



**Ministry of Water and Power
Office of the Chief Engineering Advisor/
Chairman Federal Flood Commission**

PAKISTAN WATER SECTOR STRATEGY

**NATIONAL WATER SECTOR STRATEGY
Volume 2
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PREFACE

Pakistan has been blessed with a rich water resource which has driven, mainly through agriculture, the economic development of the country. Pakistan has a long and proud history of the development of water resources and the infrastructure for delivering water to where it is needed, including the vast Indus Plain, constituting the largest contiguous irrigation system in the world.

As the population continues to grow the country is approaching the utilisation limits of its water resources and Pakistan is becoming a water scarce country. As never before, there is now a strong and growing need to manage this precious resource more carefully and efficiently to ensure water for all on a sustainable basis.

In recognition of this need, the Government of Pakistan, with the support of the Asian Development Bank, instituted the Water Resources Strategy Study. It was undertaken by the Ministry of Water and Power, Office of the Chief Engineering Advisor/Chairman Federal Flood Commission. The Study began in July 2001 with the main objective of preparing a road map for future development of the water sector toward more efficient service delivery and optimum utilisation of resources to meet the competing demands of all water users in the future.

The Government has addressed the issue of developing the water sector through several initiatives, including the Ten Year Perspective Plan (Planning Commission, 2001), Vision 2025 (Water and Power Development Authority, 2001) and the National Water Policy (Ministry of Water and Power, Draft, 2002). Now the Pakistan Water Sector Strategy Study provides a road map for the future development of the sector.

The end product of the Study comprises three main documents which are referred to in total as the Pakistan Water Sector Strategy. These are:

1. The National Water Sector Profile (NWSP), which summarises and details all aspects of the Water availability and utilisation as they exist today. As such, it will become a standard source document for future water sector work.
2. The National Water Sector Strategy (NWSS), which identifies the key issues and objectives for the water sector and proposals for planning, development and management of water resources and their use in all water sub-sectors.
3. The Medium Term Investment Plan (MTIP), which identifies the key programmes and projects which should be undertaken up to 2011 which will make the initial contribution to achieve the objectives of the Strategy.

This is a document for the whole of the water sector, in all its sub-sectors of: Water Resources Development, Urban Water Supply and Sanitation, Rural Water Supply and Sanitation, Industrial Water Supply and Pollution Control, Irrigation and Drainage, Hydropower, the Environment and Flood Protection.

As 95% of our water resources are used for agricultural purposes, the role of the agriculture sector is also discussed extensively, with recommendations and a proposed strategy for a closer relationship with the water sector.

The Strategy and MTIP emphasize institutional, management and financial matters as well as infrastructure. It prioritizes equity in water allocation, improving and maintaining the quality of water, the conservation of the country's water resources and the need for efficiency and financial sustainability in water service delivery. It promotes an integrated approach to water sector development and participation of all stakeholders in decision making.

This is a collaborative document. The study adopted a participatory approach to ensure that all stakeholders of water have been consulted and have contributed to this Strategy and MTIP. Working Groups from each province and at the federal level were formed at the start of the Study and have been closely associated with the development of the work throughout. Four National Workshops were held to broaden the scope of stakeholder consultation, bringing people together from all areas to contribute to the Strategy document.

The effective implementation of the Pakistan National Water Sector Strategy and its accompanying Medium Term Investment Plan is paramount to the continued development of Pakistan's water sector and economy well into the 21st century.



Mirza Hamid Hasan, Secretary, Water and Power 4 October, 2002



Riaz Ahmad Khan, Chief Engineering Advisor, Ministry of Water and Power
4 October, 2002

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The Ministry of Water and Power, Government of Pakistan, Office of the Chief Engineering Advisor/Chairman Federal Flood Commission led the development of the Water Sector Strategy under the guidance of Mr. Riaz Ahmad Khan. Mr. Asjad Imtiaz Ali, Project Director, also chaired the Federal Working Group.

The Provincial Working Groups contributed significantly to the content and quality of the Strategy and Investment Plan for their respective provinces under the guidance of their conveners:

Mr. A. Salam Khan / Mr. Munawwar Khan Mandokhel, Secretary, Irrigation and Power Department, Balochistan

Mr. Fazal Abbas Maken, Secretary, Irrigation and Power Department, NWFP

Mr. Javed Majid, Secretary, Irrigation and Power Department, Punjab

Mr. Idrees Rajput / Mr. Hifz ur Rehman / Mr. Meer M. Perhyar, Secretary Irrigation and Power Department, Sindh

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The Water Resources Strategy Study was funded through the Asian Development Bank (ADB) Technical Assistance programme and the Ministry of Water and Power gratefully acknowledges their assistance.

The documents which make up the Pakistan Water Sector Strategy are:

Volume 1, Executive Summary, which is the summary of the Water Resources Strategy Study, under which the Water Sector Profile, Strategy and MTIP were developed;

Volume 2, National Water Sector Strategy, which is a concise presentation of the Water Sector Strategy;

Volume 3, Medium Term Investment Plan, which details the projects and costs for the MTIP, in support of the Water Sector Strategy;

Volume 4, Detailed Strategy Formulation, which presents the supporting information and considerations for the formulation of the Strategy;

Volume 5, National Water Sector Profile, which presents detailed background information on the water sector in Pakistan.

Disclaimer:

The Water Sector Strategy document presented herein brings out the proposed road map to meet the objectives of the National Water Policy for a sustainable and environmentally and economically sound water sector in Pakistan.

This has, however, yet to pass through the formal channels of approval, with possible fine tuning. The adopted country Strategy for the Water Sector will follow this approval.

List of Abbreviations

A	Acre
ADB	Asian Development Bank
AJ&K	Azad Jammu and Kashmir
AWB	Area Water Board
BCIAP	Balochistan Community Irrigation and Agriculture Project
BCM	Billion Cubic Meter
BOD	Biochemical Oxygen Demand
BOOT	Build-Own-Operate-Transfer
CBO	Community Based Organization
CCI	Council of Common Interest
CDP	Community Development Project
CDA	Capital Development Authority
CDWP	Central Development Working Party
DSES	Drainage Sector Engineering Study
COD	Chemical Oxygen Demand
CTW	Community Tubewell
DO	Dissolved Oxygen
DRIP	Drainage and Reclamation Research Institute of Pakistan
ECNEC	Executive Committee of National Economic Council
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
ESA	External Support Agency
FANA	Federally Administered Northern Areas
FATA	Federally Administered Tribal Areas
FCT	Federal Capital Territory
FFC	Federal Flood Commission
FGW	Fresh Ground Water
FPSP	Flood Protection Sector Project
FO	Farmer Organization
GDP	Gross Domestic Product
GNP	Gross National Product
GOP	Government of Pakistan
GW	Ground Water
GWh	Gigawatt hour

Ha	Hectare
HRD	Human Resources Development
IDA	International Development Agency of World Bank
IEE	Initial Environmental Examination
IRSA	Indus River System Authority
IWASRI	International Waterlogging & Salinity Research Institute
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
KESC	Karachi Electric Supply Company
LBOD	Left Bank Outfall Drain
M	Million
M&E	Mechanical and Electrical
Mha	Million Hectare
MIS	Management information System
Mt	Million Ton
MTIP	Medium Term Investment Plan
MWP	Ministry of Water and Power
NCS	National Conservation Strategy
NDP	National Drainage Project
NEPRA	National Electric Power Regulation Authority
NEQs	National Environmental Quality Standards
NGO	Non Government Organization
NIAB	Nuclear institute of Agricultural Biology
NOC	Non Objection Certificate
NSDS	National Surface Drainage System
NWC	National Water Council
NWFP	North Western Frontier Province
NWPo	National Water Policy
OFWM	On-Farm Water Management
O&M	Operation and Maintenance
PARC	Pakistan Agriculture Research Council
PC-I	Planning Commission Proforma I
PCRWR	Pakistan Council of Research in Water Resources
PDWP	Provincial Development working Party
PEPC	Pakistan Environment Protection Council
PEPO	Pakistan Environment Protection Ordinance
PHED	Public Health Engineering Department
PIDAs	Provincial Irrigation and Drainage Authorities
PMU	Project Management Unit

PPSGWDP	Punjab Private Sector Ground Water Development Project
PSP	Private Sector Participation
RBOD	Right Bank Outfall Drain
SAR	Sodium Absorption Ratio
SCARP	Salinity Control and Reclamation project
SGW	Saline Ground Water
SHYDO	Sarhad Hydropower Development Organization
SMO	SCARP Monitoring Organization
TA	Technical Assistance
TDS	Total Dissolved Solids
TYPDP	Ten Years Prospective Developments Plan 2001-2010
UNICEF	United Nations Children's Fund
USD	United States of America Dollar
WAPDA	Pakistan Water and Power Development authority
WASA	Water and Sanitation Authority
WB	World Bank
WHO	World Health Organization
WRSS	Water Resources Strategy Study
WUAs	Water Users Associations
WWF	World Wide Fund for Nature

WATER SECTOR STRATEGY

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1

DRIVING FORCES BEHIND THE WATER SECTOR STRATEGY

This section provides a very brief description of the salient points of the trends in factors related to the water sector and the Water Sector Strategy. It also roughly estimates or discusses qualitatively the impact of not responding to the various components of the Strategy. References are made to some of the objectives of the Strategy, which are more fully outlined in the later sections of this document. The discussion is very selective and is intended only as an illustration.

1.1

Population Growth

Continued rapid population growth is the single most important driving force affecting the water sector, with the increasing demands it will place on irrigated agricultural production and non-agricultural water services.

Figure 1.1 shows the trends in total, urban and rural population growth since 1947, and the population projections to 2025. Pakistan's population is currently 141 million people, growing at a rate of 2.61% between 1986 and 1998. With an assumed reduction in growth rate over the next 25 years, averaging at 2.1%, the population is predicted to reach 221 million.

With rapid urbanisation also taking place, the present urban population of 48 M (34% of the total), increasing at 3.7 % per annum, is predicted to be 114.5 M (52% of the total) by 2025. Urbanisation is another major driving force affecting the water sector, because of the resultant requirement for expanded and improved urban water supply and sanitation services, industrial pollution control and electricity. Rural population growth is expected to be much less, with the present total of 92 million increasing by only 15% to 106 M in 2025.

The growth and the demographic changes have significant impacts on the water sector of Pakistan, as described in the following sections.

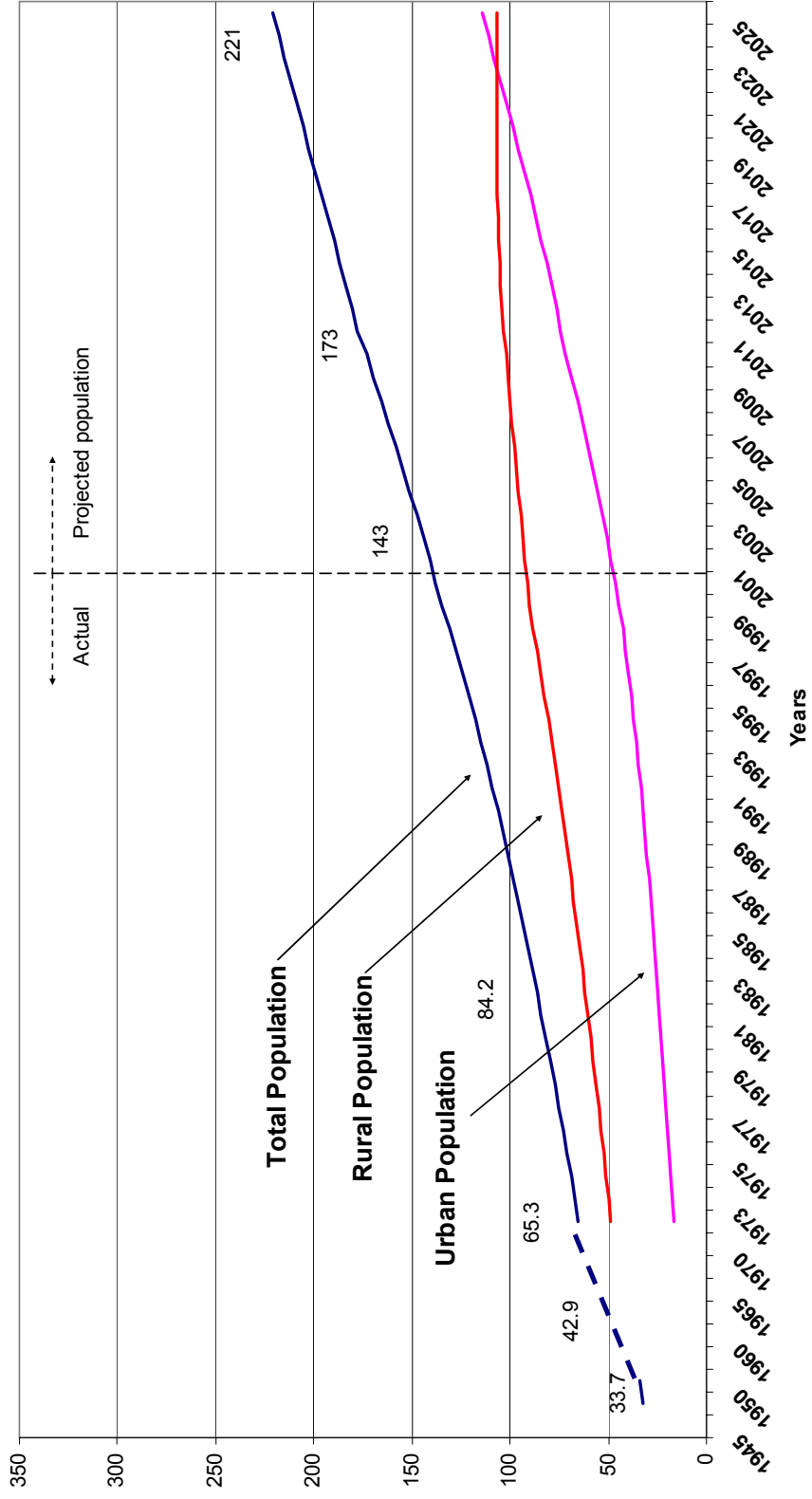


Figure 1.1: Population Trends and Projections

1.2

Increasing Agricultural Demands

With increasing population are the increasing demands for agricultural produce, for food and raw materials for industry, with attendant requirements for cropped area and for irrigation. Figure 1.2 shows the growth in irrigated and cropped area, with growth in wheat production also shown as an example. Cropped and irrigated areas have grown approximately in line with population, with wheat production growing somewhat faster.

Projections for wheat production were derived during the Strategy study at 34.8 million tonnes by 2025, shown on Figure 1.2. While some of the production growth will be met by increased cropping, much of it will be through increases in crop yield, which is feasible with efforts in farmer education, improved seed and other inputs. Low crop yields also contribute indirectly to greater water use because, with higher yields, the same amount of water would be used to achieve a higher rate of production.

On Figure 1.2, projections are given for cropped area but not for irrigated area because much of the increase will be achieved through increased intensification of existing area rather than expansion into new areas.

The main impact of a failure to achieve the projected growth in agricultural production would be increases in food imports and a decrease in export earnings from agricultural goods, mainly cotton. A simple but illustrative calculation of the cost of this is given in Table 1.1 below.

Table 1.1 is presented for illustration only. In the Water Resources Strategy estimates are made of required crop yield and production increases based on the food needs of 2010 and 2025 (see Volume 4, Section 5). Production increases will be met through intensification of cropping and increases in crop yields; both of which are feasible if sufficient water is provided. The scenario presented in Table 1.1 assumes that, even without additional water, there will be some growth in crop yield and overall production, albeit slower. For simplicity, production is assumed to achieve the 2010 food and fibre requirements only by 2025. This results in a shortfall in agricultural produce of the difference between the needs of 2025 and the needs of 2010.

