The Federal Democratic Republic of Ethiopia

Ministry of Water Resources

Water Sector Development Programme

2002-2016

2002

Foreword

This Water Sector Development Programme **(WSDP)** has been prepared in support of the fundamental principles and objec-tives endorsed and issued by the Government of Ethiopia in its Water Resources Management Policy and Water Sector Strategy. The Government of Ethiopia has made a conscious decision to commit itself to the time frame agreed on by the international community for achieving the Millennium Development Goals (MDGs). As such, the WSDP provides a structured framework to deliver a coordinated response by all relevant stakeholders to address the water sector challenges of Ethiopia while working towards the MDGs.

The WSDP is the product of extensive work undertaken by a multi-disciplinary team of national experts over a period of two years. The team worked very closely with different stakeholders at different levels to define the directions and priorities outlined in this document. In this context, the team drew overall guidance from documents such as: The Ethiopian Water Sector Strategy, The Ethiopian Economic Policy, and The Ethiopian Economic Development Strategy. An extensive consultative process in the form of workshops and meetings was employed at the Federal, Regional and Local levels to seek the input and contributions of a wide range of stakeholders. During the preparatory process, reflections and input from international partners were continuously sought through especially organized meetings, both on the nature of the consultative process as well as the content of this program.

The WSDP contains projects/programs that are expected to make significant contributions towards poverty eradication in Ethiopia, as well as in achieving many of the other MDGs. These projects/programs have been included after careful screening and analysis consistent with the growth targets and methodological frameworks established for this purpose. The list of selected projects include those identified in various basin master plan studies, and are proposed within the framework of Nile Basin initiative. The projects identified by the regions to meet their specific socioeconomic development priorities are also included in the list. Investment schedules are drawn-up for different planning horizons for improved financial planning and better mapping of available resources to the program needs.

I am confident that the WSDP will not only effectively enhance our ability and capacity to respond to the needs of the Ethiopian people, but it will also assist the external partners to target their development assistance to where it matters the most. The WSDP should be viewed as an instrument of the Poverty Reduction Strategy in pursuing Ethiopia's fight against poverty. While implementation of WSDP marks the beginning of a new era of people-centered social and economic development in Ethiopia, we also see it as a living and continuously evolving document that will be subject to adjustments based on the realities on ground.

Finally, I would like to take this opportunity to thank all those who have contributed to the preparation of this document. Special thanks are due the United Nations Development Programme (UNDP) for providing financial assistance in undertaking this important exercise. We would like to extend our deep appreciation to the United Nations Department of Economic and Social Affairs (UNDESA) for providing excellent technical assistance and advisory services during all stages of the preparatory process.

Shiferaw Jarsso

Minister
Ministry of Water Resources
Addis Ababa, Ethiopia
20 July 2003

Table of Contents

Section I

Socio-economic Context and Background

Section II

Subsectoral Development Programs

Section III

Impact Analysis and Implementation Arrangements

Abbreviations and Acronyms

ADD	Average Daily Demand
AFD	French Agency for Development
CIWD	Commercial and Institutional Water Demand
CoSAER	Commission for Sustainable Agricultural and Environmental Rehabilitation
CPI	Consumer Price Index
CSA	Central Statistical Authority
DWD	Domestic Water Demand
EELPA	Ethiopian Electric Light & Power Authority
EEPCo	Ethiopian Electric Power Corporation
EFY	Ethiopian Fiscal Year (Julian Calendar)
ENCP	Eastern Nile Cooperative Program
ENSAP	Eastern Nile Subsidiary Action Program
EPA	Environmental Protection Authority
ESDP	Education Sector Development Program
ESRDF	Ethiopian Society for Rehabilitation and Development
EWRIC	Ethiopian Water Resources Information Center
EWRIS	Ethiopian Water Resources Information System
EWRRC	Ethiopian Water Resources Research Center
EWWCE	Ethiopian Water Works Construction Enterprise
FDRE	Federal Democratic Republic of Ethiopia
FPMU	Federal Program Management Unit
GDP	Gross Domestic Product
GNP	Gross National Product
GSE	Geological Survey of Ethiopia
GWh	gigawatt-hours
ha	hectares
HDP	Hydropower Development Program
HIPC	Highly Indebted Poor Countries
HSDP	Health Sector Development Program
ICBP	Institution- and Capacity-Building Program
ICCON – CG	International Consortium for Cooperation on the Nile
ICS	Interconnected System [of EEPCo]
IDA	International Development Association [of the World Bank]
IDP	Irrigation Development Program
IERR	Internal Economic Rate of Return
IFAD	International Fund for Agricultural Development
IWD	Industrial Water Demand
kg	kilogram
km	kilometer
kV	kilovolt
kWh	kilowatt-hour
LB	Left Bank
lpcd	liters per capita per day
LMSIDP	Large and Medium-scale Irrigation Development Program
LT	Long Term [WSDP plan period 2012–2016]

LU	Livestock Units
LWD	Livestock Water Demand
MDGs	Millenium Declaration Goals
MDWD	Maximum Daily Water Demand
m	meter
m^3	cubic meter
MEDaC	Ministry of Economic Development and Cooperation
Mln/M	million
mm	millimeter
MoWR	Ministry of Water Resources
MT	Medium Term [WSDP plan period 2007–2011]
MUS$	million United States dollars
MW	megawatt
NBISAP	Nile Basin Initiative Subsidiary Action Plan
NGO	Non Governmental Organization
NSC	National Steering Committee (inter-ministerial body)
PIM	Program Implementation Manuel
PMU	Project Management Unit
RB	Right Bank
RC	Regional Council
RPMU	Regional Program Management Unit
RTC	Regional Technical Committee
RSDP	Road Sector Development Program
RWS	Rural Water Supply
SCS	Self-contained System [of EEPCo]
SL	System Loss
SNNPR	Southern Nations Nationalities and Peoples Region
SSIDP	Small-scale Irrigation Development Program
ST	Short Term [WSDP plan period 2002–2006]
TWh t	erawatt-hour
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
USA	United States of America
US¢	United States cent (US$ 0.01)
USD	United States dollar
UWS	Urban Water Supply
WC	Water Committee
WAPCOS	Water and Power Consultancy Service
WMEB	Water, Mines and Energy bureau
WMO	World Meteorological Organization
WRDP	Water Resources Development Program
WRMC	Water Resources Management Council
WSDP	Water Sector Development Program
WSSA	Water Supply and Sewerage Authority
WSSDP	Water Supply and Sewerage Development Program
WUA	Water Users' Association
WWDSE	Water Works Design & Supervision Enterprise

Outline of the Report

Ethiopia has abundant water resources, but they have yet to contribute more than a fraction of their potential to achieving the national economic and social development goals. Because of the uneven distribution of those resources, and the limited financial and technical resources available, Ethiopia has repeatedly suffered from drought and the aridity of much of its lands. Very little has been done to date in harnessing the country's water resources as engines to propel national economic and social development.

The Federal Democratic Republic of Ethiopia has begun to take systematic measures towards a more fruitful utilization of the country's water resources. The Federal Government published the *Ethiopian Water Resources Management Policy* in 1999 as an essential national policy document to steer the development and management of the country's water resources. This was followed by the preparation of a *National Water Strategy* providing a roadmap to translate the policy into action. Last in the series was the preparation of *Water Sector Development Program* (WSDP) that is presented in this report. It defines concrete interventions in terms of projects and programs to achieve the water policy objectives, using the guidelines set under the national strategy.

The WSDP is to have a time horizon of 15 years (2002–2016, by the international calendar). An important feature of WSDP is the inclusion of priority projects from river basins master-plan studies, as well as those identified by various stakeholders, especially the regional governments. Another feature of the program is the inclusion of projects as discussed and agreed under the Nile Basin Initiative (NBI). In summary, the WSDP provides an inventory of the projects to be implemented over the next 15 years with accompanied investments. Overall environmental and social impacts of WSDP are assessed to draw conclusions for future policy analysis, and guidelines provided as how to undertake such impact analysis at the project level. A comprehensive institutional and financial framework is proposed to secure successful implementation of the program.

A consulting agreement for preparing the WSDP was signed between the MoWR as Client, the Water Works Design & Supervision Enterprise (WWDSE) as Consultant, and the United Nations Department of Economic and Social Affairs (UN DESA) as the UN executing agency in May 2000. The WWDSE conducted the WSDP formulation work by engaging a team of senior national experts. In addition, a team of national and international consultants made useful contributions to the report, especially with regard to analysis of potential social and environmental impacts. The United Nations Development Programme (UNDP) provided the financial assistance, while UN DESA provided overall technical assistance in finalizing the WSDP. Major outputs of the WWDSE consultancy included the following.

- Sector Review Report
- Methodological Framework
- Subsectoral Reports (5)
- Project Profiles
- Main Report accompanied with an Executive Summary

The final report on WSDP is presented here in two volumes: *Volume I: Executive Summary, and Volume II: Main Report on Water Sector Development Program.* This final report reflects the results of various levels of reviews undertaken and coordinated by the Ministry of Water Resources, and thus views expressed in this report are those of the Government of Ethiopia. The report highlights technical content of planned activities, major outputs, and the investment plan. Related sectoral programs, institutional interrelationships, and other technical considerations are identified as important program components. The report draws heavily on the above mentioned documents, and has consulted many other policy documents during the course of this exercise. All background documents are available upon request from the MoWR.

The *Main Report on Water Sector Development Program* contains 14 chapters, grouped in 3 sections as outlined below.

Section I: Socio-Economic Context and Background

- Chapter 1 describes the physical and social context of Ethiopia that WSDP has been designed for.

- Chapter 2 presents an overview of the water sector in Ethiopia which draws primarily from documentation of the 5-year development plans (1988–1992 and 1993–1997, Ethiopian Calendar) and from information collected by consultants on field visits to the Regions.

- Chapter 3 explains the rationale for developing a plan for the water sector, the interrelation ships with Federal and Regional Government agencies that WSDP depends on, and the lessons learned from other sectoral development programs that can be applied in the current scenario.

- Chapter 4 outlines the methodology that was followed in articulating each stage of the planning process.

