Position Papers and arrive at appropriate strategy for dissemination of experiences and information.

Based on the prepared visions, and discussions held during the Second World Water Forum, the following guiding principles emerge which have relevance for further policy development and implementation of action points during the next 25 years.

i) To cater to the projected rise in the world's population from 6 to 8 billion, which will mostly be in the developing countries, food production shall have to be doubled in the next 25 years. Increase in food needs by a whopping 100% for population increase of just 33% might be due to the following.

1. Population below poverty line will decrease and will need and be able to avail and consume more calorie intake.

2. With economic uplift, the food purchasing capacity will go up and with better Public Distribution System (PDS), accessibility to available food will increase.

As brought out in Section III, bulk of this increase will come from expansion and intensification of irrigated agriculture, which calls for sustained efforts;

ii) Development and management of irrigation and drainage systems as well as flood management strategy must form an integral component of the rural development strategy within the parameters of the concept of IWRDM. This will not only result in a viable rural development model, but also will help achieve poverty reduction in the rural areas;

iii) Institutional reforms aimed at stakeholder controlled operation and maintenance are necessary, not only to achieve the required increase in food production but also to enable the habitants of rural areas to have an humanly acceptable standard of living to prevent deprivation due to poverty and involuntary migration to urban areas or switch over to non farming vocations.

The work-bodies of ICID will integrate the guiding principles, policies and action points in their rolling plans for implementation.

IV.4 WIDE DISSEMINATION OF WORK ALREADY DONE BY ICID

ICID, through its sustained efforts during the last 50 years, has brought out several publications, which do cover many of the issue highlighted/identified through the vision process. These publications can serve as valuable source of background material, on different aspects, some of which might even have been missed during the hectic vision process. These reports will enable stakeholders in the National Committees to understand the importance and scope of work done. ICID's own website has been operationalised during this year for dissemination of all such useful information. A Text Delivery Service (TDS) has been transferred to the Central Office by the International Program on Technology and Research in Irrigation and Drainage (IPTRID). It is being strengthened presently to upgrade it to the 'International Information Centre' status. The TDS has been enriched by uploading on it over 29000 publications accessioned to ICID Central Office Technical Library, out of which over 14000 publications are with abstracts, enabling the viewer to know about their contents to scan the required information. So far, 144 full-length papers of the 17th ICID Congress (Granada, 1999) have also been put in PDF format on the TDS, and papers from other ICID Congresses are being added. Facility is being developed on the TDS page, wherefrom the viewer can directly communicate with ICID Central Office library for requisitioning the desired information/material. ICID has also planned to promote the information network for its National Committees, along with installation of complementary TDS facilities. It is hoped that the information and communication technology advances that would be available during the coming years, will greatly enhance the availability of relevant information for the stakeholders and the ICID associates.

IV.5 PROPOSALS TO MOBILISE FUNDING

It is planned to approach the multilateral and bilateral funding agencies around the globe for promoting activities through the National Committees, the Work Bodies and the Central Office. It is proposed to build strong linkages with the UN sister organisations, CGIAR Institutions and water and agriculture related governmental institutions, especially in the developing world. There are several regional outfits/groupings of countries for addressing socio-economic issues of different continents, which also will be able to support activities to be taken up by ICID. Several proactive steps are being initiated for technology information transfer, capacity building and information dissemination.

IV.6 MONITORING, REPORTING AND REVIEW OF PROGRESS ON PROPOSED ACTIONS

After conclusion of the Second World Water Forum, the Central Office is trying to facilitate organisation of several activities with the help of Work Bodies and the National Committees. It is proposed to set up appropriate committees with representation from the participating institutions and organisations for monitoring, reviewing and guidance of the various "Initiatives". Reports will be made to the Work Bodies through the annual meetings. Efforts are in hand to arrange for the organisation of one international workshop and three regional workshops in different continents to chalk out a detailed strategy for action in the immediate future. ICID is represented on the WWC Board of Governors by the Secretary General. President Hon. Aly Shady is serving as Chairman of the Programmes Committee of the WWC. The outcome of the ICID activities would also be reported to the WWC, who is going to monitor activities through this Program Committee.

IV.7 INCREASE IN WATSAVE ACTIVITIES AND RECOGNITION OF EXEMPLARY WORK THROUGH WATSAVE AWARDS

With the highlighting of scarcity of water in many countries during the vision exercise. ICID will accelerate its watsave programme and popularise water saving techniques in irrigation to achieve higher output per unit of water. This will be done through organising a series of seminars/workshops through National Committees. It is expected that the WatSave activities will get tremendous boost from the multilateral as well as bilateral funding agencies. ICID will avail of such support to promote its WatSave programme in member countries. It is seen during the last 3 years that countries and National Committees have been volunteering and willing to support the ICID WatSave awards. Not only the amount of award money has been enhanced to US $ 1500 for each of the three WatSave awards, viz., on Water Management, Technological Innovations and for Young Professionals, but it is also expected that the coverage of WatSave programme promoting new water efficient technologies and management approaches will be expanded. ICID plans to publicise around the world, in a big way, the work of individuals which has merited awards through various fora, including ICID's own publications and through ICID's website, which is now considerably strengthened.