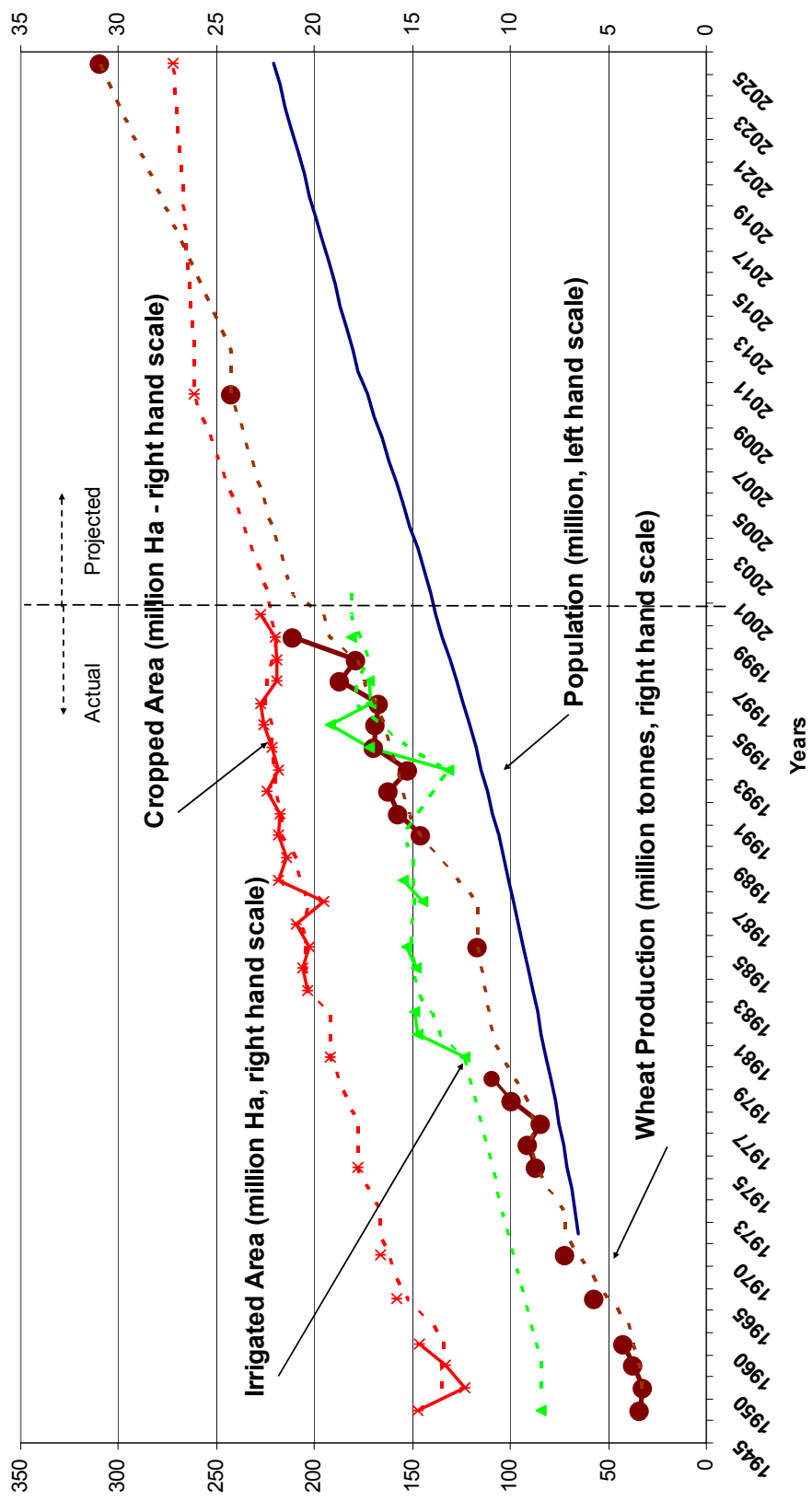


Figure 1.2: Agricultural Trends and Projections

Crop	Production Requirements (million tonnes)			Annual Production Shortfall (M tonnes)	Crop Price (Rs./tonne)	Annual Cost of Shortfall (M Rs.)
	2001	2010	2025			
Wheat	21.08	24.20	30.80	6.60	8,105	53,493
Rice	5.16	5.70	7.22	1.52	15,946	24,238
Cotton	1.91	2.46	3.16	0.70	56,670	39,669
Sugar Cane	46.33	57.92	65.61	7.69	14,534	111,766
Oil Seeds	4.41	5.02	6.41	1.39	24,767	34,426
Annual Import Cost of Staples Alone (wheat and rice) (M Rs.)						77,730
Annual Import Cost of Staples Alone (wheat and rice) (M US\$)						1,300
Total Annual Import Cost (M Rs.)						263,600
Total Annual Import Cost (M US\$)						4,400

Table 1.1: Illustration of Annual Costs of Importing Agricultural Commodities

Notes: Crop production requirements developed in the Water Resources Strategy Study. Crop Prices are based on "Global Economic Prospects and the Developing Countries 2002", World Bank. All prices and costs in 2001 prices.

The "Annual Production Shortfall" is the difference between the annual production requirements of 2025 and the annual production requirements of 2010 (which, for this case, is assumed to be the total possible production increase by 2025 assuming no additional water but improvements in other inputs). The Annual cost of that shortfall is given in the final column, with totals for staples (wheat and rice) only and for a larger selection of the basic crops.

While this is a very rough illustration it serves to show the impact of not achieving the main objectives of the strategy, particularly with regard to water resources. The annual cost of US\$ 4.4 billion compares to the estimate of capital cost of US\$ 10 billion for developing about 20 MAF of new storage during the Strategy period. It also compares with the capital cost of US\$ 1.7 billion in conservation efforts to save 4.7 MAF.

1.3

Domestic Water Supply

For illustration of the domestic water supply situation, the urban water supply sub-sector is discussed, though similar conclusions can be drawn for rural water supply.

As shown on Figure 1.3, with the current urban population estimated at about 34 million, and current levels of urban water supply coverage of around 60%, 20.4 million people have access to urban water through conventional supplies. By 2025 it is projected that over 50% of the population, some 115 million people, will be living in urban areas. The objectives of the Strategy are to deliver water to 95% of the urban population, or 109 million people, an increase of 80 million people served by 2025, almost triple the current level of service; a significant undertaking.

For comparison, a “do nothing” scenario of not extending the service from today’s level of 28 million people would result in only 25% of the 2025 urban population having access to a clean water supply. Extending the service coverage to maintain the current percentage of the population served at 60% would mean an urban population of some 70 million people without access to clean water supply by 2025.

Domestic water supply, urban and rural combined, and including industrial water supply, currently uses 5.1 MAF, which is projected to increase to 7.9 MAF by 2011 and 11.3 MAF by 2025. Given the top priority of domestic water supply, this volume will have to be found either through developing additional storage or by taking it from current irrigation uses.

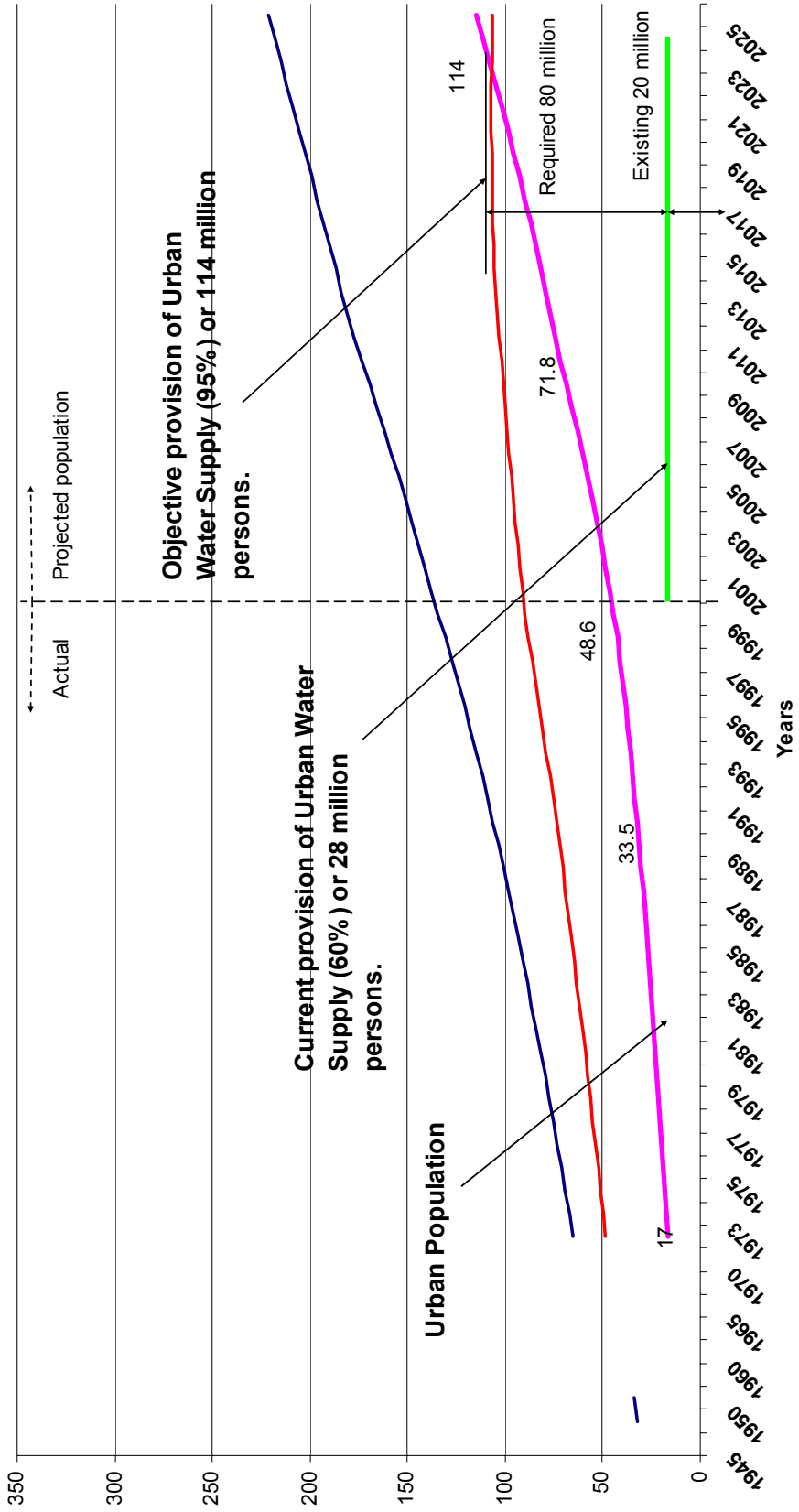


Figure 1.3: Urban Water Supply and Population, Trends and Requirements

1.4

Water Resources

Against a background of a growing population and growing demands for water, Pakistan is now essentially at the limit of its surface water resources. The drought of the past three years has led to water shortages and have illustrated just how close water use is to the limits of the resource. In addition, declining groundwater levels and increasing groundwater salinity in irrigation areas of the Indus and in Balochistan illustrate that there is little, if any, potential for further groundwater development.

While there are smaller hydrological units which are of local significance, namely the Kharan Desert and Makran Coastal Basin, both in Balochistan, most of the surface water is generated in the Indus Basin. The water resources and water use of the Indus Basin are therefore used to illustrate the water resources situation.

Figure 1.4 shows the long term trends in inflow and canal diversions, mainly for irrigation use. The long-term sustainable average annual surface water net inflow of the Indus Basin is 142 MAF. Canal diversions over the same period have averaged 104 MAF, with an average of 38 MAF flowing downstream of Kotri Barrage to the sea. The actual requirements downstream of Kotri remain the subject of intense debate. However, assuming that this level of outflow will remain, two simple future scenarios are presented in Figure 1.4.

Scenario 1 assumes the development of 18 MAF of additional storage on the Indus. In this case, potential canal diversions would increase to 122 MAF annually, allowing an increase in cropping intensity, limited expansion of cropped area and an increase in agricultural production.

Scenario 2 assumes no additional storage on the Indus. Sedimentation of the existing reservoirs will continue and a further loss of storage volume of as much as 3 MAF will occur by 2025. Average canal diversions will decrease accordingly with a significant impact on agricultural production.

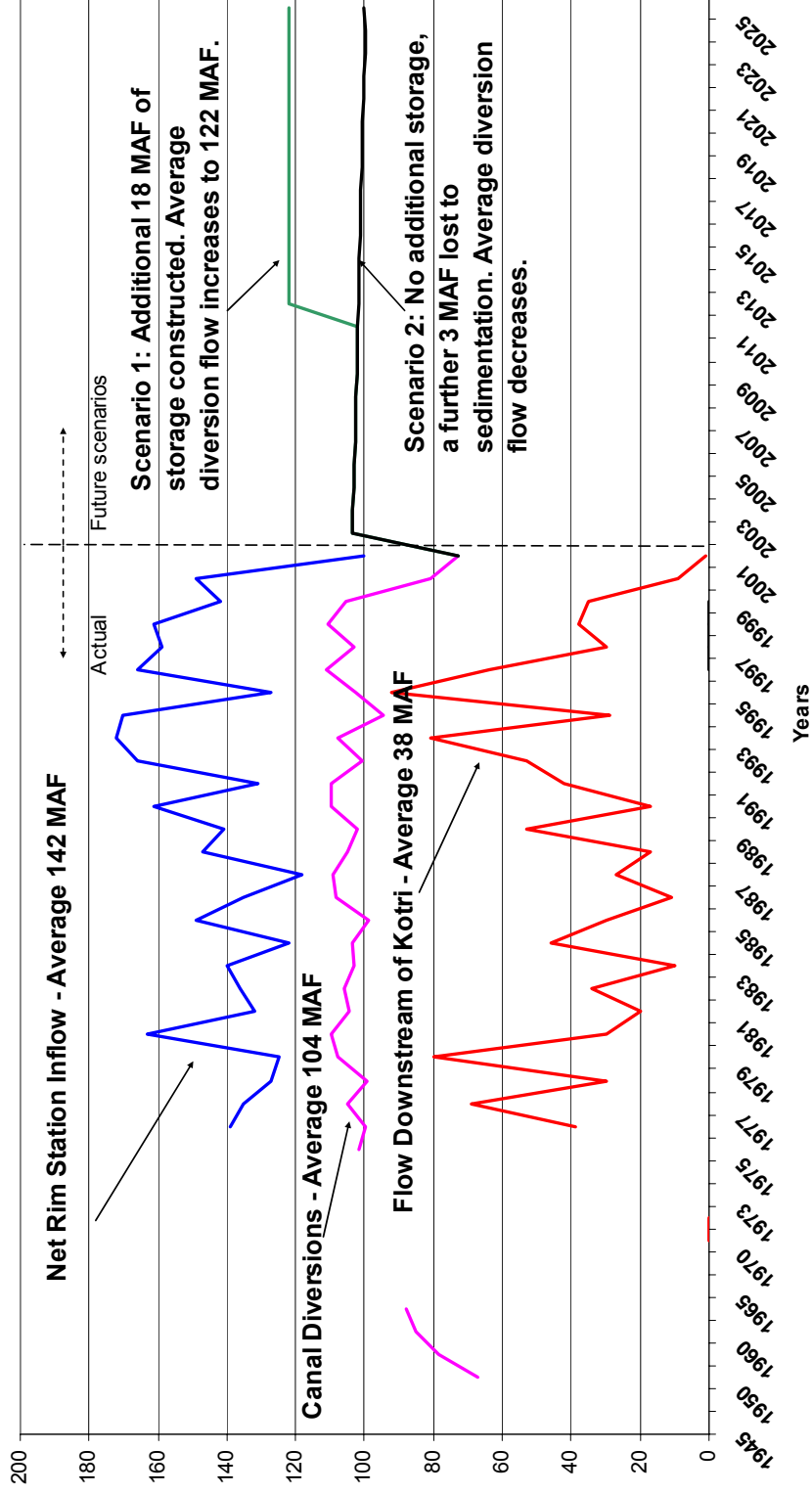


Figure 1.4: Water Resources and Requirements, Trends and Projections

1.5

Cross-Cutting Issues

The above discussion provides a very generalised picture of the past trends affecting and affected by the water sector. These are also selected examples and do not cover the whole of the picture. There are also issues which cut across the whole of the water sector and beyond into other sectors.

Linking the discussion on water resources and on domestic water supply is the fact that there will be a demand of some 11.3 MAF (an increase of 8.2 MAF) for domestic consumption by 2025. Scenario 2 of Figure 1.4 indicates a further decline in canal diversions of about 3 MAF due to continued reservoir sedimentation. In total, this will result in a shortfall of 11.3 MAF for irrigation without the development of additional storage.

Water conservation is a key component of the Strategy. The majority of water saving will be from the irrigation sub-sector because of its place as the largest user of water by far. It is estimated that 4.7 MAF could be conserved by improving irrigation efficiency from the current 40% to 45% by 2025. This amount of water would make up for a significant proportion of the currently available water lost to reservoir sedimentation or for the needs for domestic water.

As described in Section 1.2 on agricultural demands, efforts to conserve water and develop additional storage must be matched by increasing crop yields and production. Neither additional storage, conservation nor crop yield and production increases can meet the food and water needs of the future alone. There must be a coordinated and determined effort on the part of the agriculture sector, the irrigation sub-sector and the on-farm water management programme.

Water quality is one of the main issues in the Water Sector in Pakistan and its improvement a key component of the Strategy. Poor water quality and its improvement affects all sub-sectors as well as the quality of life of the people. Pollution is caused by several sub-sectors, most notably municipal wastewater disposal, industrial wastewater disposal and disposal of saline and chemically polluted agricultural runoff. Attacking this problem will require the cooperation of several agencies, especially: environment, agriculture, irrigation, municipal service providers and the industrial sector. Lack of action of the water quality

issue will mean a continued decline in water quality, increasing costs of treatment, reduced crop yields, further loss of fish and wildlife in the rivers and riparian environment, among other factors.

Institutional and management issues also cut across the whole of the water sector. The lack of financial sustainability in water service delivery, caused by low levels of water tariffs and their collection, has led to a strain on government financial reserves and to deteriorating infrastructure in the domestic and irrigation sub-sectors. Failure to improve this will result in continued deterioration and increased borrowing to support it.

In summary, a determined and coordinated effort is needed across the water sector, the agricultural sector and the environmental sector to tackle the many problems affecting water resources and water use in Pakistan.

The Water Sector Strategy that has been developed is summarised in this Volume. It lays out a road map to guide the management and further development of water resources to support the seven sub-sectors of the water sector and for service delivery in the water industry.

2

THE WATER SECTOR: PRIMARY ISSUES

2.1

The Policy Environment

The Pakistan Water Sector Strategy is one of several complimentary initiatives by the GOP. Of greatest importance have been:

- Ten Year Perspective Plan (Planning Commission, 2001)
- Vision 2025 (Water and Power Development Authority, 2001)
- National Water Policy (Ministry of Water and Power, (Draft) 2002)

In addition to the above, the Pakistan Framework for Action (Pakistan Water Partnership, 2002) is non-government but of importance as it outlines many of the issues not otherwise addressed.

The Strategy has adopted, as its primary objective, the Vision Statement of the National Water Policy:

THE NATIONAL WATER VISION

“By 2025, Pakistan should have adequate water available, through proper conservation and development. Water supplies should be of good quality, equitably distributed and meet the needs of all users through an efficient management, institutional and legal system that would ensure the sustainable utilization of the water resources and support economic and social development with due consideration to the environment, quality of life, economic value of resources, ability to pay and participation of all stakeholders.”

2.2

Changing Responsibilities in the Water Sector

2.2.1

National

The waters of the Indus River basin are allocated to the provinces through the Water Accord which is implemented by the Indus River Systems Authority (IRSA). With five members, one for each province and a Federal member, it acts in the national interest. But there are frequent disputes over water allocation, especially in sharing water

during dry periods. This has led to controversy between the provinces which has contributed to the slow growth in water resources developments in the past decades.