Section II: Subsectoral Development Programs

- Chapters 5 through 9 summarize the individual subsectoral programs for developing water supply and sewerage, irrigation, hydropower, water resources (multi-sectoral and in general), and institution- and capacity-building.

- Chapter 10 brings together all the planned WSDP outputs and funding requirements (as identified in Chapters 5 through 9 for implementing program activities.

Section III: Impact and Analysis Implementation Arrangements

- Chapter 11 makes the case for assessing the possible social and environmental impacts of WSDP. The text is based on a report by a team of national and international consultants.

- Chapter 12 outlines main elements of the implementation strategy, program management arrangements, and necessary conditions to achieve program objectives.

- Chapter 13 presents a plan of action for resource mobilization and makes the case for achieving financial sustainability in future investments.

- Chapter 14 sums up main conclusions and recommendations in the form of an action agenda for the short-term.

Chapter 1 Socio-economic Context

1.1 Summary of geographic information

1.1.1 Physical geography

Ethiopia is part of the East African region commonly referred to as the "Horn of Africa." Situated between 3°30´ and 15º North latitude and 33° and 48° East longitude, it covers an area of approximately 1.13 million km². Bordered by Somalia and Djibouti to the east, the Sudan on the west, Eritrea to the north, and Kenya to the south, Ethiopia is a land-locked country. Nonetheless, Ethiopia is naturally endowed with sufficient water resources that, if sufficient financial resources were made available, it could easily fulfill its domestic requirements for irrigation and hydropower,.

A prominent feature of Ethiopian topography is its rugged landscape, with the Great Rift Valley dividing the country into the Central Highlands, which run from north to south, and the Eastern Highlands. Ethiopia's landscape holds mountain chains, flat-topped plateau, deep canyons, river valleys, and rolling plains. Altitudes range from 110 m below sea level in the Dallol Depression to more than 4,600 m above sea level in the Semien Mountains. Extensive lowland areas with altitudes under 1,000 m abound on the western, eastern and southern margins of the country.

Despite Ethiopia's proximity to the equator (within 15°), the Central and Eastern Highlands enjoy a temperate climate due to the moderating influence of high altitudes, with a mean annual temperature rarely exceeding 20°C. The sparsely populated lowlands, on the other hand, typically have sub-tropical and tropical climates. Rainfall generally occurs in a 5-month unimodal rainy season from May to September in the western parts of the country and averages around 1,000 mm annually. The eastern and southern parts, on the other hand, have bimodal rainfall averaging annually from less than 200 mm in the semi-desert to 1,000 mm in the highlands. Rainfall can sometimes be erratic, especially in the eastern half of the country and drought is a common feature.

1.1.2 Population

According to the 1994 census, Ethiopia had a population of 53.5 million, equally divided between male and female. The 1999 statistical abstract of the Central Statistical Authority (CSA) estimated that the population of Ethiopia would be 63.5 million as of 1 July 2000. The 1994 census projected Ethiopia's population to reach 83.5 million by 2010 and 106 million by 2020. Those projections imply average annual population growth rates of 2.90 per cent, 2.77 per cent, and 2.42 per cent, respectively, between 2 successive years of projection, starting from the actual census year (1994). The breakdown of population by region is given in table 1-1.

Nearly 81 per cent of Ethiopia's population lives in the 3 regional States of Oromiya, Amhara, and the Southern Nations Nationalities and Peoples (SNNP) Region; representing 35, 26, and 20 per cent of the national population, respectively. Excluding the Harari Region (a city-state) and the Addis Ababa and Dire Dawa Administrative Councils (both of which are city administrations), the SNNP has the highest population density (111 people per km2), with Amhara having the second highest population density (102 people per km²). Afar Region has the lowest population density of any region (7 people per km²). Gambella and Benshangul-Gumuz also have low population densities, with less than 11 people per km². At the woreda level, Gog of Zone 3 in Gambella, and Guba of Metekel Zone and Yaso of Kemeshi Zone in Benshangul-Gumuz, are among the woredas with the lowest population densities in Ethiopia

(less than 3 people per km²). At 895 people per km², Wonago Werda of Gedeo Zone in SNNP has the highest population density in the country.

Ethiopia's population is 85 per cent rural and 15 per cent urban. The economically active population is 49.6 per cent of the total population. Unemployment in 1994 was 2.9 per cent at the national level; i.e., 22 per cent for urban and 0.7 per cent for rural areas of the country.

The 1994 census established 2 major types of migration patterns: rural-urban and inter-urban. The former is the most dominant migration pattern by far. In 1994, the estimated number of migrants in the country was 6.9 million.

Table 1-1. Total population of Ethiopia by region, in thousands

No.	Region	Total population	Rural	Urban
1	Tigray	3 694	3 072	622
2	Afar	1 216	1 117	99
3	Amhara	1 6295	14 615	1 680
4	Oromiya	22 324	19 706	2 648
5	Somali	3 698	3 138	560
6	Benshangul-Gumuz	537	490	47
7	SNNP	12 515	11 557	958
8	Gambella	211	175	36
9	Harar	160	63	97
10	Addis Ababa	2 495	0	2 495
11	Dire Dawa	318	89	229
	Total	63 495	54 022	9 473

Source: CSA, Ethiopia, Statistical Abstract, 1999.

1.2 Socio-economic conditions

1.2.1 Income level and poverty

According to the CSA, in 1997/98 Ethiopia had a gross national product (GNP) at market prices of Birr 44.86 billion. That is equivalent to a per capita GNP (at market prices) of Birr 755, one of the lowest in sub-Saharan Africa. In the same year, agriculture contributed 45.7 per cent of the gross domestic product (GDP). The contribution to GDP of the other sectors of the economy was as follows: industries 11.6 per cent, distribution services 14.8 per cent, and other services 27.9 per cent. Among industries the share of water and electricity is a mere 1.5 per cent of GDP. Given the huge rural proportion of the population the contribution of agriculture, a largely rural activity, to GDP is rather small. The income level and standard of living of the rural population is relatively low and the rural population is poor. In fact, 83 per cent of rural households cultivated less than 2 hectares (ha) per household and 52 per cent cultivated less than 1 ha per household in 1998/99.

Additional indicators of relative poverty include a high rate of infant mortality, limited access to potable water, and a low level of dietary intake, as measured in calories. Ethiopia has one of the lowest social indicators in sub-Saharan Africa. According to the World Development Report (1999/2000) and African Development Indicators (1998/99), from 1995 to 1997, Ethiopia had an infant mortality rate of 107 per 1000 live births and a maternal mortality rate of 1,400 per 100,000 live births.

Life expectancy at birth is 43 years, and only 26 per cent of population has access to potable water.

The corresponding figures for all of sub-Saharan Africa are infant mortality rates of 91 per 1,000 live births, maternal mortality rates of 820 per 100,000 live births, a life expectancy of 52 years, and 47 per cent of the population with access to safe drinking water. Access to potable water in urban (excluding Addis Ababa) and rural areas of Ethiopia average about 65.3 per cent and 5 per cent, respectively. Even in urban centers (excluding Addis Ababa), sanitation services are almost non-existent. The 1992/93 daily per-capita dietary intake of 1,518 calories or 447 grams of cereal equivalent fails to meet the minimum requirement of 2,100 calories established by the World Health Organization (WHO). In consequence, about 48 per cent of Ethiopian children under age 5 suffered from malnutrition between 1992 and 1997.

1.2.2 Infrastructure

The development of infrastructural facilities is critical to the economic development of a country. With the exception of air transport services, infrastructural facilities in Ethiopia remain grossly underdeveloped, even in comparison with other sub-Saharan African countries.

With regard to roads, according to African Development Indicators of the World Bank, the road: population ratio of Ethiopia is 0.5 or 500 km per 1 million persons. That is less than 1 quarter of the 2.2 ratio, excluding South Africa, quoted for sub-Saharan Africa. In order to improve the road infrastructure, Ethiopia's 10-year Road Sector Development Program envisages the construction and upgrading of a total of 15,600 km of new and existing roads starting in 1996.

With per capita consumption of electric power at 26 kilowatt-hours in 1996, Ethiopia appears to have one of the least-developed systems of power generation in sub-Saharan Africa. About 90 per cent of the total installed electric generation capacity of the country is derived from hydropower.

Regarding telecommunication facilities, Ethiopia had 3.3 connected telephone lines per 1,000 persons by the end of 1998, according to the Ethiopian Telecommunications Corporation. The rate in sub-Saharan African countries was 5 connected lines per 1,000 persons from 1994 to 1996. Total number of Internet connections is under 3,000, one of the lowest in Sub-Saharan Africa.

1.2.3 Agriculture

The Ethiopian economy is dominated by smallholder subsistence agriculture, which accounts for 46 per cent of GDP and 85 per cent of employment. Almost the entire sector depends on rainfall. Only 63,170 ha (0.7 per cent) of the total cultivated area of 8.92 million ha under smallholder agriculture was under traditional irrigation in 1998/99. The major crops cultivated are cereals (75.6 per cent), pulses (9.8 per cent), permanent crops (7.6 per cent), and oilseeds (4.2 per cent). Of the total area under traditional irrigation, cereals and permanent crops cover 47.7 per cent and 33.8 per cent, respectively.

According to the Water and Power Consultancy Service (WAPCOS), Ethiopia could potentially develop irrigation over 3.73 million ha of farmlands. Nevertheless, the total area to date under irrigation is estimated to be about 160,000 ha, including the area under traditional irrigation. Irrigated agriculture has realized only 4.3 per cent of its estimated potential and in terms of output accounts for approximately 3 per cent of total food crop production. Thus, Ethiopia faced with rising population pressure, has remained a food-deficit country since the 1970s. In 1999/2000, for example, Ethiopia imported over 800,000 tonnes of grain in the form of food aid. If the country is to achieve its stated aims of food self-sufficiency and food security, the current production shortfalls call for drastic measures to improve productivity of irrigated and rain-fed agriculture.