The publication 'WatSave Scenario' brought out during 1998 has generated considerable interest in the global community. The second part covering activities of remaining countries is proposed to be brought out during the near future. The Workshop on WatSave liberally funded by CIDA and held at Cape Town with the 51st IEC, has set the tone for promotion of these activities. It is planned to bring out a CD-ROM covering all the activities undertaken so far by the ICID on the subject of Water Saving. This CD-ROM will contain the papers presented at the WatSave Workshop held in Cape Town in October 2000, as well as all the prize-winning papers, so far. the prize-winning papers have also been uploaded on the ICID website for all interested professionals to view or download..

IV.8 IDENTIFICATION OF TOPICS FOR FUTURE CONFERENCES

The Second World Water Forum has provided indicators of the concerns of the world community about regions and countries which are likely to be water stressed because of decreasing per capita availability of water, or which are likely to get into a crisis situation during the coming 25 years. It has now become necessary to shift the thrust of ICID from exchange of information and technology to a more proactive and advocacy mode during the next few years.

A very good start has been made during the last two years, about preparation of position papers by ICID's National Committees. The subject of 'dams' and 'water for food' sector vision are two instances in this connection. It is expected that the ICID will be organising conferences, symposia, seminars dealing with more actions on such issues in the areas of irrigation, drainage and flood management. This action-oriented approach will also require more participatory consultations and roundtable conferences, with other allied sectors, who participated in the vision process.

IV.9 CO-SPONSORING OF ACTIVITIES FOR IMPLEMENTATION

ICID has always actively collaborated with other water related international organisation and is providing secretarial services for the International Water-related Associations Liaison Committee (IWALC), which is now headed by Dr Chris George of the International Association of Hydraulic Research (IAHR). As a result of the Forum, IWALC is expected to provide a new direction to the Associations. ICID is presently effectively participating in the WWC and GWP, and most of the water related UN organisations. These linkages are expected to be strengthened during the coming years. There is tremendous scope for joining hands with all these organisations and co-sponsoring various activities including those, which focus more on collection of the experiences of various stakeholders and build such database through our National Committees for identifying further line of actions.

IV.10 ACCORDING RECOGNITION TO THE GOOD WORK DONE BY THE NATIONAL COMMITTEES

Several National Committees (NCs) of ICID especially in developing countries are strongly supported by their Governments. The Governments themselves are in the process of reduction of their own role and promoting public participation in the irrigation sector. It is expected that these Governments dealing with the WFFRD sector will play a crucial role with the support of ICID through their National Committees. ICID has set up a Task Force to examine how the broad basing of the National Committees could be achieved. Recommendations of the Committee will be adopted by the IEC after modifications. It is expected, that the broad basing already initiated by several National Committees will form the basis for the recommendations of the TF and hence the new policy will generate active interest in ICID activities by all the National Committees. The broad based National Committees will be motivated to critically examine all the issues brought out in this document and provide inputs to IEC for mid-course corrections in the Strategy. A series of workshops will be planned through the regional working groups of ICID for brainstorming to include all stakeholders, particularly the irrigation water users and drainage organisations on these issues. The National Committees who provide a lead in this direction will be identified for recognising their role and encouraging such activities amongst other National Committees.

IV.11 MECHANISM TO MONITOR AND EVALUATE IMPLEMENTATION OF THE STRATEGY

The permanent committees namely, the PCTA and PCSPOA will be providing the thrust for actions as identified in this document. They will be setting up a monitoring and evaluating mechanism for implementation of the strategy. The Central Office will provide a much strengthened support role for the 'Strategy for Implementing Sector Vision for Food and Rural Development' for which a mechanism will be put in place soon.

IV.12 TOWARDS THE THIRD WORLD WATER FORUM, 2003 JAPAN

It has been agreed that the Third World Water Forum will be held in the year 2003 in Japan. Issues that in all probability will play a prominent role then will be : how to achieve the required enhancement/doubling of the food production in light of sustainable rural development; and how to identify reasonable mechanisms to attain financial sustainability in irrigation drainage and flood protection;

ICID has already planned the following activities having a direct bearing on these issues.

- the 1st Asian Regional Conference on Agriculture, Water and Environment and related workshops to be held in Seoul, South Korea, 16 - 21 September 2001;

- two events during the 18th ICID Congress in Montreal, Canada, 21 - 28 July 2002, viz.

    * special events regarding the progress that has been made by ICID after the Second World Water Forum;
    * the Symposium on Private sector participation in irrigation and drainage.

In light of this, it is decided to reconstitute the existing Task Force established to prepare ICID's input in the vision process into the following Task Force.

TF 1: To guide ICID's preparations for the Third World Water Forum. The Task Force will operate in close consultation with the Japanese National Committee.

Further taking into consideration the trend of discussions during The Hague Forum, followed by exchange of views amongst the membership, ICID decided to set up the following two new Task Forces.

TF 2: To develop an ICID position paper on global issues related to food production, security and food trade.

TF 3: To prepare an ICID position paper on issues related to socio-economic sustainability of services provided by irrigation, drainage and flood control schemes.

The President, ICID will set out the composition, terms of reference and time frames for the activities of these 3 Task Forces.

An important milestone event that will be taking place between the second and third World Water Forum is the UNCSD 10-year review of Agenda 21 adopted in Rio in 1992. Chapter 18 of Agenda 21 is related to freshwater issues with which ICID is closely concerned. It was pointed out that there are about 12 chapters in Agenda 21, which are related to activities of ICID. It was decided that the reconstituted Task Force will undertake preparatory work of ICID's concerns through ICID work-bodies for preparatory work of Rio+10 meetings and utilise the outputs of the Rio+10 review to feed forward activities of third World Water Forum.