While there are several federal agencies with responsibility for various areas or sub-sectors of water, there is no inter-ministerial, inter-provincial body to oversee integrated water sector planning, development and management. Such a body is needed to oversee the implementation of the Water Sector Strategy to ensure that investments are targeted specifically at achieving its objectives. It is also needed to broker consensus on the major initiatives of the Strategy which are inter-ministerial and/or inter-provincial in nature, such as addressing water conservation, improvements in agricultural yield and production and the development of additional water storage. Changes in the water sector in Pakistan, from becoming a water scarce nation to changing demographics placing a different emphasis on water use, demand a new approach to water management.

2.2.2

Provincial

Much of the water sector planning, development and management has been mainly a provincial responsibility. Irrigation, domestic water supply and sanitation, environment have been managed through respective provincial departments. This is now changing with the programme of devolution in all sub-sectors.

The Devolution Plan of August 2001 decentralises most public sector activities from the federal and provincial levels to the district level, including public sector water supply and sanitation. The former provincial Public Health Engineering Departments have been reduced or even dissolved. There is some concern that the district authorities will lack the technical and managerial skills needed to support development of rural water supply and sanitation. It is hoped that these problems will be worked out as district administration comes to grips with their new responsibilities. The effectiveness of the districts in planning and development of rural water supply and sanitation should be monitored to ensure that it remains on track and assistance is provided where needed.

In urban water supply and sanitation larger cities manage their own systems. With rapid growth in the demand for water in the urban sub-sector, effective strategic planning will be of great importance. There is special concern for smaller cities and towns where much of the urban growth will take place in the coming years. They may need additional support and technical assistance and a support body to help coordinate the sub-sector would be a valuable addition.

In irrigation, legislation has been passed to convert the Irrigation Departments into financially self sustaining autonomous Provincial Irrigation & Drainage Authorities (PIDAs). Under the PIDAs, the operation and maintenance of individual canal systems is to be entrusted to autonomous self-accounting Area Water Boards (AWBs), which would entrust the O&M of the distributaries and minor canals to Farmers Organizations (FOs). This is currently an issue as agricultural and irrigation reforms are not fully accepted, a situation which has led to the slow progress of the National Drainage Programme. In turn, this has resulted in international funding agencies such as the Asian Development Bank and the World Bank to reconsider their investments in the water sector in Pakistan. Future financial commitments by these agencies may rest on an agreeable resolution to this problem.

2.3

Population Growth and Demographic Changes

Pakistan's population is currently 141 million people, growing at a rate of 2.61% between 1986 and 1998. With an assumed reduction in growth rate over the next 25 years, averaging at 2.1%, the population is predicted to reach 221 million. The increasing population means increases in food and fibre requirements and increased demands for water across the sector and changes in the sub-sectoral allocation of water.

Rapid urbanisation is also taking place. The present urban population of 48 M (34% of the total), increasing at 3.7 % per annum, is projected to be 114.5 M (52% of the total) by 2025, with the urban population beginning to exceed the rural population by 2022. Urbanisation impacts on the water sector in two ways. There will be a resulting requirement for expanded and improved urban water supply and sanitation services, industrial pollution control and electricity. With the majority of the

population living in cities, political influence will move away from being rural and agriculturally oriented and begin to emphasise urban concerns.

The uneven population distribution of the four provinces (see Figure 2.1) of Pakistan: Balochistan (4.9%), North West Frontier Province 15.9%, Punjab (55.1%) and Sindh (22.9%) is of particular significance in water sector development. Investment is distributed according to a formula which closely reflects the population distribution and the provinces of lower population consider this an improper way to distribute finances, arguing that without additional funding their development will continue to be held back.

2.4

Poverty

Poverty is an overriding social problem in Pakistan and its reduction is given high priority. Although average per capita food availability of some 2,700 calories per day is adequate, malnutrition is widespread, with a reported eight 8 million malnourished children in 1999/2000. At 62.5 years, average life expectancy is similar to that in most other South Asian countries, but infant morbidity and mortality rates amongst the under-fives are well above the regional average.

Interventions by the water sector for direct poverty reduction are limited but are addressed specifically in the Water Sector Strategy through small-scale irrigation developments in poor areas where other opportunities for economic development are limited and improved health and living conditions through increased access to domestic water supply and sanitation.

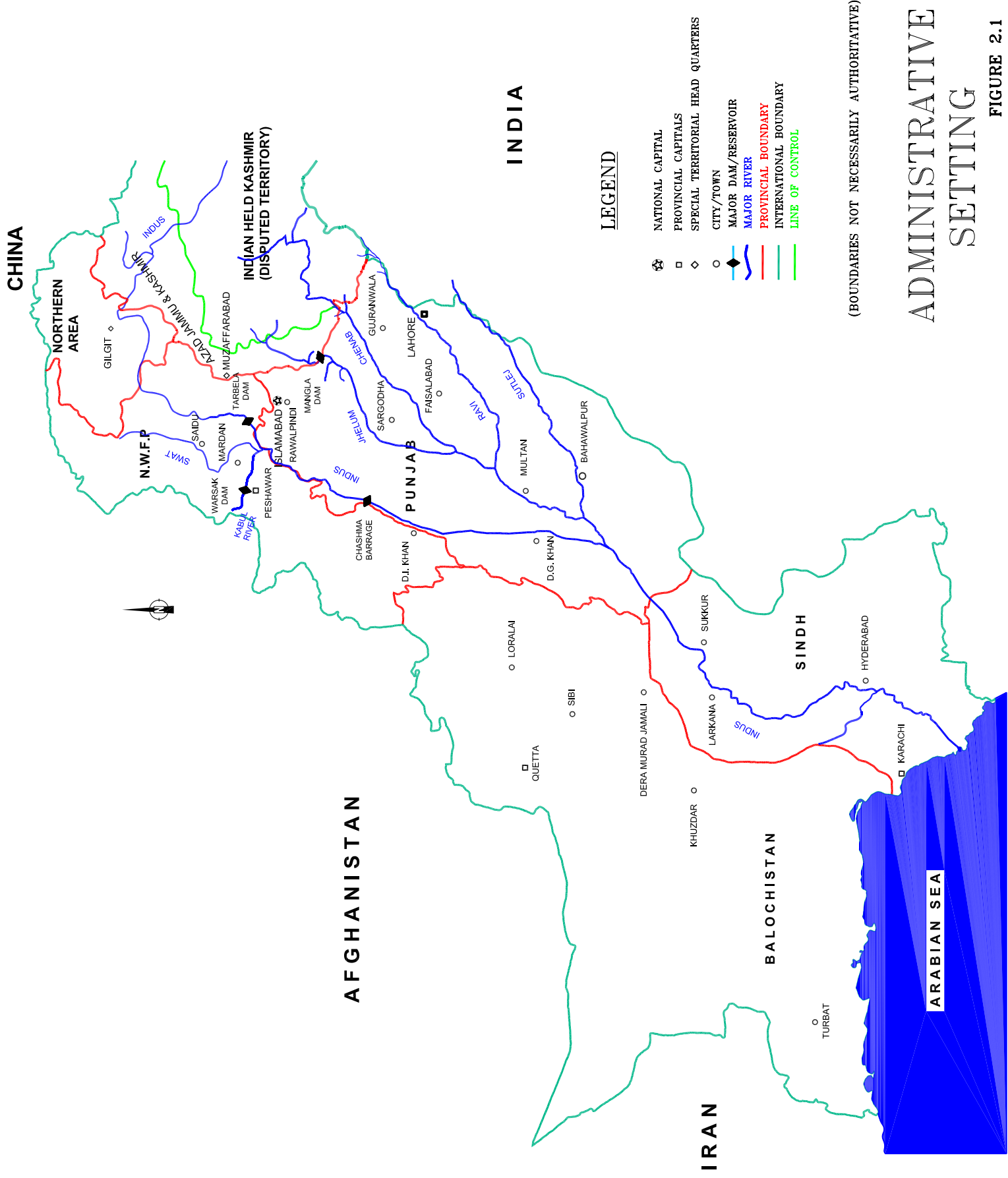


FIGURE 2.1

2.5

Involvement of Women in the Water Sector

Specific consideration of women's role in water sector has not been a traditional feature of water sector development in Pakistan. However, under the Devolution Plan, one third of the places on the District Councils are reserved for women. With the same council responsible for domestic water supply, this should improve the involvement of women in decision-making in this sub-sector.

The proposed strategy for the rural water supply and sanitation programme targets women specifically for participation in decision-making in planning, development and management.

2.6

Equity in Water Allocation

Equity in water allocation and access in irrigation is a major concern in Pakistan, as it is in many countries with large scale irrigation systems. It is a problem of those farmers at the tail end of irrigation systems not receiving their allotted share of water because those at the head end tend to take more than their share. This is related to poverty issues because the tail end farmers are usually the poorer ones, partly because of inequitable water distribution.

This has a special relevance in Pakistan. Since the development of tube wells for irrigation, mainly in Southern Punjab and Sindh, the tail end farmers have come to rely on groundwater to enhance their poor water supply from the irrigation system. In most areas groundwater levels are either declining or the water quality is deteriorating, evidence that access to groundwater will decline in the future, either directly through aquifer depletion, or through increasing pumping costs which will again affect poorer farmers to a greater extent.

Equity is a difficult problem to solve as it is not a technical one. Rather it is driven by malpractice within the irrigation systems. Nevertheless, with government commitment a solution is possible.

2.7

Water Resources Availability

2.7.1

Surface Water Resources

The hydrological units of the Kharan Desert and Makran Coastal Basin in Balochistan generate about 4 MAF and there is some potential for capturing flows to improve water availability locally. Otherwise, most of

the surface water is generated in the Indus Basin. Figure 2.2 shows the river system of Pakistan.

The long-term sustainable average annual surface water net inflow of the Indus Basin is 142 MAF. Canal diversions over the same period have averaged 104 MAF, with an average of 38 MAF flowing downstream of Kotri Barrage to the sea. The actual requirements downstream of Kotri remain the subject of intense debate. However, this illustrates that Pakistan is now essentially at the limit of its surface water resources. The drought of the past three years has led to water shortages and illustrated just how close water use is to the limits of the resource.

2.7.2

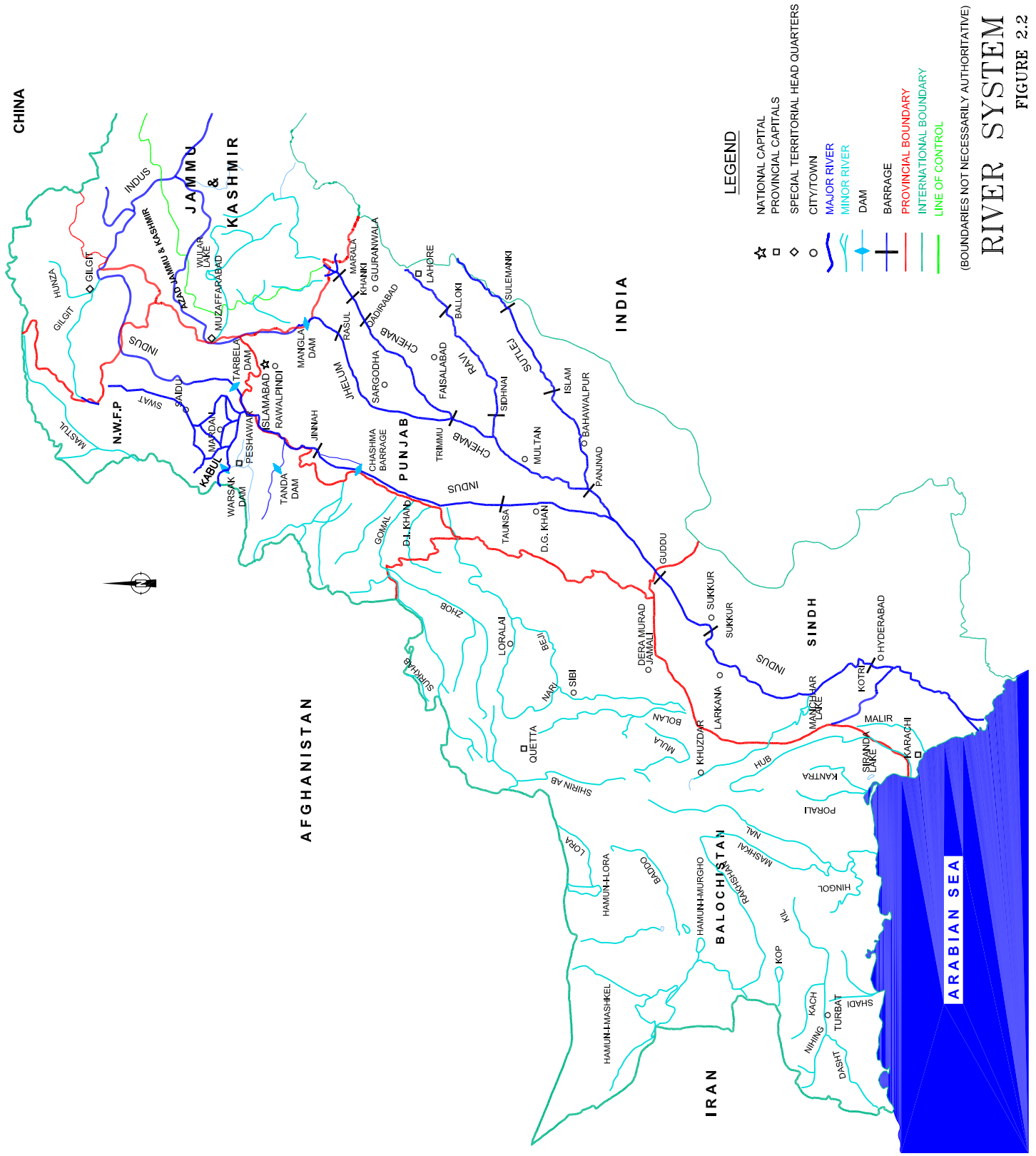
Groundwater Resources

Estimates of groundwater availability in Pakistan have been made in several studies, and vary from 45.6 MAF (56.2 BCM) to 53.3 MAF (65.7 BCM), with an average of 51.1 MAF (63.0 BCM). Abstraction of groundwater for irrigation and for urban and rural drinking water supplies is estimated that about 41.6 MAF. While these figures may suggest some potential for further exploitation, they are based on very little actual monitoring of the resources or the abstraction and should be treated with caution. Other evidence, such as increasing salinity of groundwater in many areas and declining water levels in others, suggests that there is little, if any, further potential for groundwater exploitation. The Strategy has assumed only 1 MAF of additional groundwater will be successfully exploited.

2.8

Rationalisation of Water Allowances

In the context of increasing water demands, the limited water resource and limited finances for water sector investments, the use of water and of money must be carefully considered. While there are water shortages there is also extensive overuse of water, as evidenced by the problem of waterlogging and salinity. There are extensive and costly plans to alleviate the drainage problem which is primarily caused by the overuse of water for irrigation. Water allowances, especially for irrigation, need to be assessed and rationalised within the larger context of the water sector.



LEGEND

- ☆ NATIONAL CAPITAL
- ◻ PROVINCIAL CAPITALS
- ◊ SPECIAL TERRITORIAL HEAD QUARTERS
- CITY/TOWN
- MAJOR RIVER
- MINOR RIVER
- DAM
- BARRAGE
- PROVINCIAL BOUNDARY
- INTERNATIONAL BOUNDARY
- LINE OF CONTROL

(BOUNDARIES NOT NECESSARILY AUTHORITY)

RIVER SYSTEM
FIGURE 2.2

2.9

Drainage and the Disposal of Drainage Effluent

Related to water allowances question is the serious waterlogging and salinity problem affecting large areas of Pakistan's irrigated agriculture. Providing an effective drainage solution is necessary to alleviate the loss of productive farm land to salinity. Disposal of the drainage effluent in an environmentally sound way is also necessary to reduce pollution of rivers and of land. The solutions proposed to date focus on large drainage schemes which act on the symptoms rather than the underlying problem of overuse of water for irrigation.

2.10

Water Quality

Water quality, of both surface water and groundwater, has been identified as one of the major water resources issues in Pakistan. While there are laws governing disposal of waste water into the rivers enforcement has been ineffective because of inadequate resources. Industries are in general acceptance of their need to treat waste water prior to disposal but a programme needs to be established to make a start. Municipal wastes need to be targeted at the same time, probably under the same programme.

Access to clean domestic water in the urban and rural subsectors is low in terms of service as well as water quality. Access to proper sanitation facilities is low and only about 1% of the total wastewater generated in the municipal sector is treated before being discharged into the rivers. Poor practice in the disposal of solid waste also pollutes the surface waters.

Agricultural drainage is also an issue, from the perspective of sustainability of irrigated land as well as environmentally sound disposal of saline drainage.

Water quality monitoring and information management is also lacking and needs to be addressed in order to develop a solid base for planning and decision making in pollution control and enhancing public awareness of water quality concerns.

2.11

Agricultural Yields and Production

While there has been continuous improvement in agricultural yields, they remain significantly lower than their potential, contributing to inefficient

water use by the agriculture sector. Crop yields must be increased significantly in order to meet the food and fibre requirements of the future.

Irrigation efficiency is low, at an estimated 40%, with good potential for conserving water through improved field application, lining of watercourses and adoption of better irrigation technologies. This will require a coordinated effort between agriculture agencies, irrigation agencies and the on-farm water management initiative.

Loan conditionalities of the main international lending agencies target increased farmer participation in irrigation management and cost recovery in irrigation service delivery. The issue of farmer ability to pay is frequently raised and is one which warrants attention if such reforms are to be successfully implemented. Figure 2.3 shows the crop price trends since 1995 and forecasts to 2015 in farm gate prices for selected crops in Pakistan. There has been a significant decline in prices since 1995 and, though a rebound is forecast, it is small and a return to the 1995 price is not expected.

The drop in prices not market driven, but rather is due primarily to the high level of agricultural subsidies in Western countries. The low price certainly reduces farmers' ability to pay, a situation which is not forecast to change in the near future. Hopes for achieving the agricultural and irrigation reforms will be hampered until some form of reconciliation of Western agricultural subsidies and imposed reforms in developing countries is achieved.