1.3 Water and land resources

With its current per-capita freshwater resources estimated at 1,924 m³, Ethiopia is endowed with one of the largest surface freshwater resources in sub-Saharan Africa. However, only 2 per cent of the potential is annually utilized, 86 per cent of that going to irrigated agriculture. On the other hand, Ethiopia's land resource potential for irrigation development, disregarding available water, is very large.

Ethiopia's various resource potentials have been identified and described in different master plans for integrated development of major river basins. The preliminary water-resources master plan study completed by WAPCOS has identified Ethiopia's general irrigation potential.

1.3.1 Water resources

A review of master-plan studies and related river-basin surveys shows that the aggregate annual runoff from the 9 river basins amounts to 122 billion m³. The 3 largest river basins (Abbay, Baro-Akobo, and Omo-Gibe) contribute 76 per cent of the total runoff from a catchment area comprising only 32 per cent of the total area of the country. Those 3 river basins have much larger specific discharges than the other 7 river basins, as table 1-2 shows. Their large runoff stems from the fact that the river basins occupy the western and south-western parts of Ethiopia, where the highest concentration of rainfall occurs. The 3 eastern river basins are dry. They include Afar-Danakil, Aysha, and Ogaden.

With regards to groundwater resources, the true potential of the country is not yet known. However, it is widely reported that Ethiopia possesses a groundwater potential of approximately 2.6 billion m³. Not only are the yield levels of water wells too low (less than 5 liters per second), but wells are generally too deep to justify economic exploitation of groundwater resources for irrigation purposes in Ethiopia.

The gross hydropower generation potential of the country is estimated to be 650 TWh per year of which 25 per cent can be exploited for power. That is about 100 times the existing installed capacity.

The transportation potential of Ethiopian waterways and water bodies has not yet been fully exploited for economic development. The socio-economic impact of water transport at the regional or local level could be significant in areas where road transport is difficult. The income to be generated if modern and efficient transport systems were organized, especially from tourism, is not negligible. Some rivers, for example the Baro-Akobo, are navigable. The Baro River is a good case in point: the Gambella Regional Government has undertaken the Baro River Transportation Study.

Table 1-2. Surface-water resources of major river basins

No.	River basin	Catchment area (km^2)	Annual runoff (BM^3)	Specific discharge ($l/s/km^2$)
1	Abbay	199 812	52.6	7.8
2	Awash	112 700	4.6	1.4
3	Baro-Akobo	74 100	23.6	9.7
4	Genale -Dawa	171 050	5.80	1.2
5	Mereb	5 700	0.26	3.2
6	Omo-Gibe	78 200	17.90	6.7
7	Rift Valley	52 740	5.60	3.4
8	Tekeze	89 000	7.63	3.2
9	Wabe Shebele	200 214	3.15	0.5
10	Afar-Danakil	74 000	0.86	-
11	Ogaden	77 100	0	-
12	Aysha	2 200	0	-
	Total	1 136 816	122.00	

Source: Compiled from various river-basin master-plan studies and river basin surveys.

Lake Tana is the water body used for transportation purposes between Bahir Dar and several islands as far as Gorgora.

1.3.2 Land resources

Ethiopia, as stated above has a total area of about 1.13 million km², with an estimated 55 million ha of arable land, or approximately half of its landmass. The arable land potential encompasses both rain-fed and irrigable lands that are agro-ecologically suited to the production of a variety of crops, including cereals, pulses, oil crops, tree crops and vegetables. Discounting availability of water, an estimated 10 million ha of land are suitable for irrigation. More than half of that potential is located in the Abbay (Blue Nile) River Basin.

Despite such vast arable-land resources, only 14.8 per cent of the country's total landmass is currently being utilized for crop cultivation. Only 16.6 million ha of land is being cropped, constituting just 30 per cent of the arable potential. The remaining 70 per cent of the potential is used in other ways, particularly for grazing.

Chapter 2 Overview of the Water Sector

This Chapter presents main characteristics of various subsectors: irrigation, water supply and sewerage and hydropower. In some cases regional reviews are also made to highlight conditions pertaining to specific areas—but which are also important from a national perspective. The review draws heavily from the Sectoral Review Report produced by the Consultants in 2001. In addition, numerous other documents (listed among the references at the end of this report) were also consulted. Observations made during field visits to the regions further contributed in enriching the review presented herein. A more detailed analysis about each subsector can be found in Chapters 5-9.

2.1 Irrigation

Irrigated farmlands countrywide in 1991 comprised some 64,000 ha under small-scale schemes and 112,105 ha under medium- and large-scale schemes. MoWR reports that the total area under irrigation increased from 176,105 ha in 1991 to 197,250 ha in 1998. Most of that increase, a total of about 21,145 ha of modern small-scale irrigation schemes, stemmed from growth in small-scale irrigation in the various regions. Little or no development occurred in medium- and large-scale irrigation during that period. Irrigation coverage has not grown significantly since then.

On a per capita basis, Ethiopia has developed irrigation over an area of a mere 0.3 ha per 100 people, vis-à-vis its potential of about 4.0 ha per 100 people. Despite this vast potential, irrigation infrastructure has remained underdeveloped while Ethiopia has endured persistent drought and famine.

There are 4 categories of irrigation schemes nationwide: traditional; modern communal; public; and private commercial. These various schemes are described in the discussion on the irrigation sub-sector to be found in Chapter 5 of this report.

2.2 Water supply and sewerage

Both the urban and rural water supply and sewerage coverage in Ethiopia are low. Various sources of information cite figures for water supply coverage, but often differ because data is not accurately recorded. According to the 1994 WSSA statistical review, the urban coverage for water supply, excluding Addis Ababa, is 65.3 per cent and that of rural areas is 15 per cent. Sewerage coverage is in a worse condition in that even the large cities lack proper services. No reliable figures can be quoted regarding sewerage coverage.

2.2.1 Addis Ababa Water Supply and Sewerage Services (WSSS)

The primary water supply sources for the city of Addis Ababa are the Gefersa and Legedadi dams. Though the total production capacity of Gefersa is 30,000 m3 per day, it currently produces 24,000 m3 per day due to the dam's agedness. Meanwhile, while Legedadi has a capacity of 150,000 m3 per day, because of water shortages in the reservoir it only produces 125,000 m3 per day. The total amount of water produced for distribution from the 2 dams is 149,000 m3 per day.

During 1995-1997 the WSSS developed 8 springs and drilled 13 wells. Together the springs and the wells produced an average of 10,000 m3 of water per day for the city.

The Dire Dam project on the Dire River was initiated in order to create a reservoir with a capacity of 19 million m^3 so that about 42,000 m^3 per day could be released to Legedadi. As the result of the completion of the dam, Legedadi water production has increased by 20 per cent.

The other water supply project for Addis Ababa is the Akaki Emergency Groundwater Development Project. Of the 25 wells that have been drilled under this project, 11 wells have been developed and the rest of the project has almost been completed.

More than 40 per cent of water produced for the city is lost and wasted through either leakage or by other means. To tackle the problem, a leakage study was conducted on treatment plants, service reservoirs, distribution systems, water meters, and other processing points to assess the wastage and find a solution. As a result, old pipes are being changed and others are being properly maintained.

The WSSS is currently undertaking the Water III Project, sewerage projects and other capacity-building projects, in addition to its normal water services for the city.

2.2.2 Afar Region

The water supply services for Afar Region cover about 16.5 per cent of the population. Urban coverage is approximately 44 per cent and rural coverage about 14.3 per cent.

Prior the creation of the Afar Regional State, according to reports received from Afar, water supply services of some kind were provided to the people in 9 towns in Zone 1 and Zone 3: the towns of Awash Sebat-Kilo, Awash Arba, Melka Warer, Melke Sedi, Gewane, Mille, Dubti, and Assaita. As the existing services were inadequate, some people used to fetch water from rivers and ponds.

People living in most parts of the region were getting their drinking water by paying prices ranging from 500 to 800 Birr per truckload of water hauled from Assab and Logia. In areas where there were no nearby rivers, people used to travel 15 to 20 km for water for human and livestock consumption.

After the formation of the Regional Administration, the Water Development Bureau in Afar has, with assistance from neighboring Regional Administrations, such as Tigray and Amhara, and numerous local, national, and international groups, built and rehabilitated some 125 local water systems.

2.2.3 Amhara Region

Amhara Region reports that in 1987 rural water supply coverage was about 5 per cent of the population. By the end of 2000 that proportion had increased to 23 per cent.

Before 1995 the urban water supply coverage in the Region was 80 per cent. By 2000 urban services had reached 1,151,288, raising the coverage from 80 to 96 per cent.

Construction of water-supply projects in Bahir Dar and Gondar has almost been completed. In addition, completion of water-supply projects to 9 towns being financed with Japanese assistance and, 5 towns financed by the International Development Association (IDA), and the rehabilitation efforts of the Sectoral Water Supply Project, will improve the urban water-supply situation in those areas.

2.2.4 Benishangul-Gumuz Region

Assosa, Bambasi, and Almu are the 3 main towns in Benishangul-Gumuz Region. According to the 1994 population census, 63.8 per cent of the population of Assosa had access to potable water. Bambasi town could supply 17.9 per cent of the population with water from protected wells or springs, 32.6 per cent from unprotected wells or springs, and 9 per cent from rivers. The water-supply coverage in Almu was much greater, at 98.7 per cent.

Water sources in rural areas of the Region are springs and shallow wells. Metekel, Assosa, and Kamashi Zones could supply water to 23 per cent,

47 per cent, and 16.26 per cent of the population, respectively. The Regional Water Bureau and CISP, a non-governmental organization (NGO), could somewhat alleviate the situation by installing hand pumps.

Established in 1995, the Region's Water Development Bureau has dug 60 wells, developed 26 springs, and drilled 8 shallow wells and 6 deep wells. Water supply coverage has thus improved from 12 per cent in 1995 to 27 per cent in 2000.

2.2.5 Gambella Region

Urban centers such as Itang, Abobo, Pungudo, Metti, and Gambella have some kind of water supply system. The systems of the first 4 towns are operating fairly well, while Gambella is critically short of drinking water. The Regional Water Bureau and MoWR, with IDA financing, have begun to study a solution for the chronic water shortage in Gambella town.

The Region's water sources are hand-dug wells, deep wells, springs, ponds, and rivers. For woreda and Zonal towns, water is currently provided from 10 deep-drilled wells and 2 developed springs. The urban water supply currently reaches 58 per cent of the population. Water supply coverage for the whole region is about 23 per cent.

Large-scale resettlement projects in the past have constructed rural water-supply schemes in the Region. In the woredas of Gog, Abobo, and Gabella, about 93 boreholes and hand-dug wells were sunk during the resettlement period. These accounted for 39.1 per cent of all the 238 schemes in the Region. Of the remaining 145 schemes, 18.5 per cent were installed by the Water Bureau, 10.9 per cent by the United Nations Children's Fund (UNICEF), 3.3 per cent by Mekaneyesus, 7.5 per cent by the United Nations High Commission for Refugees (UNHCR), 5.0 per cent by the Red Cross Society of Ethiopia, and 15.5 per cent by the Ethiopian Society for Reconstruction and Development (ESRDF). To demonstrate cattle-watering practices in the Region, 20 cattle troughs were built.

2.2.6 Harari Region

A feasibility study of water supply for Harar was first made in 1983 as part of the "34 towns project." The study indicated that future sources of water for Harar should include Alemaya Lake, groundwater from the lake basin, and storage from the Hamaressa and Maya Gudo rivers.

Harar was also included in a study of water supply and sanitation for 12 towns by the Gibbs consulting firm in November 1995. The Gibbs study looked at options for Harars town, Alemaya town, Bati village where the university is located, and the villages of Awedaiy and Hamaressa. The water source was to be the Maya Gudo and Errer rivers.

The groundwater investigations in the Dire Dawa area suggest potential for large-scale development. The well field at Dire Jara is located about 22 km North West of Dire Dawa town. The water source at Dire Jara well field is believed to be adequate up to the 2012 water requirement. For the second phase, up to 2022, the well field at Hursso, 27 km west of Dire Dawa, could be used.[PC1]

2.2.7 Dire Dawa Administration

Dire Dawa town and the local Peasant Associations totally depend on groundwater. The region has no surface-water sources except for some springs. Urban water supply comes from 9 boreholes and 3 developed springs. The urban supply system consists of 80 km of distribution lines, 6 reservoirs, and 69 communal distribution points.

A decade ago, the town's potable water supply was accessible by fewer than 20 per cent of the rural population and 98 per cent of the urban. Currently, urban coverage is 67 per cent.

2.2.8 Oromiya Region

The last 5-year plan envisaged raising rural water-supply coverage in the Oromiya Region from 17.7 to 24.8 per cent and urban water-supply coverage from 72.8 to 83.6 per cent. During implementation of the plan, both governmental and NGO efforts accomplished 23.4 per cent of the target for rural water supply and 75.4 per cent of that for urban water supply. Between 1992 and 1995, the percentage of the population served in the Region rose by 6 points, from 23.5 to 29.5 per cent. [PC2]

The 5-year plan had envisaged construction of water-supply projects for 26 towns, rehabilitation and extension works for 5 towns, feasibility study and detailed design for 8 towns, pre-feasibility studies for 20 towns, and 1,788 operation and maintenance projects. By the end of the planned period, water supply works for 6 towns had been constructed, study and design completed for 1 town, rehabilitation and extension works completed for 5 towns, and pre-feasibility studies executed for 7 towns.

2.2.9 Somali Region

The 1999-2000 plan of the Water Bureau was initially to raise water-supply coverage from 21 to 40 per cent of the population. However, the plan was reportedly not based on adequate information and should have set the target at 15 per cent. Based on this correction, at the end of 2000 the coverage was 19.2 per cent. The physical achievements were 1 deep-drilled well of the 5 initially planned and 19 improved water-supply schemes of the 61 planned. Of the planned total of 88 water-supply studies, 27 were completed.

Jijiga town has a critical water-supply problem. A few wells were drilled with assistance from UNICEF. The town is attempting to upgrade performance of its water-related administration and management activities. In the areas where a Livestock Herders' Association has been formed, construction of birka and ponds have been planned. Most rural water systems are supervised by water committees, which have had no training in water systems management.

2.2.10 Southern Nation and Nationalities Peoples Region (SNNPR)

The Water, Mines, and Energy Bureau (WMEB) set a 5-year plan (1996-2000) to raise water-supply coverage by building new schemes and by emphasizing the importance of timely operations and maintenance of existing schemes. By the end of the plan period, water-supply coverage had increased from 20 to 28.12 per cent of the population.

2.2.11 Tigray Region

Water supply coverage in 1995 was reported at 10 per cent of the population. The 5-year plan (1995-2000) proposed to raise rural coverage to 35 per cent and that for urban water supply to 77 per cent. For the Region as a whole, the plan envisaged coverage of 42 per cent. By the end of the planned period, coverage had been raised to 34 per cent. During the past 3 years, water-supply construction works have been completed for Axum, Adwa, and Mekele towns.

WMEB has planned to drill, on average, 224 shallow wells and 16 deep wells per year. The annual results have been reported as 124 shallow wells and 13 deep wells, yielding an implementation rate of 55 per cent for shallow wells and 81 per cent for the deep wells. Subsequent reports have disclosed that 20 to 50 per cent of the shallow-drilled wells have become unproductive. By 1999, there were 1,800 hand-dug wells, shallow-drilled wells, deep-drilled wells, and developed springs that supply potable water to the Region.

The reasons for the low implementation rate are reported as shortage of skilled manpower, inadequate and unreliable data and information, and planning of unrealistically high targets.

2.3 Hydroelectric power

2.3.1 Subsectoral overview

Ethiopia is endowed with vast energy resources. The gross hydropower potential of the country is estimated at 650 TWh per year of which 25 per cent could be exploited for power. Over 70 billion m^3 of natural gas, more than 1,000 MW of geothermal power, and several hundred millions of tons of coal and oil shale constitute the energy potential so far estimated.

Traditional energy resources such as fuel wood, dung, crop-residues and human and animal power are estimated to generate 95 per cent of the energy actually consumed. Electricity and oil products supply the remaining 5 per cent. The electricity supply is generated domestically, with hydroelectricity accounting for over 90 per cent of supply. Oil is imported in the form of refined products.

Annual energy consumption is about 25 kWh per capita for electricity, 16 kgoe (kilograms of oil equivalent) per capita for petroleum, and 276 kgoe per capita for other sources, mainly of biomass origin. Per capita electricity consumption is among the lowest in the world, while petroleum consumption is much below the world average of about 600 kg per capita per annum.

The household sector is the primary consumer of energy, accounting for 82 per cent of the total energy supplied. The transport sector utilizes more than 70 per cent of imported oil, while agriculture consumes only 3 per cent.

The import of petroleum products is a major drain on export earnings. Net import of fuels to Ethiopia amounted to 54 per cent of export earnings in 1992/93, though that declined to about 22 per cent of export earnings in 1995. Improvements in revenues from coffee exports accounted for that positive development. The corresponding figure for 1996/97 stands at about 34 per cent.

An estimated 13 per cent of the population has access to electricity - not necessarily through direct services, but from nearby low-voltage infrastructure. Even then, supply is deliberately constrained in the diesel centers in order to save on fuel and maintenance costs. A rough assessment in 1992 indicated that 9 per cent of the population had access to hydroelectricity, while only 1 per cent had access to diesel-generated electricity. The same assessment indicated that 13 towns with populations exceeding 10,000 and another group of 80 towns with populations of 5,000 to 10,000 were awaiting electrification. The same situation basically prevails today.

Access to public electricity supply, in terms of percentage of population with access to a low-voltage supply, has been growing steadily but slowly. The rate of electrification must stay ahead of the population growth rate in order to register any growth in access to electricity. That has not been easy in a country whose population grows at about 3 per cent annually.

2.3.2 Current development level

Ethiopia's huge hydroelectric generation potential has barely been exploited. About 160 GWh/year could be produced if 1 quarter of the potential could be exploited economically by today's technologies. That estimate agrees with the estimate in studies by Water and Power Consultancy Services (WAPCOS). WAPCOS refers to the "technical" potential (although it would be more appropriate to say the "economic potential") and gives the parallel figure of about 145 GWh/year.

The WAPCOS study considered water regulation options that require dam/diversion weir lengths of less than 750 meters and dam heights below 120 meters in establishing "technical" or "economic" potential. The installed capacity, corresponding to 145,000 GWh/year output at an average plant utilization factor of 0.6, would be about 27,000 MW.

The "economic" hydroelectric potential is therefore nearly 100 times the present demand for electricity. Hydroelectric energy development is patently sustainable in Ethiopia. The potential dwarfs the installed capacity in the interconnected system (ICS) of the Ethiopian Electric Power Corporation (EEPCo).

ICS peak loads were 285 MW in 1995 and 318 MW in 1999. Annual per capita production of electricity is among the lowest in the world and low even by regional standards. Per capita generation in 1996 in Ethiopia, Uganda, Sudan, and Kenya was 26, 40, 50, and 150 kWh, respectively.

The supply system itself is currently capacity-constrained, with hydroelectric generation capacity hard put to meet demand in terms of peak power and annual energy output. The situation is exacerbated by low rainfall. Reservoir siltation in older plants has reduced storage capacity, thereby accentuating spillage requirements in flood situations and water shortage in dry years.

2.3.3 Small-scale hydropower considerations

Small-scale hydropower schemes are normally understood to produce less than 10 MW. They are commonly subdivided into 3 categories: micro-hydro schemes (< 100 kW), mini-hydro schemes (100-1,000 kW), and small-scale hydro schemes of 1-10 MW.

The WAPCOS hydropower studies referred to earlier considered plant capacities ranging from 600 kW to 1,569 MW in various basins. The lower-capacity ranges are shown mostly for the Abbay and Awash basins, which are relatively well known and better assessed. In comparison, sites in the Omo and Genale basins evidently have higher generation potential. It is quite likely that the small-scale hydro potential of Ethiopia is much higher than that indicated in the WAPCOS studies.