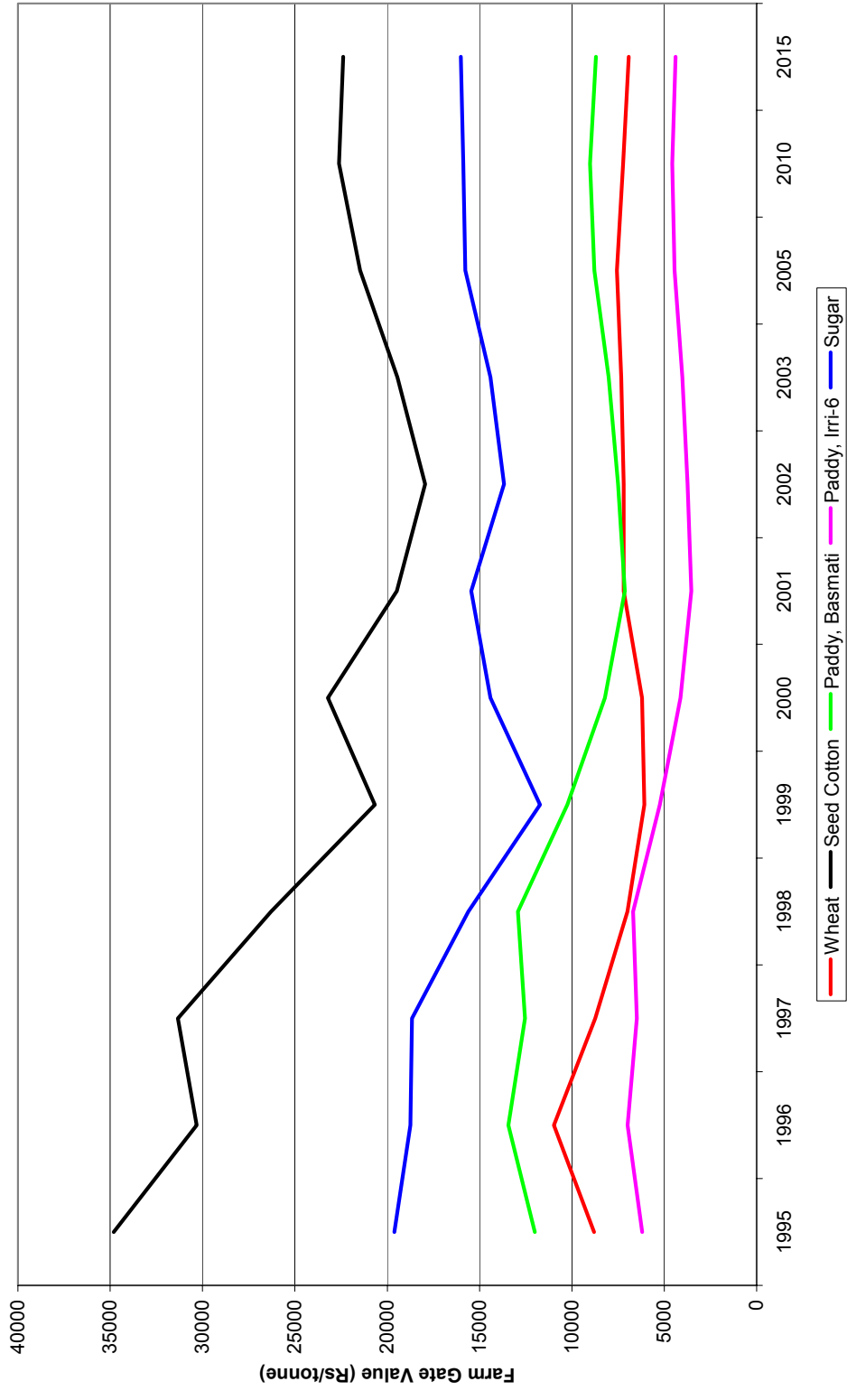


Figure 2.3: Farm Gate Prices for Selected Crops, Trends and Forecasts

(Source: Global Economic Prospects and the Developing Countries 2002, World Bank)

2.12 Economic Setting

2.12.1 General

In 2000/01 Pakistan's Gross Domestic Product (GDP) totalled Rs 3,411 billion (US\$ 56.9 billion). Average per capita income was Rs 24,500 (US\$ 408 or US\$ 1.12 per day), with widespread and rising rates of poverty. Economic growth has slowed in recent years from 6.1% in the 1980s to 4.0% in the 1995-2000 period and 2.6% in 2000/01. The assumption for the Strategy is an annual GDP growth rate of 3% for 2002-03, 4% for 2004-05 and 5% thereafter, in line with the latest ADB forecast¹.

2.12.2 Agriculture

Agriculture is the largest sector of the economy, with primary commodities accounting for 25% of GDP and 47% of total employment, and contributes more than 60% of foreign exchange earnings. Growth in the sector has been stagnating over the past few years, though it is likely to remain the primary contributor for some time.

2.12.3 Industry

The industrial sector has been growing faster than the agricultural sector. Manufacturing accounts for 17% of GDP, though textiles, which is a secondary product of agriculture, accounts for a considerable portion of the output of the industrial sector.

It is unlikely that labour requirements in the agriculture sector will grow at anywhere near the population growth rate and it will be the industrial sector which will provide most jobs in the future. Rapid growth of the industrial sector will be necessary to provide them and an appropriate balance will be needed to ensure both irrigation supplies and adequate water supplies for industries. Effective pollution control will also become increasingly important.

2.12.4 Hydropower

The water sector makes a substantial contribution to power generation. Hydropower accounts for 5,009 megawatts (MW) of the total installed generation capacity of 17,980 MW. This is an area with good potential

¹ ADB (April 2002): Pakistan Economic Update

for growth and, while not a consumptive user, water for hydropower development must be considered within the overall Strategy.

2.13

Availability of Finances

A key parameter influencing the Water Sector's future development will be the availability of government funds for public sector capital investment and recurrent expenditure. There has been a substantial public sector budget deficit for many years, ranging from 5.3% of GDP (2000/01) to 8.8% (1990/91), with some reduction in public expenditure over time (from around 26% in 1990/91 to 21.8% in 2000/01), but also a slight parallel decline in revenue generation. Considerable efforts are now being made to reduce the fiscal imbalance, and the fact that the 5.3% deficit in 2000/01 was the lowest in the past decade is encouraging. Nevertheless, public sector funding can be expected to continue to be a serious constraint on the Water Sector, as it is in many developing countries.

Donor assistance has provided disbursements in loans and grants of around US\$ 2.4 billion per annum in the 1994/95 to 1998/99 periods. For investment planning purposes the assumption made is that total donor funding would average about US\$ 1.6 billion per annum (at 2000/01 prices) over the period up to 2011. Of this total, about US\$ 360 million (22%) is assumed to be available to the water sector if there are adequate and appropriate investment opportunities.

At present, there is little scope for significant private sector participation in the municipal water and hydro-power sub-sectors, though an important government aim is to increase it.

The Asian Development Bank has been providing assistance to the Government of Pakistan since 1968, and to date it has provided a total of US\$11.5 billion in aid to the country. In 2001, ADB provided a total of US\$ 957 million to Pakistan. ADB's strong commitment to Pakistan will continue with over US\$ 800 million in average annual assistance for the period 2002 to 2005. In particular, ADB is providing major policy based assistance to support the Government's economic and governance reform agenda.

The upper level of annual investment for the Water Sector is estimated at Rs 40 billion (US\$ 667 million) at present. Based on past trends and expected increases in the availability of external financing, the total investment during the period of the Medium Term Investment Plan (MTIP) is expected to be of the order of Rs 500 billion (US\$ 8.3 billion), inclusive of the contribution by the Pakistan Government. On-going commitments for the water sector amount to Rs 209 billion (US\$ 3.5 billion), leaving a budget space for new projects of Rs 291 billion (US\$ 4.9 billion) during the MTIP period. Annual disbursements are expected to be similar, unless a specific initiative for a large project (such as large storage) is undertaken.

A more detailed discussion of the available funding is presented in Annex B of Volume 3, The Medium Term Investment Plan.

2.14

Coordination Within the Water Sector

There is a need increase the level of coordination within the water sector to bring about the much needed reforms and changes. Pakistan's water resources need to be developed and managed in an integrated and holistic manner in keeping with the principles of integrated water resources management (IWRM). The increasing water demands have the potential to lead to conflict if not managed with due consideration of all water users, including the environment. A spirit of cooperation must be maintained.

Interprovincial insecurities regarding water sharing during periods of shortage has led to controversy and has led to the slow pace of development of the water sector for the last decade or more.

Lack of coordination is also apparent among the water related agencies of the various sub-sectors. Water resources development agencies and the irrigation sub-sector dominate water activities and water investment in Pakistan. Irrigation is the largest user of water, but water use in other sub-sectors is equally important, is also increasing, and will need to be addressed in Strategy plans.

Cooperation, coordination and collaboration between the irrigation departments and the agriculture departments need to be improved. Given that the only purpose of irrigation is as an input to agricultural

production, full coordination between these departments is essential to the development and sustainability of irrigated agriculture and to ensuring that investments in irrigation are directed specifically at improving agricultural production.

2.15

Project Implementation

At a time when Pakistan is in dire need of water sector investment, there have been considerable delays in project implementation. Some projects have been initiated but stopped before completion, wasting valuable investment resources and reducing confidence in implementation ability.

A way forward must be found here, probably through frank discussions between the international funding agencies and the GOP as well as the provincial government agencies in their role as implementing agencies.

While commitments to reforms must be honoured, there must also be acceptance on the part of the international lending agencies that reforms such as farmer participation in irrigation management have not yielded tangible results in other countries. Agriculture and irrigation reforms are not areas where quick results are possible and long-term commitments are required. Referring to Figure 2.3 above, such reforms are unlikely to be successful until some form of reconciliation of Western agricultural subsidies and imposed reforms in developing countries is achieved.

2.16

Financial Sustainability

Financial sustainability in all sub-sectors needs improvement. In the urban water supply and sanitation sub-sector, this is mainly due to low levels of income generated through water tariffs and their collection. In the irrigation sub-sector introduction of farmer-managed irrigation could benefit to sustainability. However, in some provinces it does not have full support of the irrigation authorities that would be responsible for its implementation. Though there are questions of farmers ability to pay in the current climate of low farm gate prices, farmer participation in irrigation management can still be beneficial as they become more involved in the decision making process and can tailor irrigation service delivery to their own needs.

The current climate for involvement of the private sector in urban water supply and in hydropower, the two sub-sectors which are most likely to be of interest to the private sector, needs to be improved as a priority

2.17

Information, Education and Public Awareness

Information on water resources and, especially, water use, is limited and not very accessible. Information on water quality is similarly lacking. Public awareness and understanding of water issues are inadequate and need to be addressed in order to garner public support for the changes in water management that will be needed in the immediate and longer- term future.

2.18

Summary of Issues

Major issues, problems and constraints addressed in the Strategy are summarised below, presented under three headings: 'Institutional and Management Issues', 'Social and Financial Issues' and 'Technical Issues'. A more detailed discussion is available in Volume 4, Detailed Strategy Formulation.

2.18.1

Institutional and Management Issues

Specific institutional and management issues include the following:

- (i) Inadequate coordination between the organisations of the various sub-sectors of the Water Sector;
- (ii) Difficulties in reaching consensus between the provinces on major water resources developments;
- (iii) Absence of an inter-ministerial, inter-provincial body to oversee water sector planning, development and management;
- (iv) Changing administration under the Devolution Plan, and uncertainty in technical ability during the transition, especially in the domestic water supply and sanitation sub-sectors;
- (v) Need for improvement of public sector management of water sector infrastructure and activities;
- (vi) Inadequate water information;

2.18.2

Social and Financial Issues

The main social and financial issues affecting water sector development are:

- (i) Rapid population growth and changing demographics;
- (ii) High level of poverty, with some potential to be improved through water sector investment;
- (iii) Low level of involvement of women in water sector decision making, with potential for improvement, especially in domestic water supply and sanitation;
- (iv) Inequity in water distribution within the irrigation systems;
- (v) Limited availability of funds for the water sector and high financial requirements to meet the needs of the future;
- (vi) Lack of financial sustainability in water sector services due to low levels of public sector funds and insufficient cost recovery;
- (vii) Low crop prices reducing farmers' ability to contribute to irrigation and drainage management;
- (viii) Limited private sector investment or participation;
- (ix) Limited stakeholder participation in decision making in all sub-sectors;
- (x) Inadequate public awareness and understanding of water issues;

2.18.3

Technical Issues

The main technical issues are:

- (i) Increasing demand for water, food and power;
- (ii) Insufficient water resources for the demands of the future;
- (iii) Inefficient use of water in all sub-sectors with greatest potential for improvement in the irrigation sub-sector;
- (iv) Low crop yields;
- (v) Deteriorating water quality;
- (vi) Inadequate domestic water supply and sanitation coverage and quality of service;
- (vii) Deteriorating infrastructure in the domestic and irrigation and drainage sub-sectors;

- (viii) Overuse of water in many irrigated areas, the main cause of (ix) below;
- (ix) Waterlogging and salinity on irrigated land and disposal of saline drainage effluent.

3 OUTLINE OF THE STRATEGY

3.1 *Introduction*

The proposed Water Sector Strategy has been formulated based on the planning approach described in Section 3 of Volume 4, Detailed Strategy Formulation. The Strategy is presented here as a summary of the key elements, which may be sub-sector related in some cases, but are in many cases applicable across the water sector. The individual strategies for the seven sub-sectors are summarised in Section 4 below.

The Key Elements of the Strategy are presented first. These are essentially a summary of issues and interventions determined to be necessary through the course of developing the sub-sectoral strategies.

A summary of the overall cost of the Strategy, a proposed prioritisation, a cost estimate and a framework table are provided at the end of this section.

3.2 *Key Objectives of the Strategy*

This section presents the key objectives of the Strategy which have reference across the water sector. In the discussion on each of the sub-sector, more objectives are given which are specific to those sub-sectors and are not repeated here.

The Water Sector Strategy goes beyond the infrastructural development of the various water sub-sectors. Following the principles and themes of the Pakistan National Water Policy, the Strategy has emphasised the elements which are essential to the sustainable achievement of the objectives of the water sector and which are raised in the discussions on the sub-sectors. This section summarises those elements.

The Water Sector Strategy and the accompanying Medium Term Investment Plan (see Volume 3, Medium Term Investment Plan) are not limited to the irrigation and drainage sub-sector, as has been the traditional emphasis in water sector work in Pakistan. Rather, all the competing sub-sectors of water are addressed, along with the cross-

cutting issues and objectives, as they should be to ensure provision of water for all in the future.

3.2.1

Provision of Water for All

Ensuring the provision of water for all is the key objective of the Strategy and essentially all other objectives support this. The primary objective of each of the sub-sectoral strategies is also directed at providing water for all within their own spheres. At the Water Resources Development level, key elements include:

Water Conservation

A good proportion of the water which will supply the additional needs of the future must come from conservation. While there is scope for conservation in the domestic water supply sub-sectors, most will be derived from the irrigation sub-sector, simply because of its sheer volume of water use. Conservation in irrigation will be the responsibility of both the agriculture sector and the irrigation sub-sector by improving irrigation efficiencies. Efficiency improvements will come from a combined programme of farmer training for improved field application and lining of watercourses, with a priority on areas of saline groundwater. It is estimated that there is potential for saving 4.7 MAF annually through increasing irrigation efficiency from the current estimate of 40% to 45% by 2025.

Another water conservation measure will be to reconsider and rationalise water allowances. Current water allowances have contributed to the waterlogging and salinity problem which damages the land as well as creating a major expense in artificial drainage and disposal of drainage effluent. Achieving equity in irrigation distribution will also contribute to conservation through reducing waste of water and reducing the growing need for pumping from groundwater.

Additional Storage

In addition to water saved through conservation Pakistan needs additional storage to meet the agricultural and other water needs of the future. Most of this storage will be developed within the Indus Basin and, because of the size of the Indus, it means large storage dams. In recent

years, the development of large dams has been looked upon unfavourably because of the significant environmental, social and cost implications. Large storage, however, is the only realistic option for the development of water resources in Pakistan.

The limited availability of funding is a constraint to developing large storage and serious consideration will need to be given to making finances available. A consensus is needed on developing storage on the Indus and on selecting the best storage sites.

A first task of the Water Resources Apex Body will be to prepare an Integrated Water Resources Master Plan which will determine the needs and development priorities for conservation, storage, watershed management and water resources development as a whole. At this time, the estimate for additional storage is 20 to 25 MAF. The storage site at Kalabagh is considered to be the best location, but the controversy surrounding this site may pose a problem to its development.

Providing Water Allocations

The above interventions will be achieved with full recognition of the Water Accord under which the provinces are allocated water. Balochistan and NWFP, however, are unable to access their provisions under the Accord because the infrastructure to deliver it has not been developed. This development should be considered within the context of overall water resources, especially in relation to additional storage.

3.2.2

Improvement of Institutional and Management Capacity

There is need to strengthen the many institutions working in the water sector to ensure pragmatic planning, development and management of all the water sub-sectors. Effective management has been the most important constraint to progress in the Water Sector in recent years. With Pakistan entering a new regime of being a water scarce country a new approach to management is needed, which will prioritise a rational approach to water allocation within and between the sub-sectors, performance in service delivery and, especially, financial and physical sustainability.

Institutional strengthening will be required for the new approach to management and several significant additions to and changes in institutions are part of the Strategy.

A Water Resources Apex Body is proposed for planning, development and management of water resources (see Section 14.1, Volume 4, Detailed Strategy Formulation). This would be the body which would have primary responsibility to implement the Water Sector Strategy.

A National Water Council (NWC) is proposed which would be the major policy and decision making body. The NWC will be inter-ministerial and inter-provincial in its focus and mandate, chaired by the Prime Minister, with members likely consisting of the Ministers of: Water and Power, Food and Agriculture and Environment, plus: Secretary, Water and Power, Secretary Finance, Deputy Chairman of the Planning Commission, the Chief Ministers of the four provinces, with FATA, Northern Areas and AJK. The Chief Engineering Advisor, MWP would be the Member Secretary.