CESEN studies actually put the small-hydro, run-of-river-scheme potential at about 5 TWh/year (i.e., about 1,400 MW at 0.4 plant factor) but aver that a fuller assessment is required to establish a correct estimate. The United Nations Development Programme (UNDP) has also studied small-scale hydro plants in Ethiopia. So far, EEPCo has studied the feasibility level of about 9 sites, with UNDP assistance. Studies of smaller-capacity plants (of less than 0.5 MW each) were also conducted in the 1980s by a Chinese team of experts working with the Ministry of Agriculture.

Currently 4 small-scale hydro plants (< 10 MW) are part of the ICS. Individual plant capacities range from 116 to 5,000 kW. In 1999 those 4 plants produced a total of about 13 GWh. They constitute 1 third of the total number of small-hydro plants built by EEPCo since the 1950s.

Small-scale hydro schemes lack the advantages of scale - their cost per installed capacity and production cost per kWh of electricity is generally higher than those of larger-scale plants. For example, at Sor, Yadot, and Dembi small-hydro plants, the cost per kW is about US$ 4,000 and cost per kWh is about US$ 0.06. That is high in comparison with US$ 2,000/kW and US$ 0.05/kWh, the prevailing costs at the time of construction of those plants, for larger hydro schemes in Ethiopia.)

2.3.4 Small-scale hydropower Regional developments

Tigray Region. Plans to develop irrigation and hydropower projects in Giba and Rama have identified 7 dual-purpose projects for irrigation and power generation with an installed capacity of approximately 3,500 kW.

Amhara Region. Previous studies on small-scale hydropower development in the Region were compiled and assessed during the 1988-1992 Ethiopian Fiscal Year (EFY) plan period. Subsequently, the Region compiled a project document for the study of 2 selected sites for small-hydro

development. The project document was sent to the Ministry of Economic Development and Co-operation (MEDaC) to request donor financing. In the 1993-1997 EFY period the Region planned to undertake small-hydro development studies on 16 sites by mobilizing finance from various donors.

Oromiya Region. In the 1988-1992 EFY period, the Region planned numerous studies of small-scale hydro sites, including reconnaissance surveys of 52 sites, pre-feasibility studies of 13 sites, and feasibility studies of 7 sites.

The Region's strategy in small-scale hydropower development is to conduct studies and make the study results available to private investors and NGOs for implementation and/or site development. The goal for the 1993-1997 EFY plan period was to construct mini-hydro plants at 7 sites, conduct pre-feasibility studies of 15 sites and feasibility and detailed studies at 10 sites, and establish 1 training center on hydropower plant technology for the Region.

SNNP Region. With an emphasis on small-scale hydropower, the Region conducted reconnaissance studies at 39 sites during the 1988-1992 EFY plan period. The 39 sites included 6 in Sidama Zone, 8 in North Omo Zone, 3 in Gurage Zone, 10 in Keffa Sheka Zone, and 12 in Bench Maji Zone. For the 1993-1997 EFY period, the Region planned various studies on 24 sites.

Gambella Region. The Region's plan for 1993-1997 EFY was to conduct a master-plan study in the energy sector, including small-scale hydropower development, and create a conducive environment for private-sector investment for implementing projects in the master plan.

Other regions. No explicit documentation of small-hydro development plans is available.

2.4 Summary of major constraints

Detailed analyses of the basic development constraints of the water sector are presented in the respective subsectoral chapters. A summary of the major constraints is produced here for ready reference.

- The absence, until very recently, of a coherent development policy, strategy and program.
- Low institutional capacity and effectiveness.
- Shortage of financial resources, coupled with immense investment requirements, particularly in the case of largescale projects.
- Lack of coordination among the various implementing institutions: Federal Government, Regional (State) Governments, NGOs, donors and others involved.
- Lack of appropriate technology at the level of local resources.
- Low level of infrastructural development that would allow easy access to inputs and outputs.
- Absence of involvement of the stakeholders in the development process.
- Inadequate technical capacities.
- Lack of data and information required for efficient sector planning and management.
- Insufficient public-private partnerships.
- Low water use efficiencies in all water consuming sectors.

Chapter 3 Rationale and Background

3.1 Water-environment-poverty nexus

Water is a precious natural resource - vital for life, national development and the environment. In too great a quantity or too little, it can bring destruction, misery, or death. Irrespective of how it occurs, if properly managed, it can be an instrument for economic survival and growth. It can be an instrument to help reduce poverty and lift people out of the degradation of not having enough for their household needs and their livestock. However, when inadequate in quantity and quality, it can limit poverty reduction and national development, resulting in poor health, low productivity, food insecurity and constrained economic development. When its quality is not protected, it can pose serious environmental health risks and adversely affect agricultural and livestock production.

The linkages between water-development initiatives and initiatives in the agriculture, food, energy, health, education and decentralized-governance sectors must be clearly understood and carefully managed in order to both benefit from the inherent synergies and also to minimize or avoid negative cross-sectoral impacts. In Ethiopia, like anywhere else, the poor are the most vulnerable and frequently the first victims as they essentially rely on land and water resources to sustain their livelihoods. The productivity of water in agriculture remains low, hampering efforts at income generation, economic growth and sustainable development. Women and girls, who have to walk farther in search of minimal household needs, are affected most by water scarcity.

When water resources are harnessed to promote irrigation and hydropower production without sufficient safeguards for likely negative social and environmental consequences, short-run advantages such as spurred economic growth can easily be eclipsed in the medium and long term by negative impacts. Such impacts might include social unrest, health problems associated with water-borne diseases, or diminished soil productivity due to salinity within irrigated land. As a resource to meet basic human and livestock needs, water is vulnerable to pollution resulting from persistent organic polluters from farming, industrial and household wastes, and chemical residues from tanning and mining processes. Heavily polluted water adversely affects aquatic life with direct and indirect negative consequences for both environmental and human health as well as water-resource related agricultural trade.

What we get out of water therefore, depends largely on what we put into it in terms of management and use. Unless a sustainable use and management regime is in place, the water resource could easily become so degraded that human, livestock and environmental health are at risk. Thus the basis for sustainable development could also be compromised.

3.2 Ethiopia's water development vision

Although Ethiopia has not yet formally articulated a national, long-term development vision, elements of a vision are available in various national and sectoral policy or legislative frameworks. **Prosperity and harmony** emerge from the emphasis given to development, peace and democracy in the draft Second 5-Year Programme. The Poverty Reduction Strategy Paper elaborates those vision elements through a road map for reducing poverty and promoting development via pro-poor growth strategies, good governance, decentralization and empowerment, without necessarily setting a target such as that in the Millen-

nium Declaration Goal of reducing poverty by 1 half by the year 2015. A healthy environment is another vision element that is clearly articulated in article 44 of Ethiopia's Constitution, which provides for the people's right to a clean and healthy environment and their entitlement to alternative means of compensation, including relocation with adequate State assistance in the event of displacement or livelihood insecurity resulting from development programs. The enabling legislation for the Environment Protection Agency (EPA) elaborates this constitutional provision by enjoining the EPA to "ensure that all matters pertaining to the country's social and economic development activities are carried out in a manner that will protect the welfare of human beings as well as sustainably protect, develop and utilize the resource bases on which they depend for survival."

That perspective on environmental rights is enriched by the Environment Policy of Ethiopia, linking it with peace as part of a people-centered and environmentally sustainable development. The policy affirms the need to ensure sustainable use and management of environmental resources and the wise use of non-renewable resources. It advises stakeholders to be as cautious as possible in balancing the trade-off between short-term economic growth and long-term environmental protection. It underscores the need to correct for market failures in order to ensure social equity in the use of environmental resources. It further advises that regular and accurate assessment and monitoring of environmental conditions be conducted and the public be duly informed of the outcome. On the investment side, environmental rights are safeguarded by a legal requirement that enjoins the Investment Authority to ensure that the intended investment activity particularly complies with conditions in the environment protection laws.

The Water Resources Management Policy reinforces the elements of prosperity, harmony, and environmental health in the policy's fundamental principle—*that water is a commonly owned economic and social good that should be as accessible to all in sufficient quantity and quality to meet basic human needs.* Additionally, the principles emphasize the need for a rural-centered, decentralized, integrated, and participatory water management system as well as the attainment of social equity, economic efficiency, empowerment of water users and sustainability. This is reflected in the overarching "vision" and policy orientation of the national water policy whose objective is: *to enhance and promote all national efforts towards the efficient, equitable, and optimum utilization of the available water resources of Ethiopia for significant socio-economic development on a sustainable basis.*

It is in this context that both the water policy and water strategy underscore the importance of:

- developing water resources as an integral part of national socio-economic development
- ensuring that water development promotes social equity
- fostering stakeholder participation and empowerment, especially of women, for sustainable use and management of water resources
- promoting self-financing and cost-recovery, as much as is practical, in using water resources
- ensuring transparency and fairness in water resource management
- while ensuring the environmental soundness of all water development activities, to attain financial viability and sustainability
- ensuring sound water governance regimes at all levels of management
- applying the "subsidiarity" principle to ensure that water management is con

ducted at the lowest, and most efficient, institutional level.

3.3 Ensuring coherence from national policy to projects

The Constitution of the Federal Democratic Republic of Ethiopia articulated clear policy for economic development in general and gave due consideration to environmental and socio-economic issues in particular in 1995. All subsequent policy and legislation has been based on the general statements in the Constitution. Sectoral development policies have been designed and implemented on the basis of the economic, social and environmental development policies of the country.

One of the sectoral policies is the Water Resources Management Policy, which is based on socio-economic and environmental development policies as stipulated in the Constitution. The objectives of the policy are:

- Development of the water resources of the country for economic and social benefits of the people, on an equitable and sus tainable basis
- Allocation and apportionment of water, based on the comprehensive and inte grated plans and optimum allocation prin ciples that incorporate efficiency of use, equity of access, and sustainability of the resources
- Managing and combating drought as well as other associated slow-onset of disas ters through efficient allocation, redistribu tion, transfer, storage and efficient use of water resources
- Combating and regulating floods through sustainable mitigation, prevention, rehabili tation and other practical measures
- Conserving, protecting and enhancing water resources and the general aquatic environment on sustainable basis.

3.2.1 Water Sector Development Program (WSDP)

The Water Resources Management Policy is one among the key policies emphasized in economic development policy. To realize policy objectives, strategies were formulated that have emanated directly from the sector development policy and are consistent in indicating the ways and means of concretely implementing the policy objectives.

The Government of Ethiopia has approached the formulation of the WSDP within an integrated policy and strategic framework. As water is multi-dimensional in nature, linkages with other sectoral policies and strategies (such as Disaster Prevention and Management, Energy, Health, and Conservation) have become inevitable and policies and since 1993, strategies that address this have been prepared and put into place. In addition, there is a legislative framework in place to provide support for these policies and strategies. More specifically, the principles put forward by the Ethiopian Water Resources Management Policy are explicitly linked to a broader policy framework at Regional and Federal levels. Similarly, the water policy has directly given rise to the National Water Strategy that in turn forms the basis for the development of the WSDP. It is crucial that these linkages between the various levels of policy and planning are explicit.

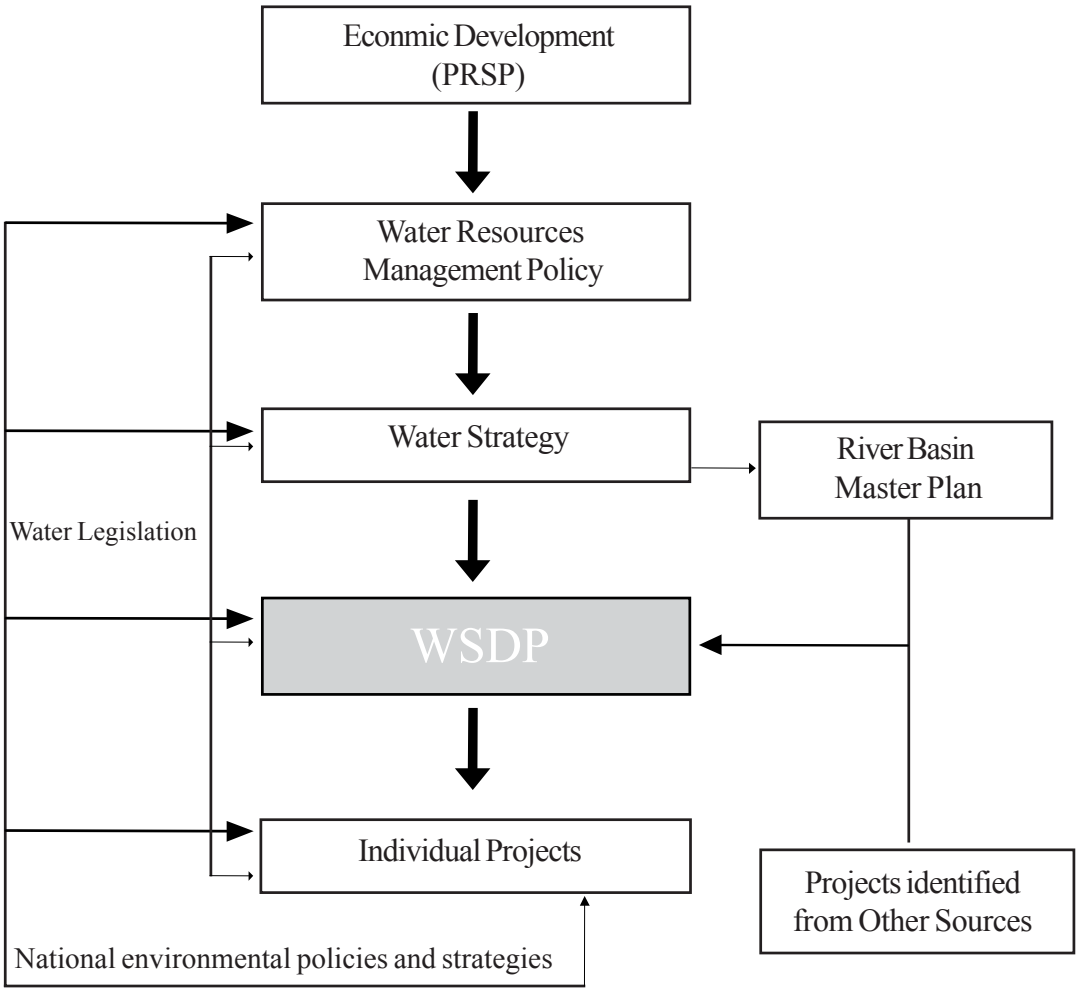
The WSDP is the instrument for implementing the water resources management policy. It follows the already identified and accepted strategy for water-resources management in the country. It identifies priority intervention areas in a 15-year time horizon and includes priority projects identified through various sources. Major list of projects came from river-basin master plans, where resource potentials and their priority areas for long-term (30-50 years) interventions are identified on

the basis of individual river basins. The WSDP, therefore, provides a fertile ground for the development of individual projects within its priority intervention areas.

3.2.2 Logical framework

A classical Integrated Water Resources Management (IWRM) framework, inter-alia, contains a national policy, strategy and legislation and an investment plan either at the national or basin level. Other important elements of the framework are coordination, financing and monitoring mechanisms for implementation, governance mechanisms to ensure transparency and accountability and a unique organization responsible for the entire framework. With the preparation of the WSDP, Ethiopia is about to complete the first part of the IWRM framework. At the same time, the WSDP provides guidelines as how to move ahead with the second part of the framework. Figure 3-1 explains the linkages between water resources management policy, strategy, program, projects and legislation (the first part of the framework).

Figure 3-1.
Linkage between water-resources management, policy, strategy, and legislation



3.3 Other sectoral development programs: lessons learned

The Ethiopian Government has so far designed and adapted 3 sectoral development programs: for public health, education, and roads. Those initiatives clearly demonstrate the commitment of the Government to improve social and economic services in the country. The major elements addressed in those sector development programs include:

- Reviews of the current situation and historical development of the sectors
- Issues, objectives and strategies related to the sectors
- Scope and physical targets over a specified planning horizon
- Financial plans and possible services
- Indicators for measuring progress towards achievement of objectives
- Implementation strategy
- Monitoring and evaluation.

The approach used in the development of these programs was basically the same. All reviewed their respective sector in relation to its status and historical development. They treated their programs as means to translate the respective policy into action. In the process of developing their sectoral program, they undertook continuous consultations with the major stakeholders. In the Health and Education sector they established a joint steering committee. In that committee the ministers of health and education as well as major donors in the sectors were represented. Such an arrangement helped to streamline activities pertinent to both sectors. The sectoral program envisaged sharing implementation and costs between the Federal and Regional Governments, users (communities and private sector), and external donors.

In the case of the *Road Sector Development Program (RSDP),* proceedings of the joint Government/ donors' conference emphasized the importance of following issues: (a) implementation capacity; (b) the speed of implementation vis-à-vis establishing the required capacity; (c) involvement of primary stakeholders; (d) private sector involvement in practical implementation; (e) establishing dedicated funding (like the Road Fund); and (f) institutional restructuring to facilitate program implementation. The WSDP has attempted to

Panel 3-1. Water and MDGs

The water sector is clearly and strongly related to those three sectors. For example, the provision of clean potable water will impact on public health by reducing the incidence of water-borne disease; as would the provision of urban and rural sanitation. The water plays key role in poverty eradication and securing basis for sustainable development. Addressing the connections between water and health programs is crucial to achieving the three main targets set under the Millenium Development Goals. First, halting by 2015 and beginning to reverse incidence of Malaria and other major diseases. Second, achieving a significant improvement in the lives of at least 100 million slum dwellers by 2020. Third, Halve, by 2015, the proportion of people without sustainable access to safe drinking water. Finally, achieving these targets will have a strong impact on achieving the overarching goals of reducing poverty and hunger. Therefore, it is important that both the formulation and implementation of WSDP should learn from the experiences gained in the implementation of these three sector development programs.

address all of the above issues in the current program formulation phase.

Review of the Education Sector Development Program (ESDP) suggests both positive and negative aspects. The positive aspects include: (a) strong ownership and commitment by the Federal Government; (b) involvement of Regional administrations; and (c) a spirit of partnership between the Government and participating agencies. The WSDP shares those 3 positive attributes with the ESDP. There are however some unresolved issues in the ESDP. There is a lack of policy dialogue between the Government and donors; additionally its implementation suffers from differences in donors' requirements and actual implementation arrangements. The issue of differences in donor requirements would apply equally for the WSDP. Again, dialogue and joint donor-recipient forums during the implementation phase could help solve the problem.

The Health Sector Development Program (HSDP) mid-term review (conducted in February 2001) raised operational problems that are not rooted in the program formulation process or in the broader framework of program implementation strategy. The review recommendations, nevertheless, underline the importance of continued monitoring of implementation problems and timely solutions. In particular, the following recommendations contained in the HSDP mid-term review report indicate some of the critical aspects of co-ordination and monitoring that are believed to influence the HSDP implementation.

- Improve the co-ordination between water supply, sanitation, hygiene promotion and information, education, and communication practices, because all those services fall under the responsibility of different institutions. The point would be to avoid duplication of efforts and wastage of meager resources.

- Establish 10 to 15 essential indicators that would help in monitoring HSDP implementation.

- Improved co-ordination between the donors, Ministry of Health, Regional Health Bureaus, and the Ministry of Finance is necessary to ensure timely and accurate disclosure on availability, flow, and disbursement of donor funds, so that non-treasury resources are fully included in budgets and that expenditures are properly accounted for.

Based on the review of the formulation process and implementation status of three sector development programs, the preparation of WSDP has attempted to align itself in line with the following considerations. The WSDP implementation strategy that is presented in this document also benefits from the lessons learned.

- A consultative and participatory approach during the preparation of WSDP is important in securing the participation and the commitment of all stakeholders right from the beginning.

- Strong coordination and implementation arrangements are required at the Federal, Regional, and local levels. The need for intersectoral implementation and coordination arrangements, involving different ministries, as well as the private sector, international development and financing institutions, and NGOs is likewise very important.