The Apex Body will support the NWC as a technical secretariat. It will be established within the Ministry of Water and Power (MWP). This would be an expansion of responsibilities of the Ministry of Water and Power and will require a change in the charter of the MWP so that it would cover all water sub-sectors. Extensive capacity will be required for its extension of current activities.

The Terms of Reference for the Apex Body will be detailed during the capacity building phase. However, at this time the broad ToR is envisaged to include:

- (a) Implementation of the Water Sector Strategy;
- (b) Coordination of all water user organisations;
- (c) Establishment of policy for allocation of water between water use sub-sectors;
- (d) Regulation of groundwater abstraction;
- (e) Developing and maintaining a Management Information System (MIS) for the Water Sector;
- (f) Developing and executing a strong Public Awareness campaign to improve public understanding of water issues.

The first task of the Apex Body would be to prepare an Integrated Water Resources Master Plan to determine the needs and development priorities for conservation, storage, watershed management and water resources development as a whole. Primary components of the Master Plan are, the need for storage, the potential and strategy for conservation of water, including reconsideration of water allowances, and the environmental needs of rivers including the Ravi and Sutlej and the Indus downstream of Kotri.

A Coordinating and Support body has also been recommended for the Domestic Water and Sanitation sub-sector. This is a forum of existing agencies in urban water which would provide support for strategic planning to all urban areas, large and small. The lack of long term planning is one of the main constraints to successful growth. Its first task will be to undertake a Strategic Medium and Long Term Plan to lay the foundations for achieving the objectives of the sub-sector. Restructuring of sub-sector financing and regulation to create an enabling environment for service providers to become financially self-sustaining is a key element of the Plan. If a climate is developed which can attract the private sector the proposed Domestic Water Supply Coordinating and Support Body could restructure to become a regulating body and be ready to take on this function as the private sector becomes more involved.

3.2.3

Poverty Reduction

Poverty reduction is targeted mainly through the irrigation and drainage and urban and rural water supply and sanitation sub-sectors. Poverty reduction is a primary objective for the Water Sector Strategy as a whole and for these sub-sectoral strategies.

3.2.4

Improving the Involvement of Women in Water

The involvement of women is to be improved within the rural water supply and sanitation sub-sector strategy. The proposed programme for development of the sub-sector targets women specifically through increasing their role in decision making. This should be supported by the establishment of seats for women in the District and Tehsil Councils under the Devolution Plan.

3.2.5

Increasing Equity in Water Distribution

Equity is a prime consideration of the Strategy, particularly in the irrigation and drainage sub-sector. Equity has an impact on poverty reduction and on conservation of water as it is closely related to overuse of water for irrigation.

3.2.6

Increasing Stakeholder Participation

The development of the water resources of Pakistan and the water using sub-sectors is undertaken specifically and only for the people of Pakistan and the support of their health and economic and social development.

It is necessary to enhance the participation of all water stakeholders: those with an active involvement in water use, such as farmers and rural communities who manage their own water systems, as well as those who rely on water services for their health and livelihoods.

Irrigation and Drainage

There have been and will continue to be difficulties in developing functional farmer management of irrigation and drainage systems. International experience with irrigation management turnover and participatory irrigation management has been mixed. In developing countries, in particular, the actual progress achieved has often been much below expectations.

However, the process should continue to be promoted with full farmer participation in the development of what will be their responsibilities. Their level of involvement in management will evolve, though government is likely to continue to be the major partner in irrigation management.

Domestic Water Supply and Sanitation

The principles and practice of user participation in rural water supply and sanitation are now becoming well established. Its role in urban water supply and sanitation is likely to remain limited, however, because urban systems lend themselves better than rural systems to operation on

commercial lines. This situation is reflected in the strategy proposals made for these sub-sectors.

To effectively participate at all levels; the public must be aware of and have an understanding of the issues in the water sector and their rights and responsibilities within it. It is the responsibility of the GOP and the provincial governments to ensure that public awareness is raised.

3.2.7 *Improving Public Awareness and Understanding and Information* Public Awareness and Understanding

Improved public awareness and understanding is a central objective of the proposed Strategy to provide the foundation for increased stakeholder participation. Awareness raising campaigns have been included in the sub-sectoral strategies of water resources development, urban and rural water supply and sanitation, industrial water supply and pollution control and environment.

A major Public Awareness campaign to increase awareness and understanding is one of the main tasks of the proposed Apex Body.

Information

Good quality and trusted information is the key to good quality and trusted decision making. A Management Information System (MIS) for water at the national level, linked with similar provincial systems is a component of the Strategy. Its development will be led by the proposed Water Sector Apex Body.

A water quality MIS has also been recommended under the environment heading.

3.2.8 *Improving Agricultural Yields and Production*

The food needs of the future will be met through combined efforts in water conservation, additional storage and, most importantly, through increases in crop yields. Improvements in government agricultural services are needed to ensure the continued growth of irrigated crop yields and output and a corresponding reduction in the need to increase the irrigated crop area and minimise additional storage. Agricultural

research and extension and seed supply are the key actors in this initiative. Increased research funding, institutional reform, especially for the seed sub-sector, and general efficiency improvements will be necessary.

3.2.9 *Increasing Cooperation Between Irrigation and Agriculture*

Agriculture will continue to be the largest user of water in Pakistan and one of the key elements of the Strategy is to conserve water used for agriculture through increasing irrigation efficiencies. This will require a concerted effort on the parts of both irrigation and agriculture departments as well as the On-Farm Water Management Programme, and their cooperation and collaboration will be crucial to its success. Improving cooperation, coordination and collaboration between irrigation and agriculture is a key recommendation in the Strategy for both the agriculture sector and the irrigation sub-sector.

3.2.10 *Enacting the National Water Policy*

The Pakistan National Water Policy is currently in draft form. This is a very important document because it outlines the philosophy, guiding principles and goals for development of the water sector. Once it has been finalized and approved, a National Water Resources Act should be enacted to encompass all the Policy provisions and provide a single set of rules and regulations for the nation's future water management. Water policies and acts are being established in many countries as a legal base for water sector development strategies and is normally regarded as essential for effective water management.

3.2.11 *Improving Cooperation and Coordination in the Water Sector*

Pakistan's water resources need to be developed and managed in an integrated and holistic manner in keeping with the principles of integrated water resources management (IWRM). The increasing water demands have the potential to lead to conflict if not managed with due consideration of all water users, including the environment. Plans and investments must be well coordinated, with high levels of cooperation between the sub-sectors and various organisations involved.

The proposed National Water Council should lead the improvement of cooperation and coordination throughout the Water Sector. This will be

supported by improvement of the quality and dissemination of information about the water sector, which the Apex Body will lead.

3.2.12

Finances

Achieving the objectives of the Strategy will be expensive. It will require major investment initiatives on the part of the government. Financing will need to be derived from government reserves, foreign borrowing and investment by the private sector.

Targeting Investments to the Objectives of the Strategy

Investments must be targeted directly at achieving the objectives of the Strategy. All projects must be assessed for their specific contribution to the Strategy objectives at the feasibility stage.

Financial Sustainability

Of crucial importance is ensuring the long-term financial sustainability of all water sector infrastructure and services. To achieve this, there will need to be a great improvement in public sector cost recovery, especially for the recurrent costs of O&M, improvement and modernisation and extension of services, as well as capital costs in some sub-sectors. The sub-sectoral strategies all target financial sustainability.

While it is unlikely that full financial self-sufficiency will be achieved, financial sustainability can be. Full financial self-sufficiency implies full cost recovery, which is not feasible in a country with high rates of poverty. To be financially sustainable, there may still be an amount of government support or subsidy, but there must still be a concerted effort to charge and collect reasonable rates for water service delivery and financial support from the government must be a clear part of the service's financial plan.

A financial sustainability assessment should be added to the PC-1 approval process for all projects. This would be in a similar manner to the environmental impact assessment, which is already included in the PC-1. It should outline how the project will be sustained; including water

tariffs and other cost recovery mechanisms, how these will be collected and how they will be applied to the associated costs.

Involving the Private Sector

The Private Sector is a potential source for both investment and management skills, especially for the urban domestic sub-sector and the hydropower sub-sector. Studies for private sector participation specifically for the urban and hydro sub-sectors have been proposed which will determine how to attract the private sector and define the roles it will play and the regulatory environment needed to manage and monitor it.

3.2.13

Improving Water Quality

Water quality, of both surface water and groundwater, has been identified as one of the major water resources issues in Pakistan. Water pollution is caused by untreated wastewater disposal from both industry and municipal systems and also from agricultural drainage. The primary problem is the lack of legal authority for the EPA to enforce existing regulations and a proposal has been included for a private – public partnership approach to improving effluent disposal.

Improvement of water quality is a key objective of the Strategy and specific proposals are included within the Urban and Rural Water Supply and Sanitation, Industrial and Environmental sub-sectoral strategies.

These need the support of a comprehensive water quality-monitoring programme, for both surface and groundwater, combined with an MIS for information management and dissemination. The main implementing agency may be the Environmental Protection Agency, but much of the work will be undertaken through the urban and rural water supply and sanitation sub-sectors, the industrial water supply sub-sector and the agriculture sector.

3.3

Summary and Main Framework of the Strategy

A Framework for the Water Sector Strategy which outlines the key issues, objectives and responsibilities of each of the sub-sectors, as well as a cost summary is provided in the following table.

SUMMARY AND FRAMEWORK OF THE PAKISTAN WATER SECTOR STRATEGY

Sub Sector	Water Resources	Urban Water Supply and Sanitation	Rural Water Supply and Sanitation	Industrial Water Supply and Pollution Control	Irrigation and Drainage	Hydropower	Environment	Flood Protection	
OBJECTIVES	Overall	To achieve the National Water Vision: By 2025, Pakistan should have adequate water available, through proper conservation and development. Water supplies should be of good quality, equitably distributed and meet the needs of all users through an efficient management, institutional and legal system that would ensure the sustainable utilization of the water resources and support economic and social development with due consideration to the environment, quality of life, economic value of resources, ability to pay and participation of all stakeholders.							
	Sectoral	<ol style="list-style-type: none"> 1. Provide sufficient water for all sub sectors based on Integrated Water Resources Management (IWRM) 2. Promote water conservation. 3. Ensure effective planning and decision making 4. Regulate groundwater abstraction where feasible 5. Improve water quality 6. Develop information base 7. Develop public awareness and understanding of the issues 	<ol style="list-style-type: none"> 1. Provide water supply to 96% of urban population 2. Provide functional sewerage to 80% of the urban population 3. Achieve financial sustainability in all urban water developments 4. Achieve full compliance with EPA standards for drinking water and wastewater disposal 5. Develop water quality information management system 	<ol style="list-style-type: none"> 1. Increase rural water supply coverage to 75% of the population 2. Increase coverage of rural sanitation to 50% 3. Improve drinking water quality to comply with EPA standards 4. Ensure services are financial self sustaining 5. Develop a comprehensive water quality monitoring and information system 6. Raise public awareness re: hygiene and sanitation 	<ol style="list-style-type: none"> 1. Ensure provision of sufficient water to industry to promote industrial and economic development 2. Ensure environmentally sound disposal of industrial waste water through regulation, in order to reduce pollution and improve water quality 	<ol style="list-style-type: none"> 1. Increase irrigation efficiency from 40% to 45% to conserve 4.7 MAF 2. Achieve equity in water distribution at all levels 3. Harness unused flood water and runoff from hill torrents 4. Increase irrigated agriculture over 2 million acres of culturable waste for agricultural production and poverty alleviation 5. Achieve sustainability including financial sustainability 6. Promote stakeholder participation, through PIDsAs, AWBs and FOs 7. Reduce waterlogging in 7 million acres 8. Provide a long term safe solution for saline drainage effluent 	<ol style="list-style-type: none"> 1. Develop the hydropower sub-sector in parallel with the overall power sector 2. Attract private investment 3. Develop the hydropower potential of any new multipurpose storage projects 4. Develop run-of-river hydro projects through private sector finance. 	<ol style="list-style-type: none"> 1. Improve the quality of surface and ground water to acceptable standards by 2025. 2. Rehabilitate coastal and other wetland areas through better management of freshwater flows to them. 3. Reduce soil erosion in the catchments of major storage reservoirs. 	<ol style="list-style-type: none"> 1. Place priority for flood protection on areas of major human habitation and economic importance 2. Prepare flood and drought management strategies, especially for major cities, towns and infrastructure 3. Promote the delineation of flood risk planning zones to be adopted by all agencies as part of the planning process
	Overall	<ul style="list-style-type: none"> • Ministry Water and Power to obtain formal adoption, initially from the Economic Coordinating Committee and, subsequently, the Cabinet for the Water Sector Strategy. • Establish an inter-ministerial, inter-provincial National Water Council with a supporting Apex Body established within the Ministry of Water and Power to oversee the planning, development and management of the water sector, beginning with the implementation of the Strategy. Determine capacity building needs and begin capacity building process. • Extend the charter of Ministry Water and Power to include all sub-sectors of the water sector • Undertake an Integrated Water Resources Master Plan, with emphasis on conservation, storage and environmental needs 							
STRATEGY	Sectoral								
	Short Term 2003 & 2004	<ul style="list-style-type: none"> • Promote and support water sector conservation • Commit to develop storage • Prepare water resources master plan • Undertake feasibility study on public awareness • Study and develop a water sector Management Information System (MIS) • Develop water quality monitoring programme 	<ul style="list-style-type: none"> • Develop coordinating and support body for the urban water sector • Develop long term plans for water and sanitation services • Restructure sub-sector financing, tariff mechanisms and regulation • Address maintenance backlog • Develop water resources to maintain continuity of supply to existing customers • Improve revenue recovery 	<ul style="list-style-type: none"> • Undertake project preparation • Establish Project Management Units (PMUs) in each Province • Train PMU staff and Community Based Organisation (CBO) personnel • Develop and execute public awareness campaigns. 	<ul style="list-style-type: none"> • Assess the need for financial incentives to industries to comply with EPA effluent disposal regulations • Determine legislative needs for regulation of industries and enforcement of standards and water abstraction licensing. • Undertake a feasibility study to develop a water quality monitoring programme • Develop an awareness campaign to promote the reduction of pollution • Prepare a national industrial pollution control plan 	<ul style="list-style-type: none"> • Commit to financial sustainability of the irrigation & drainage infrastructure and prepare a plan for this • Initiate actions to increase irrigation efficiency to 45% - to include addressing improved water management, farmer participation and cost recovery • Assess benefits of lining distributaries in saline areas and develop plan • Prepare plan to modernise barrages and the feasibility studies for priority works • Restructure NDP • Complete pre-feasibility study for spinal drain • Prepare plan to harness hill torrent flows • Prepare plan for expansion of agricultural area • Prepare/upgrade feasibility studies for small schemes • Complete regulations for groundwater abstraction 	<ul style="list-style-type: none"> • For large storage dams, the hydro strategy follows that for water resources and the national power plan • For smaller run of river schemes, develop a private investment enabling environment 	<ul style="list-style-type: none"> • Plan a comprehensive national water quality management programme • Develop a major campaign to raise public awareness of the environment • Support the studies to determine the volume of flows required downstream of Kotri • Assess the need for incentives to industries to comply with EPA effluent disposal regulations • Determine the needs for legislation for regulation of industrial development, enforcement of standards and water abstraction licensing 	<ul style="list-style-type: none"> • Restart the Second Flood Protection Sector Project, including non physical works and studies, which are important to a holistic approach to flood protection. • Following the Second Flood Sector Project, implement the proposed Third Flood Sector Project
	Medium Term 2005 – 2011	<ul style="list-style-type: none"> • Promote and support water conservation • Implement water resources master plan and begin implementation of storage development • Implement public awareness programme • Develop MIS • Implement Water Quality improvement programme 	<ul style="list-style-type: none"> • Develop water resources to meet projected new demand and consumption • Extend networks to increase service coverage • Achieve compliance with drinking water quality and effluent discharge standards • Possible reorientation of Coordinating and Support body to Regulating Body if private sector investment improves 	<ul style="list-style-type: none"> • Establish water quality testing laboratories • Assist communities to form CBOs • Undertake rehabilitation programme for existing schemes • Phase I development of new schemes 	<ul style="list-style-type: none"> • Enact new legislation for industrial effluent control • Develop and implement a water quality monitoring programme • Execute public awareness campaign • Execute National Industrial Pollution Control Plan, including, public private partnership approach to pollution control 	<ul style="list-style-type: none"> • Undertake training/capacity building to strengthen PIDsAs and AWBs • Implement pilot projects for development of stakeholder participation and then expand • Initiate pilot projects to evaluate modern irrigation technologies • Expand the on farm water management programme (OFWM) • Independently monitor and evaluate the OFWM programmes • Line distributaries in saline GW areas • Implement modernisation of barrages • Rehabilitate/improve existing irrigation systems • Prepare studies for modernisation of 2nd priority barrages • Complete revised NDP I • Prepare NDPs II and III and complete NDP II, inc. the spinal drain • Plan increased cropping intensity as new storage comes on line 		<ul style="list-style-type: none"> • Implement the national water quality monitoring programme • Execute the public awareness campaign on the environment • Support municipal and industrial waste water control measures • Improve urban and rural solid waste management to a coverage of 55% • Enact new legislation where required 	