- WSDP must pace itself according to the implementation capacity of the executing institutions as well as the availability of funds in time and amount.

- Resource mobilization from various sources is the most critical aspect of implementing the program. Therefore, publicizing, promoting and seeking funds has to be started well in advance of pro

gram implementation and has to be a regu lar and continuous activity thereafter.

- Prioritizing the programs and projects - in the context of an investment strategy - is especially important in the case of lim ited financial resources.

Chapter 4 Methodological Approach

Preparation of the WSDP started, inter-alia, with the development of a methodological framework. This framework was discussed in a workshop that involved almost all the concerned stakeholders (institutions and individuals). The workshop resulted in a document which the participants agreed to use as a step-by-step guide in preparing the WSDP. The document described a set of procedures to prepare the WSDP, as well as the physical targets to be achieved in various subsectors. However, as it would become clear in the subsequent Chapters, this methodological framework has provided broad guidelines for the preparation of each subsectoral program but has not served as a blueprint in every instance. Adjustments had to be made where data has not been consistently available across subsectors or where the nature of the program has dictated otherwise.

4.1 The WSDP formulation process

At the beginning of this exercise, Regional Technical Committees (RTCs) were set up in all regions in order to give voice to regional preferences and priorities. Each RTC was composed of the chairpersons of the regional water, mines, and energy bureaus, health bureaus, and planning, agriculture, and irrigation commissions or authorities, as the case may be. Staff of the consulting firm (WWDSE) and the MoWR made repeated visits to the regions to explain the general aspects of the WSDP and discuss basic principles, approaches, and requirements from RTCs.

At the start of the process, the WWDSE prepared an inception report and presented it to the RTCs for discussion. A comprehensive questionnaire was distributed to the regions to obtain basic data and information. The results of that survey, together with the consultants' assessments, contributed to the finalization of a sectoral review report and helped in identifying regional priorities and preferences. Reviews of the National Economic Development Policy and Strategy as well as the Ethiopian Water Resources Management Policy helped to ensure that the WSDP was aligned with them. Development programs in other sectors (education, health, and road transport) were consulted for their relevant experience.

The consultative process at the regional and local levels was steered by the RTCs and, in this regard, a number of regional meetings or workshops were organized in each region. The staff of the MoWR, UNDP and WWDSE also attended many of these regional level meetings. At the national level, the consultative process consisted of two major workshops to review and comment on various outputs, namely, the methodological framework and the draft WSDP. Almost all stakeholders from the regions, Federal institutions, private sector, and international agencies participated in these workshops and contributed to the final results embodied in this report. In summary, what makes the WSDP unique, as compared to other sector development programs, is that it is based on an elaborated consultative process reflecting inputs ranging from international donors agencies to local level communities.

The MoWR as lead owner of the program provided technical guidance at all stages of the program preparation both to the regions as well as to the consultants engaged to execute this work. In view of the limited technical capacities of the regions, the UNDP provided technical assistance to the RTCs through a team of national consultants in defining and elaborating their water sector priorities, while UN DESA provided overall technical guidance and backstopping to ensure that project outputs met quality standards.

4.2 WSDP scope

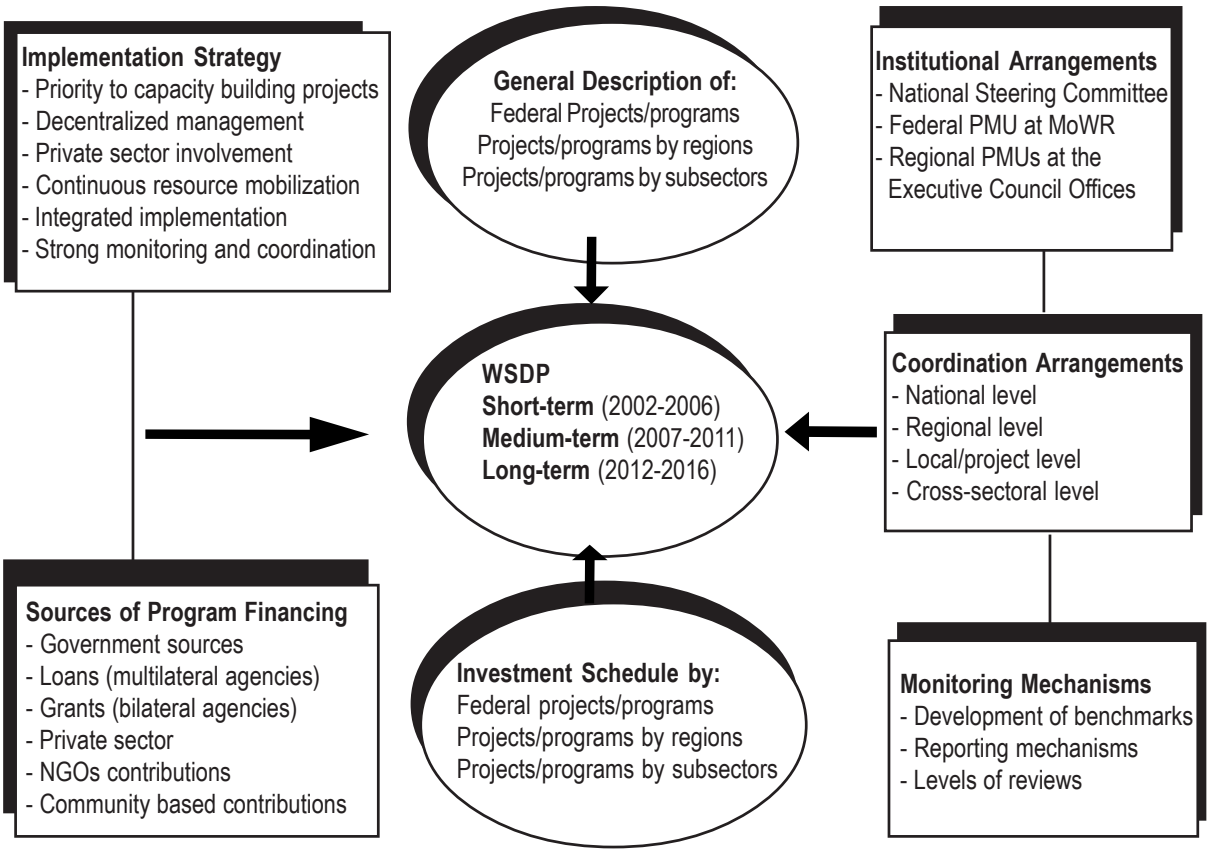
The WSDP consists of programs and projects grouped into the subsectors of irrigation, hydropower, water supply and sanitation, water resources, and institutional/capacity building aspects. The various programs and projects reflect local, regional, and national priorities in the water sector. Programs and projects have their respective investment schedules, implementation strategies, institutional and coordination arrangements, and monitoring and evaluation mechanisms. Figure 4-1 displays the scope and components of the WSDP, including its general strategy, process-related activities and inputs.

4.3 Main principles

The main principles that form the basis for development of the WSDP are derived from national water management policy. Those principles hold that the WSDP and its component programs and projects should:

- Be consistent with the national water policy and strategy.
- Align consistently with the national eco nomic development strategies and socio-economic development goals.
- Promote sustainable development and management of water resources.
- Use the "basin" as a conceptual unit in plan ning for development and management of water resources.
- Incorporate linkages with the ongoing and planned projects.
- Support the achievement of water related

Figure 4-1. Scope and Components of Water Sector Development Program



Millennium DevelopmentGoals.

4.3.1 Planning horizon

The planning horizon of the WSDP is 15 years and is divided into 5-year periods (short, medium, and long term). The time periods suit the existing practice of Federal and Regional institutions of setting 5-year plans. All WSDP programs and projects, as well as their respective investment schedules, comply with this planning horizon.

The plan for the short-term is presented in greater detail than those for the medium- and long-terms, because the short-term horizon coincides with those of existing Federal and Regional plans and has well-defined physical targets and budgetary requirements. The medium-term plan carries some projects from the short-term so it is comparatively better defined than the last 5-year term. The long-term plan is, for the time being, indicative and serves to outline the guiding vision for sectoral development.

4.3.2 Program priorities

The national and regional priorities reflected in the WSDP relate largely to: (a) developing water resources for different uses; and (b) meeting national and regional development objectives that reinforce prospects for successful WSDP outcomes. The WSDP focuses particularly on actions to:

- Make clean water available for drinking and sanitation.
- Make water available for livestock in nomadic and other special areas.
- Extend irrigation for agricultural development to the maximum possible.
- Expand generation capacity to meet hydroelectric power needs.
- Provide water for industrial development.
- Provide water for, among other uses, fisheries, tourism and transportation.

Within the above perspective, the highest priority is given to those programs and projects that:

- Are ongoing (with implementation expected to continue during the plan period) and for which most of the required investments are in place; and those in which efficiency in implementation could be significantly improved with little additional investment.
- Require rehabilitation and reactivation if they are malfunctioning or abandoned.
- Have been discontinued for various reasons (but still remain economically feasible).
- Have already been subject to appraisal and evaluation through feasibility studies and designs, and recommended for implementation (although the feasibility study and design may require updating).
- Are already being considered for possible funding.
- Have either been identified in master-plan studies or are recommended for backward or less developed areas, where there is a large population at risk as a result of drought and environmental concerns.
- Are small with short gestation periods, but will: (a) strengthen subsistence farming and provide social benefits directly (such as improved health conditions, employment opportunities, and income generation); and (b) enable women to participate as owners and operators.

- Are multipurpose in nature.
- Do not lead to unacceptable levels of environmental damage.
- Promote participatory approaches by includng gender issues in implementing, operating and maintaining, and monitor ing the schemes.
- Seek to build capacity as an important part of the project.
- Are favored as a result of political consid erations.
- Form part of the Nile Basin Initiative (NBI) and Eastern Nile Subsidiary Action Pro gram (ENSAP).