Sub Sector		Water Resources	Urban Water Supply and Sanitation	Rural Water Supply and Sanitation	Industrial Water Supply and Pollution Control	Irrigation and Drainage	Hydropower	Environment	Flood Protection
	Long Term 2012 – 2025	<ul style="list-style-type: none"> Promote and support water conservation Implement storage projects Maintain effective public awareness programme Continue updating MIS Update and improve water quality improvement programme 	<ul style="list-style-type: none"> Continuation of development of water resources Continuation of extension of networks Continuation of programme to achieve compliance in drinking water and effluent quality standards 	<ul style="list-style-type: none"> Phase 2 development of new schemes 	<ul style="list-style-type: none"> Continue to improve monitoring programme Monitor and evaluate the National Industrial Pollution Control Plan 	<ul style="list-style-type: none"> Extend implementation of stakeholder participation to entire network Introduce new technologies with the participation of the farmers Expand OFWM programme to all watercourses Continue to monitor saved water Continue lining of distributaries in saline areas Continue rehab/improvement of the existing irrigation system Continue modernisation of second priority barrages Carry out NDP III including completion of the spinal drain Implement crop intensification programme 		<ul style="list-style-type: none"> Monitor, evaluate and improve the national water quality management programme Continue a reduced public awareness campaign Continue improvement of urban and rural solid waste management with coverage increasing to 90% 	
Cost US\$ Million	Total = 33,622	10,000	5,066	2,173	253	11,099	4,500	113	418
RESPONSIBLE ORGANISATIONS	Overall	Overall responsibility for the implementation of the Strategy will be with the National Water Council, supported by an Apex Body to be established and developed to necessary capacity within the Ministry of Water and Power.							
	Federal	National Water Council Ministry of Water and Power IRSA	Proposed Coordination and Support Body for urban water supply.	Planning Commission	Pakistan Environmental Protection Agency (EPA)	Proposed National Drainage Authority	Min of Water and Power Water Wing of WAPDA Private Power Investment Board	Pakistan Environmental Protection Agency	Federal Flood Commission
	Provincial	Planning and Development Departments	KWSB, WASAs, District Councils, Private Sector	Public Health Engineering Departments and District and Tehsil Councils	Provincial Environmental Protection Departments (Agencies)	PIDAs, AWBs and FOs	NWFP and AJK Private Power Cells Plus the Private Sector	Provincial Environmental Protection Departments (Agencies)	Provincial Irrigation Departments
PRIORITY		To be accorded special priority and funding	Top priority	Top priority	Licensing and pollution control measures to be given priority	Priority accorded to conservation, modernisation of existing infrastructure, small schemes for poverty reduction, intensification of cropping	Major schemes with major storage, small schemes through private finance	Equal priority to water supply and sanitation, particular emphasis on water quality and pollution control	Second priority, as a result of risk to life
SECTORAL CONSTRAINTS		<ol style="list-style-type: none"> Time Slow growth in Water Sector Development Project implementation difficulties Finances 	<ol style="list-style-type: none"> Lack of institutional arrangements Lack of consistent approach to funding and regulation Low tariffs and collection rates Non commercial approach to service delivery Poor climate to attract private sector 	<ol style="list-style-type: none"> Poor and deteriorating water quality at source and within systems Variable history of community involvement Uncertain impact of devolution plan 	<ol style="list-style-type: none"> Inadequate monitoring of industrial effluent Inability to enforce existing effluent quality regulations Inability of industries to finance on-site effluent treatment to comply with regulations. 	<ol style="list-style-type: none"> Poor project implementation Scarcity of water Lack of consensus and cooperation Poor information availability Overuse of water in some areas and lack of effort in conservation Design of the irrigation systems Inequitable distribution of water Low cost recovery and poor maintenance Weakness of institutions Lack of stakeholder participation 	<ol style="list-style-type: none"> Consensus and government policy Finances Poor private sector investment climate Legal and regulatory issues 	<ol style="list-style-type: none"> Low priority accorded to water quality Inadequate institutional capacity to implement effective pollution control Insufficient funding Governance problems Existing legislation is punitive rather than cooperative Planning is poor and tends to be over ambitious Poor stakeholder and private sector participation 	<ol style="list-style-type: none"> Stalling of the Second Flood Protection Sector Project Lack of support for a realistic and holistic approach to flood protection
OVERALL ISSUES		<p>Management: (1) Lack of financial sustainability, (2) Inadequate cost recovery, (3) Ineffective public sector management of water sector infrastructure and activities, (4) Limited stakeholder participation, (5) Poor public awareness, (6) Poor water information, (7) No private sector investment or participation, (8) inadequate cost recovery.</p> <p>Technical: (1) Increasing demand for water, (2) Deteriorating water quality, (3) Inadequate domestic water supply and sanitation, coverage and quality of service, (4) Deteriorating irrigation and drainage infrastructure, (5) Waterlogging and salinity on irrigated land and disposal of saline drainage effluent.</p>							

4 SUB-SECTORAL STRATEGIES

4.1 *Introduction*

The following Sections are specific to the agriculture sector and the seven sub-sectors of water. They provide a summary of the objectives, the main constraints and the proposed strategy for each sub-sector. More detailed discussions on the sub-sectoral strategies are provided in Volume 4, Detailed Strategy Formulation.

4.2 *The Strategy for the Agriculture Sector*

While this study is not specifically concerned with the agriculture sector, the sector is of great importance to the water sector as it is by far the largest consumer of water in Pakistan. A detailed strategy has not been developed, but the following points should form part of an agriculture sector strategy:

- (i) Improve cooperation and coordination with the irrigation sub-sector;
- (ii) In cooperation with the irrigation departments, work to improve water use efficiency;
- (iii) Increase crop yields through, agricultural extension and the following interventions;
- (iv) Increase funding to research in agriculture;
- (v) Improve farmer access to better seed varieties;
- (vi) Improve the agricultural policy environment, especially marketing and crop prices to improve the potential for export of higher value crops.

4.3 *Water Resources Development*

For the purpose of Strategy presentation, the proposals for the responsibility for overseeing the implementation of the Strategy as a whole are included within the Water Resources Development sub-sector, as this will be one of its primary directives.

4.3.1

Objectives

In this study the Water Resources Development sub-sector is defined as that which works to ensure that there is sufficient water of good quality available for all users. The objectives are to:

- (i) Provide sufficient water to meet the needs of all water sub-sectors based on the principles of Integrated Water Resources Management.
- (ii) Promote conservation in irrigation water use through increases in irrigation efficiency.
- (iii) Regulate groundwater abstraction where appropriate and feasible.
- (iv) Improve water quality, with links to environment, municipal, industrial and agricultural sub-sectors.
- (v) Develop an information base to affect good management of water resources.
- (vi) Develop public awareness and understanding of the issues in water resources.

4.3.2

Constraints

The main constraints to the achievement of the strategy for water resources development are:

- (i) Time: because of the rapid pace required in the progress of the water sector;
- (ii) Recent slow progress in water resources development;
- (iii) Financing the high cost of the overall Strategy;
- (iv) Need for an Apex Body to oversee and implement development.

4.3.3

Proposed Water Resources Development Strategy

The proposed Strategy for the water resources development sub-sector is:

- (i) Establish the National Water Council;
- (ii) Establish an Apex Body to oversee the implementation of the Water Sector Strategy;

- (iii) Implement an Integrated Water Resources Master Plan to determine conservation potential and environmental and storage needs;
- (iv) Carry out capacity building for the Apex Body;
- (v) Promote and oversee initiatives in water conservation and improvement of water quality.
- (vi) Develop sufficient additional storage to meet the water needs of the future.
- (vii) Implement a Public Awareness Programme on water resources and conservation issues.
- (viii) Develop a Management Information System (MIS) for water and related information.
- (ix) Develop and implement a comprehensive Water Quality Improvement Programme.

Water for the additional needs of the future will come from a combination of conservation and storage. Conservation will mainly come from the agriculture / irrigation sector through various interventions.

Additional storage is also needed and there is good potential for it, though it is capital intensive. A consensus must be achieved on additional storage before it can go ahead and, given the urgency of the need for storage, achieving consensus must be a priority. This will be a key objective of the proposed Integrated Water Resources Master Plan.

In considering additional storage and other aspects of water availability, consideration should be given to providing the infrastructure needed to supply the full accord provision to Balochistan and NWFP.

The proposed Strategy is shown in Table 4.1.

	Medium Term (to 2011)	Long Term (to 2025)
Institute the inter-ministerial, inter-provincial National Water Council (2003)		
Establish an Apex Body within MWP for to assess and plan water resources developments in the national interest. (2003-2004)	Carry out capacity building in the MWP Apex Body. (2003-2005)	
Promote and support water conservation efforts among the various water sub-sectors.	Promote and support water conservation efforts among the various water sub-sectors.	Promote and support water conservation efforts among the various water sub-sectors.
Prepare a Integrated Water Resources Master Plan to determine needs and potential for conservation, environment and an appropriate storage development programme. (2003-2004)	Complete feasibility studies for all potential storage sites and prioritise to plan storage development determined through the Storage Master Plan. (2004-2006)	Implement storage projects for the required level of storage. (2005-2025)
Carry out a feasibility study for a Public Awareness Programme on water resources issues. (2003)	Implement the Public Awareness Programme. (2004-2007)	Maintain a reduced but effective Public Awareness Programme. (2007-2025)
Carry out a feasibility study for a Management Information System (MIS) at the national level in cooperation with the provinces and federally administered areas. (2003)	Implement the Management Information System (MIS) at the national level in cooperation with the provinces and federally administered areas. (2004-2007)	Continue upgrading and updating the MIS. (2008-2025)
Develop a comprehensive Water Quality Improvement Programme. (2003)	Implement the Water Quality Improvement Programme. (2004-2006)	Maintain update and improve the comprehensive water quality improvement programme. (2007-2025)

Table 4.1 Water Resources Development Strategy Interventions

4.3.4

Cost Estimate

The full cost of the water resources strategy is difficult to estimate, primarily because much will depend on the choices made regarding additional storage. However, based on Table 6.3 of Volume 3, the total cost of constructing all of the structures identified in the table would be US\$ 14,338 million for creating storage of 22.5 MAF. This is approximately the total amount of storage estimated in this study. However, significant savings of the order of US\$ 4.5 billion could possibly be achieved through water conservation initiatives, which should be given the highest priority, if only on the basis of cost saving.

In addition, there are several studies and developments, for which costs are also estimated in Table 4.2.

Project	Cost (M US\$)
Capacity Building in the Apex Body	3.0
Integrated Water Resources Master Plan	2.0
Public Awareness Programme	3.0
Development of MIS	8.0
Water Quality Improvement Programme	2.0
Total without storage	18.0
Cost of 22.5 MAF of Storage	14,338
Total (including storage)	\$US 14,356
Total with 4.7 MAF of water saving achieved	US\$ 10,000

Table 4.2: Cost Estimates for the Water Resources Strategy

The cost of developing additional storage is beyond the available annual funds estimated for the water sector as a whole. If the decision is made to develop storage, this will have to be considered as a special initiative, with more than the usual funding being dedicated to the water sector.

4.4
4.4.1

Urban Water Supply and Sanitation

Objectives

The main objectives for the urban water supply and sanitation sub-sector are to:

- (i) Increase coverage to 96% of the urban population with clean water supply;
- (ii) Increase coverage to 80% of urban population connected to functional sewerage;
- (iii) Achieve financial sustainability in all urban water developments;
- (iv) Achieve full compliance with EPA standards for drinking water;
- (v) Achieve full compliance with EPA standards for wastewater disposal;
- (vi) Develop a water quality information management system for data storage and assessment.

The financial objective of sustainability is based on the principles of:

- (b) Appropriate levels of cost recovery to ensure that the responsible operating agencies are financially viable;
- (c) Appropriate charging systems to ensure that adequate services are provided to all users, including poor and disadvantaged communities, at an affordable cost;
- (d) Private sector participation in appropriate areas of the water sector;
- (e) Urban wastewater charges that comply with the principles of cost recovery and the polluter pays, especially for commercial and industrial users.

The water quality objectives are based on the principles of:

- (a) Establishing and maintaining water quality standards for potable water;
- (b) Ensuring that effluent from wastewater is treated before disposal;

- (c) The preservation of surface water and groundwater resources to ensure sustainability of supply;

4.4.2

Constraints

The primary constraints to the continued development of the urban water supply and sanitation sector are:

- (i) The inadequacy of institutional arrangements for formulating and evaluating strategic options or for monitoring the implementation of national policies for public water and sanitation services;
- (ii) The lack of a consistent approach to funding and regulation;
- (iii) Low tariffs for water and sanitation, varying collection rates and a lack of a sustainable policy for setting and collecting water charges;
- (iv) An inefficient and non-commercial approach to service delivery;
- (v) Limited private sector involvement in the sub-sector.

4.4.3

Strategy for the Urban Water Supply and Sanitation Sub-Sector

The implementation of the Strategy will require investment in a package of measures, which will include asset renewal and business improvement as well as development projects.

Management Measures:

- (i) Establish a Coordinating and Support Body on a country-wide basis for the urban water supply and sanitation sub-sector to support long term planning and cooperation between urban service providers and to support the smaller cities and towns.
- (ii) Develop a Strategic Medium and Long-term Plan for urban water supply and sanitation, including tariff levels, improved collection methods, demand management measures and participation by the private sector, as well as infrastructure improvement and expansion.

- (iii) Promote private sector participation starting with a study of how best this can be achieved, with the necessary regulatory, fiscal and other measures.
- (iv) Restructure urban water supply and sanitation financing arrangements, including tariff reform and the improvement of cost recovery.
- (v) Formulate appropriate institutional arrangements for water supply and sanitation services in the smaller cities (those without WASAs) and towns in the light of the Devolution Plan.

Technical Measures:

- (vi) Renew the existing operational assets to address the maintenance backlog, with specific reference to existing sewage treatment plants.
- (vii) Extend existing and develop new water supply and sanitation networks to increase service coverage to the stated objectives.
- (viii) Develop additional surface water and groundwater resources to meet the growth in consumption.
- (ix) Construct new sewage treatment works in line with EPA effluent disposal regulations.

4.4.4

Implementation Plan

Proposed target dates for the implementation of the priority and medium to long-term programmes are contained in Table 4.3 below.

	Medium Term (to 2011)	Long Term (to 2025)
Develop a Coordination and Support Body for the urban sub-sector (2003-2005)		
Strategic long-term planning for water and sanitation services (2003-2005) This can be carried out with development of the Coordination and Support Body under the same TA.	Development of water resources to meet projected new demand and increased consumption (a) Groundwater (2008 – as required by strategic plan) (b) Surface water (2008 – as required by strategic plan)	Continuation of development of water resources
Re-structuring of sub-sector financing, tariff mechanism and regulation (2003–2004)	Extension of networks to increase service coverage (2008 – as required by strategic plan)	Continuation of extension of networks
Renewal of existing operational assets to address maintenance backlog Networks (2003-2008) M & E plant (2003-2006) Other civil works (2003-2008)	Compliance with drinking water quality and effluent discharge standards (a) Drinking water quality (2003-2008) (b) EPA effluent discharges (2005 – as required by strategic plan)	Continuations of programme for compliance with drinking water and effluent quality standards
Development of water resources to improve continuity of supply to existing customers Groundwater (2003-2005) Surface water (2003-2008)		
Improvement of revenue recovery (2003-2006)		

Table 4.3 Urban Water Supply and Sanitation Strategy Interventions

4.4.5

Cost Estimate

Table 4.4 shows the estimated costs for associated studies and other supporting interventions, which will be necessary to achieve the objectives.

Type of Intervention	Cost (US\$ million)
Development of a Coordination and Support Body for urban water supply and sanitation	2.0
Assessment of Private Sector Involvement Study	0.5
Strategic long-term planning for water and sanitation services	1.0
Re-structuring of sub-sector financing, tariff mechanisms and regulation	1.0
Improvement of revenue recovery	1.0
Total	5.5

Table 4.4: Cost Summary for Supporting Interventions

The total cost estimate for developing urban water supply and sanitation up to 2025, in 2001 costs, is given in Table 4.5. Several scenarios were considered, but the figures presented below are for fulfilling the full objectives stated above, to be completed by 2025.

Concern has been raised over the large cost of the overall strategy as proposed. The costing has been carried out on the principle that the full objectives will be met. However, it is recognised that there may be insufficient funds to carry out the work. However, for urban water supply and sanitation, achieving a level of full cost recovery will mean that there will no longer be recurrent costs, which must be supported by government. Placing financial sustainability as a priority in this sub-sector will result, in the end, in a saving of government reserves.

Province / Location	Cost (US\$ million)
CDA, Islamabad	97.0
Balochistan	
Quetta	129.0
Medium/Small Towns	58.0
Balochistan Total	187.0
NWFP	
Peshawar	333.0
Medium/Small Towns	127.0
NWFP Total	460.0
Punjab	
Lahore	690.0
Faisalabad	330.0
Guiranjwala	96.0
Multan	165.0
Rawalpindi	177.0
Medium/Small Towns	603.0
Punjab Total	2061.0
Sindh	
Karachi	1907.0
Hyderabad	135.0
Medium/Small Towns	219.0
Sindh Total	2261.0
Pakistan Total	5066.0

Table 4.5: Cost Summary for Urban Water Supply and Sanitation

4.5

4.5.1

Rural Water Supply and Sanitation

Objectives

The main objectives for the rural water supply and sanitation sub-sector of the National Water Sector Strategy are to:

- (i) Increase coverage of rural water supply to 75% of the population;
- (ii) Increase coverage of rural sanitation 50%;

- (iii) Ensure that involvement of women in water supply and sanitation decision making;
- (iv) Improve drinking water quality to achieve full compliance with EPA standards for drinking water;
- (v) Ensure that rural water supply and sanitation services are financially sustainable;
- (vi) Develop a comprehensive water quality monitoring and information system;
- (vii) Raise public awareness of the need for satisfactory standards of hygiene and sanitation.

4.5.2

Constraints

The primary constraints to the continued development of the rural water supply and sanitation sub-sector are:

- (i) Poor and deteriorating water quality at source and within systems;
- (ii) Variable history of successful community involvement;
- (iii) Changing administration under the Devolution Plan, and uncertainty in technical ability during the transition, especially in the domestic water supply and sanitation sub-sectors;

4.5.3

Strategy for the Rural Water Supply and Sanitation Sub-Sector

Domestic water supply and sanitation, which includes both the rural and urban environments, should be a priority for this strategy period. Initially there will need to be continued government support, in light of the socio-economic conditions of the rural areas. The Strategy is to:

- (i) Commit to the adoption of the method developed by the Punjab Rural Water Supply and Sanitation Project, which places a high degree of emphasis on community involvement at all stages and the establishment, capacity building and support of CBOs.
- (ii) Develop and implement a training programme for the administration and management of rural water supply

- and sanitation schemes and systems, for the benefit of CBOs and scheme beneficiaries.
- (iii) Enhance the ability of CBOs to collect water tariffs, possibly through involving a member of the District Council.
 - (iv) All schemes will be combined piped water supply and sanitation to allow the coverage of sanitation to begin to catch up with water supply.
 - (v) The strategy will likely be implemented through a series of projects, which should be managed provincially. They should follow the method developed in the Punjab Rural Water Supply and Sanitation Project. Each province will require a PMU, as well as one to administer the programme for AJK, FATA, FANA and CDA areas.
 - (vi) A Project Preparation TA (Technical Assistance) should initiate the preparation of the projects to detail and cost each provincial project.
 - (vii) Implement Public Awareness Programmes to inform the public of the programme so that they know to apply for a scheme in their village. It should also include awareness raising on health and water quality issues. These should be integral components of all future rural water supply and sanitation projects.
 - (viii) Rehabilitate existing schemes where necessary as part of the overall project, including those which have not yet been connected to power.
 - (ix) Establish water quality testing laboratories at District level in each province and for federal areas.

4.5.4

Implementation Plan

There is significant variation between provinces in their current coverage of rural water supply and sanitation facilities, with a resulting difference in the specific interventions among the provinces. The additional work to be carried out during the Strategy period, in terms of percentage of coverage, is given in Table 4.6. A mid point objective of 2011 is also provided in the table as a target for the MTIP.

Province	Current Water Supply Coverage (2000)	Water Supply Objective (2011)	Sanitation Objective (2011)	Water Supply Objective (2025)	Sanitation Objective (2025)
Punjab	27%	40%	13%	75%	50%
Sindh	10%	40%	30%	75%	50%
NWFP	45%	65%	20%	75%	50%
Balochistan	55%	65%	10%	75%	50%
FATA	63%	75%	12%	75%	50%
FANA	16%	75%	50%	75%	50%
CDA	55%	100%	20%	100%	50%
AJK	32%	75%	43%	75%	50%

Table 4.6: Additional Coverage Required for Rural Water Supply and Sanitation (% of population served)

4.5.5

Supporting Programmes

The following supporting programmes are needed for achievement of the objectives:

- (i) Public Awareness Raising;
- (ii) Establishment of Water Quality Laboratories;
- (iii) Training of PMU Staff and CBOs.

Proposed target dates for the implementation of the priority and medium to long term programmes are contained in Table 4.7 below.

	Medium Term (to 2011)	Long Term (to 2025)
Project Preparation TA (2002-2003)		
Establish PMUs in each province (2003)		
Training of PMU staff and CBO personnel (2003)		
Develop and execute public awareness campaigns in each province to inform communities about the programme and their options and responsibilities within it (2003-2004)		
	Establish water quality testing laboratories (2003-2008)	
	Assist communities to form CBOs (2003-2011)	
	Carry out rehabilitation programme for existing schemes (2003-2011)	
	Phase I of development of new schemes (2003-2011)	Phase II of development of new schemes (2012-2025)

Table 4.7 Rural Water Supply and Sanitation Strategy Interventions

4.5.6

Cost Estimate

The cost estimate for the rural water supply and sanitation sub-sector is given in Table 4.8.

Concern has been raised among the stakeholders of this study that there will be insufficient funding available to achieve the whole of the objectives of the strategy. This is a valid concern.

The total cost for rural water supply and sanitation is estimated at US\$ 2,173 million. While this is a significant amount of money, domestic water supplies have been given a high priority in this Strategy. There is no reasonable option to not achieving the objectives, so if there are funding constraints, extending the end date is the only alternative.

For rural water supply and sanitation, implementation an effective programme based on community participation will result in community operation of the systems once constructed. This will potentially result in a cost reduction to the government in recurrent expenses in the long run.

Province / Area	Total Population Served (million)		New Scheme Cost (million US\$)		Rehabilitation Cost (million US\$)		Total Cost (million US\$)	
	2011	2025	2011	2025	2011	2025	2011	2025
Punjab	9.07	30.34	378	1264	75	75	439	1339
NWFP	4.60	7.18	123	191	24	24	147	215
Sindh	5.39	12.84	216	514	9	9	225	523
Balochistan	0.74	1.44	22	43	14	14	36	57
FATA	0.49	0.87	5	10	0.42	0.42	5.4	10.4
FANA	0.50	0.50	5	5	0.10	0.10	5.1	5.1
CDA	0.16	0.16	0.5	0.5	0.00	0.00	0.5	0.5
AJK	1.00	1.00	6.7	6.7	1.1	1.1	7.8	7.8
Total	21.95	54.33	756	2034	124	124	880	2157

Table 4.8: Cost Estimate for the Rural Water Supply and Sanitation Strategy

Plus Supporting Programmes:

Project Preparation TA – US\$ 1 million

Public Awareness Programmes - US\$ 2 million

Establishment of Water Quality Laboratories - US\$ 10 million

Training of PMU Staff and CBOs - US\$ 3 million

Total Estimated Cost - US\$ 2173 million

4.6

4.6.1

Industrial Water Supply and Pollution Control

Objectives

The following have been adopted as objectives for the industrial water supply sub-sector:

- (i) To ensure provision of sufficient water to industry to promote industrial and economic development.
- (ii) To ensure environmentally sound disposal of all industrial wastewater through regulation, in order to reduce pollution and improve water quality.

4.6.2

Constraints

The main constraints concern industrial pollution control rather than water supply. Public sector capability in monitoring industrial effluent discharges and enforcing the existing pollution control regulations is very limited, there is as yet insufficient public interest in curbing pollution, and many industries would at present be unable to afford the capital outlay for on-site wastewater treatment. The constraints to achieving the objectives of the Strategy are:

- (i) Inadequate monitoring of industrial effluent and surface and groundwater quality
- (ii) Inability to enforce existing effluent quality regulations
- (iii) Inability of industries to finance on-site effluent treatment to comply with regulations

4.6.3

Proposed Sub-Sector Strategy

The main components of the proposed strategy for industrial pollution control can be summarised as follows:

- (i) enhance enforcement of the existing pollution control regulations and standards, through institutional strengthening and other measures.
- (ii) develop a nation-wide awareness raising campaign to increase interest in and support for the reduction of industrial pollution, as part of a campaign to raise overall environmental awareness.

- (iii) prepare a National Industrial Pollution Control Plan.
- (iv) introduce a system of monitoring wastewater disposal and quality. This would need to cover municipal as well as industrial wastewater.
- (v) introduce the principle that “The Polluter Pays”, with measures such as pollution charges based on the content and strength of pollution discharges.
- (vi) consider the provision of fiscal measures (e.g. tax breaks, low-cost loans and other financial incentives) to encourage industries to install pollution control. Finance could be provided through a special Environment Fund to be set up by GOP for this purpose.
- (vii) provide technical assistance (by EPA) to industries to help them identify opportunities for modifying production processes to reduce pollution.

4.6.4

Cost Estimate

No cost breakdown has been included in the Strategy for industrial water supply because industries will generally make their own arrangements for water supply and will meet the costs themselves. With respect to industrial pollution control, an order of magnitude cost of US\$ 250 million over the Strategy period has been allowed as the cost to Government. There would be a considerably larger cost to industry, since it would finance the major part of the pollution control investment itself.

A sum of US\$ 3 million has also been allowed for the studies for the preparation of the proposed National Pollution Control Action Plan.

The proposed programme for the implementation of the industrial pollution control strategy is included in the overall Environmental Strategy programme since it is an integral part of it. Table 4.9 indicates the industrial component.

	Medium Term (to 2011)	Long Term (to 2025)
Assess the need for financial incentives to industries to comply with EPA effluent disposal regulations		
Determine legislative needs for: regulation of industrial development, enforcement of standards, water abstraction licensing	Enactment of new legislation for industrial effluent control, where necessary	
Undertake a feasibility study to develop a comprehensive water quality monitoring programme in cooperation with EPA and WASAs	Develop water quality monitoring programme in cooperation with EPA and WASAs	
	Implement the water quality monitoring programme	Continue and improve monitoring programme
Develop a nation-wide awareness raising campaign to increase interest in and support for the reduction of industrial pollution	Execute public awareness campaign	
Prepare a National Industrial Pollution Control Plan	Execute the National Industrial Pollution Control Plan	Monitor and evaluate the National Industrial Pollution Control Plan
	As part of the Plan, develop a private-public partnership approach to pollution control	

Table 4.9 Industrial Water Supply Strategy Interventions

4.7
4.7.1

Irrigation and Drainage

Objectives

In view of the future irrigation requirements and the issues related to the agricultural drainage, the following objectives for development of irrigation and drainage for agriculture emerge as:

Basic Objectives

- (i) Increase irrigation efficiency from 40% to 45% to conserve 4.7 MAF of water through watercourse improvement and improved field application;
- (ii) Achieve a system of equitable distribution of water in all systems;
- (iii) Harness unused flood water and runoff from hill torrents;
- (iv) Increase irrigated agriculture over total area of 2 million acres of culturable waste land in the country for both national agricultural needs and local poverty alleviation;

Objectives Specific to Groundwater

- (v) Continue disinvestments (privatisation) of the tubewells in fresh groundwater areas to reduce government expenditure on, primarily, electricity costs;
- (vi) Complete the ongoing process of formulation of regulations relating to groundwater abstraction by private tubewells.

Financial Objectives

- (vii) Ensure sustainability of irrigation and drainage infrastructure;
- (viii) Ensure financial sustainability of irrigation and drainage infrastructure by promoting stakeholder participation in irrigation management and improving management capabilities of the PIDAs; AWBs and FOs.

Drainage Objectives

- (ix) Reduce waterlogging in 7 million acres of waterlogged irrigated land; and
- (x) Provide a long term, environmentally safe solution to disposal of saline drainage.

4.7.2

Constraints

The primary constraints to the achievement of the proposed strategy for the irrigation and drainage sub-sector are:

- (i) Slow project implementation;
- (ii) Scarcity of water;
- (iii) Inadequate information availability;
- (iv) Overuse of water in certain areas and insufficient efforts in conservation;
- (v) Design of irrigation systems which will inhibit achieving a demand-based distribution regime;
- (vi) Inequitable distribution of water within the irrigation systems;
- (vii) Low cost recovery and insufficient maintenance of infrastructure;
- (viii) Management problems within the irrigation systems;
- (ix) Inadequate stakeholder participation.

4.7.3

Proposed Strategy for the I&D Sub-Sector

The Strategy for the irrigation and drainage sub-sector is as follows:

- (i) Commit to financial sustainability of irrigation and drainage systems.
- (ii) In close collaboration with the Departments of Agriculture, implement a programme of improving irrigation efficiency from the current 40% to 45%.
- (iii) Improve equity in irrigation distribution through participation of farmers and strong government commitment.

- (iv) Modernize, rehabilitate and improve old barrages deteriorated irrigation systems.
- (v) Improve drainage on approximately 7 MA of waterlogged land.
- (vi) Increase cropped area, mainly through intensifying cropping over the existing area, with minimal expansion to new irrigation areas.
- (vii) Develop new irrigation areas totalling approximately 2 million acres.

The proposed Strategy for the irrigation and drainage sub-sector is given in Table 4.10.

Immediate and Short Term	Medium Term (to 2011)	Long Term (to 2025)
<p>Make a strong commitment to financial sustainability of irrigation and drainage infrastructure at the highest levels. (2002)</p> <p>Prepare a plan for undertaking interventions for financial sustainability of the existing and proposed irrigation infrastructure. (2002-2003)</p> <p>Begin a programme of improving equity in water distribution</p>	<p>Undertake Training and capacity building to strengthen PIDAs and AWBs. (2003-2008)</p> <p>Implement pilot projects in all provinces for development of stakeholder participation in management of distributary and minor canals and paying and collecting water charges to support the upper systems. Monitor results of the pilot projects. (2003-2005)</p> <p>Implement stakeholder participation in distributary and minor canals based on the results of the pilot projects. (2004-2011)</p>	<p>Continue implementation of stakeholder participation for distributary and minor canals over the entire irrigation and drainage infrastructure. (2011-2025)</p>
<p>Initiate specific interventions aimed at increasing irrigation efficiency to 45% in order to conserve 4.7 MAF (5.8 BCM) of water. (2002-2003)</p>	<p>Initiate Pilot Projects to evaluate use of modern irrigation technologies in all provinces for the garden areas. (2003-2005)</p> <p>Initiate on-farm interventions such as, lining of watercourses, precise land levelling etc. in cooperation with the agriculture sector. (2004-2011)</p> <p>Create independent M&E groups in the provinces to monitor the saving of water arising from on-farm intervention and refine the technical details of the intervention for better and sustainable results. (2003-2004)</p>	<p>With participation of the farmers carry out projects involving new technologies in provinces based on the results of the pilot projects. (2004-2010)</p> <p>Continue carrying out elements of on-farm intervention such as, lining of watercourses, precise land levelling etc and complete this activity in all provinces by 2025.</p> <p>Continue to monitor the saving of water. (to 2025 or open-ended)</p>

Immediate and Short Term	Medium Term (to 2011)	Long Term (to 2025)
Carry out assessments of distributary lining in saline areas to ensure their value and prioritise actions. (2002-2003)	Begin activities for lining of distributary canals only in saline areas. (2003-2011)	Continue lining of distributary canals in saline areas. (2012-2025)
Determine the rehabilitation needs for physical sustainability of the irrigation infrastructure and prepare a plan for rehabilitation and achieving financial sustainability for the future. (2003-2005) Prepare a plan to modernize old barrages on a priority basis (most needed works first). Prepare the feasibility studies for modernization of the prioritised barrages. (2003-2004)	Implement the modernization of the prioritised barrages for which feasibility studies are completed. (2003-2011) Rehabilitate/improve the existing irrigation systems for which feasibility studies have been prepared. (2005-2011) Prepare feasibility studies for modernization of the second priority barrages. (2005-2008)	Continue rehabilitation/improvement of the existing irrigation systems. (2011-2025) Continue modernization for second priority barrages. (2009-20015)
Restructure the National Drainage Programme (NDP) with more provincial focus to meet the objectives of improved drainage on 7 MA of waterlogged land. (2002) Complete the pre-feasibility study for construction of a Spinal Drain to carry saline effluent for environmentally safe disposal to the sea. (2002 – 2003)	Complete the revised NDP I. (2003-2006) Prepare NDP II and III and make use of lessons learnt during implementation of NDP I. Carry out the feasibility study for construction of a Spinal Drain to carry saline effluent for environmentally safe disposal to the sea. (2003 – 2005) Complete implementation of NDP II, which can include construction of a part of the Spinal Drain. (2007-2011)	Carry out NDP III and complete construction of the remaining part of the Spinal Drain. (2012-2025)
	Prepare a plan to intensify cropping as new storage comes on line (2005)	Implement crop intensification programme (2007-2025)

	Medium Term (to 2011)	Long Term (to 2025)
Prepare a plan to carry out feasibility studies to implement harnessing of hill torrents and unused floodwater in Balochistan. (2002-2003)	<p>Carry out construction of delay action dams, gabion dams and small storages where feasibility studies indicate positive results. (2003-2011)</p> <p>Carry out the feasibility studies for other sites to harness hill torrents and implement projects found feasible.</p> <p>Carry out studies to identify ways to utilize unused floodwater in Balochistan.</p>	<p>Continue implementation of feasible projects for delay action dams, gabion dams and small storages. (2011-2025)</p> <p>Carry out implementation of feasible projects to utilize unused floodwater in Balochistan.</p>
<p>Prepare a plan to carry out implementation of projects involving the expansion of irrigated agriculture. (2003-2004)</p> <p>Prepare/upgrade feasibility studies for the small irrigation schemes in NWFP, Balochistan, NA and FATA. (2002-2003)</p>	<p>Implement prioritised projects in the Indus Basin for expansion of irrigated agriculture. (after commitment to create additional storage). (2004-2011)</p> <p>Carry out small irrigation schemes in Balochistan and NWF for which feasibility studies have indicated positive results. (2003-2011)</p>	<p>Continue implementation of projects in the Indus Basin involving the expansion of irrigated agriculture.</p> <p>Continue carrying out small irrigation schemes in Balochistan, NWFP, NA and FATA for which feasibility studies have indicated positive results. (2011-2025)</p>
Complete the on-going process of formulation of regulations relating to groundwater pumping by private tubewells and take measures to enforce them and monitor the aquifers on regular basis. (2002-2003)	<p>Continue disinvestments (privatisation) of the tubewells in fresh groundwater. (2002-2011)</p> <p>Enforce the regulations relating to groundwater pumping by private tubewells. Monitor and document the aquifers on regular basis. (2002-2011)</p>	Monitor and document the aquifers on regular basis. (2012-2025, or open-ended)

Table 4.10: Irrigation Strategy Interventions

4.7.4

Cost Estimate

The total cost to achieve the objectives of the irrigation and drainage sub-sector is summarised in Table 4.11.

Intervention	Province (\$US Million)				Total
	Punjab	Sindh	NWFP	Balochistan	
Studies	71	54	14	12	151
Drainage	364	615	100	66	1,145
Conservation of Water	742	643	183	92	1,660
New Irrigation	1,543	1,218	842	993	4,596
Small Storages/Harnessing of Hill Torrents	238	131	531	437	1,337
Rehabilitation/Modernization/Sustainability	1,323	707	150	30	2,210
Total	4,281	3,368	1820	1630	11,099

Table 4.11: Cost Summary for the I&D Subsector

The total cost of the strategy for the irrigation and drainage sub-sector is high and some prioritisation must be made where funding is limited. Within the irrigation and drainage subsector the proposed priorities should be as follows:

- (i) develop new irrigation areas totalling approximately 2 million acres targeted at poverty alleviation;
- (ii) modernizing, rehabilitating and improving old barrages deteriorated irrigation systems.
- (iii) improving irrigation efficiency;
- (iv) improve drainage on 7 MA of waterlogged land;
- (v) intensifying cropping over the existing area;
- (vi) Develop larger irrigation schemes.

4.8

Hydropower

4.8.1

Objectives

The main objectives of the hydropower sub-sector are to:

- (i) develop the hydropower sub-sector in parallel with an overall power sector strategy;

- (ii) attract private sector investment through creating a favourable climate for private investment;
- (iii) develop the hydropower potential of any new multipurpose storage projects (proposed under the water resources sub-sector) (potential > 6000 MW);
- (iv) develop run-of-river hydro projects through private sector financing (potential – 2750 MW).

Objectives for the hydropower sector are not dependent on the water sector alone but must be part of the objectives of the power sector.

It is proposed in this Strategy that large storage be developed for the primary purpose of ensuring water supplies for the future. Developing the hydro potential associated with it would be an attractive option for the power sector. The cost and contribution to the installed capacity of these is shown in Table 4.12.

Project	Cost (MUS\$)	Installed Capacity (MW)
Kalabagh 1 st Phase only	5,000	3,000
Basha	6,000	3,360
Raising Mangla	883	180
Total	11,883	6,540
Say	12,000	6,500

Table 4.12: Cost and Capacity of Major Storage Projects

These projects are likely not suitable for private sector financing and are likely to require international financial assistance to develop.

There are several run-of-river schemes, which have been proposed and these should be considered for priority development, with emphasis on attracting investment from the private sector. These could contribute an additional 2,400 MW of capacity and a development cost of around US\$ 3,425 million. The potential run-of-river schemes are shown in Table 4.13 below.

4.8.2

Constraints

The primary constraints to developing the hydropower sub-sector are:

- (i) The need for formulation of a policy attractive to private investors;
- (ii) The length of time required to develop large storage associated with hydropower;
- (iii) The longer development time for run-of-river hydropower, as compared with thermal power plants, making the thermal sub-sector more attractive to private investors;
- (iv) High cost of development;
- (v) Inadequate private sector investment;

4.8.3

Proposed Hydropower Development Strategy

The proposed strategy is as follows:

Institutional Interventions

- (i) Strengthen the National Electric Power Regulatory Authority (NEPRA);
- (ii) Reorganise the Private Power & Infrastructure Board (PPIB);
- (iii) Develop an investor friendly Hydro Policy;
- (iv) Develop model agreements.

Development of Hydropower Schemes

The development of hydropower schemes needs to be considered in two parts, the major storage schemes and the smaller run of river schemes. These are both discussed and costed above. The potential hydropower projects, both those associated with large storage and run-of-river, are shown on Figure 4.1.

Name	Installed Capacity (MW)	Cost (million US\$)	Studies Completed	Status
Allai Khwar	121	110	Lahmeyer Feasibility Study late 1990s. Generation cost estimated at Us Cents 2.44/kwh, peaking project. EIRR estimated at 30.79%	Abu Dhabi fund have agreed US\$ 60 m. Gov have called for bids from Contractors.
Dubair Khwar	130	109	Feasibility Study by SHYDO/GTZ completed in 1998. EIRR 34.7%, 4 year implementation period, Dam height 30m, tunnel 5.2km. Generation costs 2.17 cents	Abu Dhabi fund have agreed US\$ 55 m. Gov have called for bids from contractors.
Khan Khwar	72	86	Feasibility study by SHYDO/GTZ 1997. Cost is from this study and is not updated. Generation cost estimated to be US cents 2.28/kwh	Abu Dhabi fund have agreed US\$ 40 m. Gov have called for bids from contractors.
Matiltan	84	133	Halcrow/Norconsult/ACE feasibility study 1996, cost is taken from this.	Synergics hold license for a BOT for this, reported that this is on hold at present but they expect to pursue when the climate is right. Also tariff requested is not acceptable to WAPDA. Logistics difficult, main road needs improvement.
Kohala	740	1381	PCII for feasibility study, design and tender documents is currently under review	Synergics hold license for a BOT for this. But Gov appears now to be taking a different route.
Renolia	11.5	11.2	SHYDO/ITECO, 1994.	License held by ITECO, has expired but ITECO have a stay order from the courts regarding any development.
Malakand 3	75	80	Studied by Binnie as part of the Upper Swat Canal study – Cost estimated at 2.18 cents/KWh	NWFP Government have arranged finance and asked for EOs for contractors to undertake this on an EPC basis. Probably the most financially, environmentally and economically attractive project.

Name	Installed Capacity (MW)	Cost (million US\$)	Studies Completed	Status
Neelum Jhellum	969	1335	HEPO/Norconsult, 1996, very good and comprehensive study. Requires two 32 km long tunnels – high risk. Long construction period – 8 years.	WAPDA have called for tenders on a finance and construct basis
Golen Gol	106	104	HEPO/GTZ, 1997. Generation cost estimated at US cents 2.04 /Kwh, EIRR at 28.44%	Approved by ECNIC and due to be financed by the Chinese but Gov still waiting for draft proposal from the Chinese on this. Logistics very difficult, road closed for 6 months of the year. Located in National Park, which may be a problem.
Bunji	1500	2689	Reconnaissance	Approved by CDWP 1/3/01, WAPDA now appointing consultants for feasibility studies.
Doyian	425	346	Feasibility Study in Progress	Feasibility study for WAPDA in progress
Satpara	13	34	Design completed	WAPDA to request EOIs from contractors for construction soon.
Dasu	2712	3107	Reconnaissance	PCII for feasibility studies, detailed design and tender documents prepared and submitted for approval.
Pehur High Level	10	8	Feasibility study by ACE/Halcrow completed.	Small scheme on outlet to Tarbella for the Pehur High Level Canal.

Table 4.13: Selected Run-of-River Hydropower Schemes



HYDROPOWER PROJECTS
FIGURE 4.1

4.9

4.9.1

Environment

Objectives

The overall water-related environmental goal is to help mitigate and reverse the current environmental degradation process resulting from the deterioration of water quality and overuse of water in some areas. To achieve this goal, the main objectives of the Environmental Strategy are to:

- (i) Improve the quality of surface water and groundwater to acceptable standards by 2025;
- (ii) Rehabilitate coastal and other wetland areas through better management of freshwater flows to them;
- (iii) Reduce soil erosion in the catchments (watersheds) of major storage reservoirs.

4.9.2

Constraints

The following major constraints have been identified as hindering environmental management activities in Pakistan.

- (i) Historically, lower priority had been accorded in Pakistan to water quality than water quantity;
- (ii) Inadequate institutional capacity to implement effective pollution control;
- (iii) Linked with this, insufficient funding to finance pollution control;
- (iv) The existing environmental legislation (1997 Act, 1994 NEQS) is punitive rather than cooperative in nature.
- (v) Planning is inadequate and tends to be over-ambitious
- (vi) Low levels of stakeholder and private sector participation in water and environmental activity.

4.9.3

Proposed Strategy for Environmental Improvement

The proposed strategy consists of a combination of management and institutional measures and technical measures, as follows:

Management/Institutional Measures

- (i) Plan and implement a comprehensive National Water Quality Monitoring Programme (also a technical measure).
- (ii) Develop and execute a major campaign to raise public awareness of the environment and its problems and to stimulate public interest and participation in environmental management.
- (iii) Develop the pollution control approach described in Section 12.4.2 (Volume 3), which emphasises the municipal and industrial sub-sectors and solid waste disposal.
- (iv) Support and participate in the implementation of the water-related components of the National Environmental Action Plan.
- (v) Strengthen and increase the funding to the EPA and EPDs, to enable them to implement and coordinate the overall programme.

Technical Measures

- (vi) Support the municipal and industrial wastewater control measures to be implemented under the Water Supply and Sanitation and Industrial Water Supply and Pollution Control Strategies. These would include: rehabilitation and operationalisation of the existing treatment plants for industrial and municipal effluents (covered under the urban water supply and sanitation programme); and establishment of new industrial and municipal effluent treatment plants in prioritised areas of the country.

- (vii) Improve urban and rural solid waste management, with the existing coverage of 25% being increased to 55% by 2010/11 and 90% by 2025.
- (viii) Support the study (undertaken by the proposed Water Sector Apex Body) to determine the volume of Indus flows required downstream of Kotri to ensure the long-term health of the mangrove forests of the Indus Delta and to check saline intrusion. This would be followed by the necessary modifications to Indus water management.
- (ix) Implement Phase III of the Tarbela-Mangla Watershed Management Project.
- (x) Support the detailed study, described in Section 9.4 (Volume 3), for the preparation of a National Industrial Pollution Control Plan, covering likely future pollution control requirements as well as the clean up of existing industries.
- (xi) Prepare and implement an Integrated Water and Environmental Management Plan for Lahore City and the Ravi River.
- (xii) Carry out studies on reducing agro-chemical pollution and on waste minimisation in industry.

An Implementation Plan for the Environment sub-sector is given in Table 4.14.

Immediate and Short Term	Medium Term (to 2011)	Long Term (to 2025)
Plan a comprehensive National Water Quality Monitoring Programme (2003-2004)	Implement the National Water Quality Monitoring Programme (2005-2010)	Monitor, evaluate and improve the National Water Quality Monitoring Programme (2010-2025)
Develop major campaign to raise public awareness of the environment (2003-2004)	Execute the Public Awareness campaign for the environment (2004 – 2007)	Continue a reduced Public Awareness campaign (2008 - 2025)
	Support the municipal and industrial wastewater control measures (2003 – 2010)	
	Improve urban and rural solid waste management, with coverage increasing to 55% (2004 – 2010)	Continue improvement of urban and rural solid waste management, with coverage increasing 90% by 2025.
Support the study to determine the environmental flow requirements of the rivers including Ravi, Sutlej and the Indus, especially downstream of Kotri (2003 - 2004)		
Assess the need for soft loans and other financial incentives to industries to comply with EPA effluent disposal regulations (2003)		
Determine legislative needs for: regulation of industrial development, enforcement of standards, water abstraction licensing	Enactment of new legislation, where necessary	
Implement Phase III of the Tarbela-Mangla Watershed Management Project. (2003)		
Support the study for the preparation of a National Industrial Pollution Control Plan (2003)		

Table 4.14 Environmental Strategy Interventions

4.9.4

Cost Estimate

A broad estimate of the likely costs of the proposed strategy is shown in Table 4.15. They do not include the costs of the proposed urban and rural sanitation measures, the National Industrial Pollution Control Action Plan (US\$ 3 million), which is covered under the Industrial Water Supply and Pollution Control Strategy, the provision of financial incentives and concessionary funding for industries to install effluent treatment (US\$ 250 million up to 2025), and the setting up of a water quality improvement programme, including monitoring, which comes under Water Resource Development.

Activity	Cost (US\$ million)
Strengthening of the EPAs (capital costs)	5.0
Public Environmental Awareness Raising Programme	3.0
Urban Solid Waste Management Improvement	25.0
Tarbela-Mangla Watershed Management Programme III	25.0
Lahore City and Ravi River Integrated Water and Environmental Management Plan	50.0
Studies into Indus flow requirements downstream of Kotri, reducing agro-chemical pollution, industrial waste minimisation etc	5.0
Total	113.0

Table 4.15: Cost Estimate for the Environment Strategy

4.10

4.10.1

Flood Protection

Objectives

The objectives for flood protection, as based on the Draft National Water Policy are to:

- (i) Place priority for flood protection on areas of major human habitation and economic importance;
- (ii) Prepare flood and drought management strategies, especially for major cities, key secondary cities and towns and major infrastructure;

- (iii) Promote the delineation of Flood Risk Planning and Regulatory Zones to be adopted by all agencies as part of the planning process.

Essentially, most of the above objectives would be covered by the Flood Protection Sector Project II and possibly FPSP-III & IV covering most of the period of this Strategy. Hence, the priority objective should be to restart FPSP-II and continue with the two follow on projects.

4.10.2

Constraints

The current drought and associated low flood risk may have caused complacency on flooding issues and has contributed to the slow implementation of the Flood Protection Sector Project-II, which contains most of the works and supporting activities needed for the sub-sector for the foreseeable future. Restructuring and bringing this project back on track is the key need in the flood protection sub-sector.

4.10.3

Proposed Sub-Sectoral Strategy

Restart the Flood Protection Sector Project-II, including non-physical works and studies, which are important to a holistic approach to flood protection. FPSP-II should be put back on track and finished. An FPSP-III has been considered by the provinces and it has been included as part of the MTIP.

4.11

Cost Estimate

The cost estimate for flood protection includes the remainder of FPSP-II, plus FPSP-III and FPSP-IV, as shown in Table 4.16.

Project	Status	Cost (MUS\$)
FPSP – II	ongoing	93
FPSP – II	planned	158
FPSP – IV	planned	167
Total		MUS\$ 418

Table 4.16: Cost Estimate for the Flood Protection Sub-Sector

5 STRATEGY IMPLEMENTATION

5.1 **Cost Summary**

An indicative estimate of the investment costs of the proposed Water Sector Strategy, by sub-sector, is shown in Table 5.1.

Sub-Sector	Cost (\$US million)
Water Resources Development	10,000
Urban Water Supply and Sanitation	5,066
Rural Water Supply and Sanitation	2,173
Industrial Water Supply and Pollution Control	253
Irrigation and Drainage	11,099
Hydropower	4,500
Environment	113
Flood Protection	418
Total	33,622

Table 5.1: Full Cost Summary for the Proposed Water Sector Strategy

Table 5.1 excludes private sector costs and public sector recurrent expenditures, and include only public sector investment in capital costs and related studies and supporting measures necessary to achieve the objectives of the Strategy. The total cost for meeting the full objectives of water sub-sectors as described in the above Sections is estimated at US\$ 34 billion.

5.2 **Prioritising the Strategy**

It goes without saying that the total cost of the Strategy, at almost US\$ 34 billion over the next 23 years is very high and likely impossible given the availability of finances in Pakistan. Some prioritisation is necessary.

Prior to a prioritisation by sub-sector, the first priority in the Strategy would be to what are referred to as the 'supporting measures'. These

provide the institutional and financial foundation on which the remainder of the Strategy is based and ensure that investments made will be effectively implemented and sustainable. They will also work to reduce government expenditure on supporting recurrent costs, thus freeing money which could be better invested in water sector development.

Table 5.2 shows the costs of the Supporting Measures. The costs of the Supporting Measures are also insignificant related to the capital investment involved, at US\$ 556.5.

Sub-Sector	Cost (\$US million)
Water Resources Development	18.0
Urban Water Supply and Sanitation	5.5
Rural Water Supply and Sanitation	16.0
Industrial Water Supply and Pollution Control	253.0
Irrigation and Drainage	151.0
Hydropower	0.0
Environment	113
Flood Protection ^{*1}	0.0
Total	556.5

Table 5.2: Cost Summary of the ‘Supporting Measures’

*Note: *1 – Supporting Measures not separated from overall programme costs.*

In both the Draft National Water Policy and the Ten Year Perspective Plan, domestic water supply and the environment (water quality, specifically) are given priority in water sector development, and this is repeated in the Strategy.

The proposed priorities for this Strategy are presented approximately, but not entirely in their prioritised order. One exception is irrigation and drainage, which has been prioritised according to individual interventions. The higher priorities of these could be implemented concurrently with the higher priority sub-sectors. The other is

hydropower. The government cost component of this is tied in with storage decisions. When and where storage is developed, hydropower should be a component.

Domestic Water Supply and Sanitation and Environment

The proposed priorities for this Strategy maintain domestic water supply and sanitation as top priority. Environment, as defined in the Strategy in its relation to water, would also be an equal priority, because of the emphasis placed on water quality in our stakeholder consultations, and also because of its relationship to the domestic water supply and sanitation sub-sectors. The pollution programme for the industrial sector also comes under this, though it is a relatively low cost to the government, with most of the cost borne by the private sector.

Flood Protection

Flood protection is accorded a second priority because of the risk to life and the significant costs of flooding and its impact on the poor, mainly farmers.

Irrigation and Drainage

Irrigation, Drainage, and Water Resources are closely related in that some aspects of irrigation depend on the development of additional storage.

Within the irrigation sub-sector the priorities are as follows:

(a) Small Schemes and Development of Hill Torrents

These schemes are mainly developed for poverty reduction purposes and should go ahead, certainly before any of the proposed larger scheme developments.

(b) Conservation

The conservation initiative is of the utmost importance as it will save some 4.7 MAF of water for an estimated cost of US\$ 1,660 Million. This is compared to the cost of developing an equivalent volume of additional storage of nearer US\$ 4,500 Million.

(c) Modernisation and Improvement of Existing Infrastructure

Much of the infrastructure and many of the older barrages are in a deteriorated state and in need of improvement. It makes little sense to construct new schemes when existing ones are in poor condition and some at risk of failure.

(d) Intensification of Cropping

Intensification is related to developing additional storage as most of the additional cropping will be in rabi season for which storage is required. Once a Master Plan is developed for storage, the site specific areas for intensification can be determined.

(e) Development of New Irrigation Areas

This should be the lowest priority except where specific poverty reduction is identified.

Water Resources Development

Despite the major cost implications, Pakistan needs additional storage. The cost of storage is beyond the estimated annual availability of funding for the water sector as a whole. Storage projects will need to be considered as 'special projects' and funding considered accordingly. Developing additional storage should not interfere with funding for the domestic water supply and sanitation sub-sectors and the environmental initiatives.

Hydropower

As stated above, hydropower should go ahead associated with large storage developments. The run-of-river schemes, which are expected to be financed mainly by bilateral aid and the private sector, should go ahead as a priority when there is opportunity.

5.3

Monitoring and Evaluation

Monitoring and evaluation should be carried out to ensure that the Strategy interventions are being implemented and the objectives achieved through them. However, specific monitoring and evaluation programmes need to be developed within the sub-sectoral strategies and performance indicators and a monitoring programme should be

included in the project preparation work which will be carried out prior to starting the projects.

It is proposed that the Water Resources Apex Body be the executing agency for the Strategy as a whole. It should also take on the role of monitoring and evaluating the progress of the Strategy.