4.4 Logical steps and stages in WSDP preparation

Preparation of the WSDP followed 3 stages that are elaborated below: (a) planning stage; (b) identification and screening stage; and (c) evaluation and ranking stage. Program structure and activities were similar in the various Federal and Regional projects insofar as data and other requisites became available. Each stage entailed a few steps as is described below.

4.4.1 Planning stage

Step 1. *Making population projections:* Estimates of national population growth over the planning horizon were used in determining crop requirements at each of the 3 subperiods, at 3 levels of demand, based on long-term population growth as estimated by the Central Statistical Authority (CSA). In the short-term planning horizon (by mid-2006), the Ethiopian population is expected to increase from its current level of 65.26 million to 74.83 million; to 85.5 million in the medium term (by mid-2011); and to 96.34 million in the long-term (by mid-2016). The projected population serves as the basis for the targets to be achieved in different subsectors.

Step 2. *Setting targets:* Target-setting in various subsectors over different planning horizons was the next important step in preparing the WSDP. A baseline was established to reflect the existing development level or service coverage of each subsector. Past performance and experience helped in fine-tuning the target-setting process. The proposed targets were presented and discussed in a national workshop in which all stakeholders participated. The targets agreed in the national workshop were further reviewed and fine-tuned by the Ministry of Water Resources in the light of national considerations stemming from (a) inclusion of ENSAP projects in irrigation development; and (b) changes in service coverage for water supply and sanitation in certain regions. Targets finally agreed for various subsectors of the WSDP appear in the subsectoral program descriptions beginning with Chapter 5.

4.4.2 Identification and screening stage

Step 1. *Identifying projects:* Project identification involved assessing planning documents, previous studies, and other planned programs of Federal and Regional agencies, supplemented by the WWDSE database. To support this exercise, most of the regions prepared their own plans that served as an important source of information, besides promoting the sense of participation. After preliminary screening, the following project categories were identified and included among the WSDP projects.

(a) All projects being implemented or ready for implementation and having termination dates within the WSDP planning horizon.

(b) All projects already defined in the current national and regional 5-year development plans.

(c) All projects identified under various basin master-plan studies.

(d) Projects identified for those areas and regions not covered by the basin master-plan studies. (Such projects have been recommended by the regions during consultations and identified on the basis of the experience in conducting the comprehensive sector review.)

Step 2. *Screening projects:* Projects identified at step 1 were screened at 2 levels. At the first level, projects were retained if they were: (a) being implemented, and if their implementation would extend into the WSDP planning horizon; (b) listed in the current five-year plans; and (c) recommended by the Regional authorities or identified by WWDSE particularly for areas not covered in earlier basin master plans. At the second level, projects identified under master plan studies were considered but were to be screened and ranked. The outcome of this step was shortened list of projects.

4.4.3 Evaluation and ranking

Step 1. *Providing a uniform basis for the projects:* The costs of all projects in the final list were updated at this stage. Two cost-updating indexes or parameters were considered: the consumer price index (CPI) that measures the changes in the price levels of selected commodities; and the gross domestic product (GDP) deflator index that accounts for all goods and services produced in the national economy. The GDP deflator index was considered best suited to Ethiopian conditions. Availability of long-term data was also an advantage in this case (see table 4-1). Since project costs comprise local currency and foreign exchange components, local and foreign costs had to be updated separately. The following procedures were used.

Local costs. Three parameters were used in updating the local costs: (a) proportion of the local component of the project cost; (b) GDP deflator index; and (c) exchange rate variation factor (ERVF). For projects whose currency components were obtained from previous studies, costs were updated with the first option. For projects whose costs were not broken into line items or those that do not yet have cost estimates, experience with similar projects was used together with WWSDE estimates of the local and foreign components.

Foreign costs. Foreign components of the project cost were updated by taking into account the US dollar inflation rate in the price escalation of imported goods. A rate of 3 per cent per year was considered generally accurate. It was tested for accuracy in comparison with recent project

Table 4-1. Basic data and parameters used to update project costs

Year	GDP constant price	GDP current price	GDP deflator index
1980/1981	-	-	100.00
1985/1986	9,557	13,575	142.04
1986/1987	10,949	14,391	131.44
1987/1988	10,948	14,971	136.75
1988/1989	10,986	15,742	143.29
1989/1990	11,433	16,826	147.17
1990/1991	10,938	19,195	175.49
1991/1992	10,535	20,792	197.36
1992/1993	11,799	26,671	226.04
1993/1994	11,910	28,328	237.85
1994/1995	12,644	31,434	248.61
1995/1996	13,987	35,093	250.90
1996/1997	14,714	38,189	259.54
1997/1998	14,513	41,358	284.97
1998/1999	15,413	45,023	292.11
1999/2000	16,218	50,775	313.08

appraisal studies and found to be consistent.

Step 2. Evaluating and ranking: Identification of objectives and priorities for the WSDP led to the preparation of the criteria in table 4-2. The ranking index for each of the selected projects was calculated by assigning appropriate weights to different attributes of the evaluation criteria and the normalized values of the selected variables. The ranking was made for subsectors or individual projects for which the decision to implement must be economically justified.

Table 4-2. Evaluation and ranking

Criteria	Measure
Economic	Net present value; cost/benefit; internal rate of return;
Level of development	Per capita income
Social equity	Level of poverty
Environmental	Available parameter
Financial	Unit production cost; operations and maintenance cost

Finally, it should be noted that not all WSDP projects were evaluated and ranked using the above methodology. It was not possible because of data limitations and other factors guiding the development of different subsectors. In other words, this framework was used for projects if data on required parameters were available, as was the case with many of the large- and medium-scale irrigation projects. Water supply and sewerage services, small-scale irrigation, basic water-resources assessment, and capacity-improvement programs were selected for the WSDP on the basis of regional needs and targets agreed upon as a result of the consultative process.

4.5 Implementation responsibilities

After evaluation and ranking, the selected projects were listed according to whether they would be implemented as Federal projects, Regional projects, or projects with joint Federal and Regional Government responsibility.

Selected irrigation projects were to be implemented both at Federal and Regional levels. All small-scale and some medium-scale irrigation development projects were to be implemented at Regional level, while some medium-scale and all large-scale work would be executed at the Federal level.

Hydropower projects were also to be implemented both at Federal and Regional levels. Medium- and large-scale hydropower works were the responsibility of the Federal Government, while implementation of small-scale hydropower projects would be the responsibility of the Regional Governments.

Water supply and sanitation work in its entirety would be executed regionally. The subsectoral program has elaborated plans for each region for the whole WSDP planning horizon.

Water-resources assessment and establishment of hydro-meteorological monitoring network are national programs. However, meteorology projects would be implemented at the Regional level. When ready for execution, the plan for the subsectoral program can be relegated to Regional authorities. Institutional development and capacity-building requirements are framed at both Federal and Regional levels.

Section II

Sectoral Development Programs

Chapter 5 Water Supply and Sewerage Development Program

While water is universally acknowledged to be a basic need in sustaining life, only a minority of Ethiopians has access to potable water. Though urban areas receive better service than rural, only about 65 per cent of urban areas (excluding Addis Ababa) are covered, while only 15 per cent of rural areas receive water supplies. Sewerage is provided to a very limited extent. The need for planning and implementing the Water Supply and Sewerage Development Program (WSSDP) is self-evident.

5.1 Goals

The WSSDP aims to enhance the well being and productivity of Ethiopians by providing them, to the greatest possible extent, with clean, adequate and reliable water supply and sewerage services; and to also meet their needs for livestock, industry, and other uses as well. Accordingly, the WSSDP will make an important contribution towards achieving the Millenium Development Goal of, by 2015, halving the number of people who do not have access to sustainable safe drinking water.

Specific objectives in achieving this aim are to:

(a) Provide potable water to most of both the urban and rural population, and water for sewerage where conditions permit.

(b) Provide water for livestock, particularly in critical areas such as nomadic regions and drought-prone areas.

(c) Make water available for industrial development.

(d) Operate and maintain water supply and sewerage services on an efficient and sustainable basis, with effective management.

(e) Ensure protection and conservation of resources and control pollution and wast age, as part of management policy.

(f) Ensure sustainable resource develop ment through development of human re sources at all levels, legislation and the regulatory framework, and other appro priate means of capacity building.

(g) Promote stakeholders participation in the planning, design, implementation, rehabili tation, operation, and maintenance of water supply and sewerage schemes. The major stakeholders are the Federal and Regional executing institutions, the local communities, women, the private sector, and non-governmental organiza tions (NGOs).

5.2 Methodological considerations

Preparation of the WSSDP began with a sectoral review and consultations with all the regions to ensure in-depth understanding of relevant issues. The core objectives, principles, and priorities of WSSDP were defined. Analysis of issues and strategic choices provided the basis for program strategy.

Specific program targets were established and activities and projects were identified to achieve those planned targets. The standard methodology established for the entire WSDP was used in formulating the WSSDP: planning, target setting, identifying and screening, and evaluating and ranking the various projects and activities, with necessary adjustments as elaborated below. The interests of all stakeholders were considered in elaborating interventions proposed under the WSSDP.

5.2.1 Planning

The primary approach in planning and developing urban water-supply systems and rural water-supply facilities is to portray the system requirements in the short, medium, and long terms in order to facilitate preparation of cost estimates and investment requirements. For estimating purposes, the main components of urban and rural systems have been "dimensioned" at a level that permits costing in sufficient detail. Since the physical and financial requirements are different for urban and rural systems they were differentiated at this stage.

5.2.2 Target setting

Water supply and sewerage targets were set by region, taking into account regional population projections for urban and rural areas by the Central Statistical Authority (CSA). The WSSDP targets were set for the 3 sub-periods of the WSDP horizon, the starting point being existing coverage levels in each region. Previous capacities of the regions, particularly those of the latest 5-year development programs of Regional Governments, were considered in determining future targets. Region wise targets for the program period are presented in tables 5-1 through 5-3.

In planning and setting the WSSDP targets, program efforts are expected to be able to provide drinking water to practically the entire urban population in almost every region by 2016. As program capacity improves during the implementation stages of the WSSDP, it is expected that rural coverage will be extended. In order to achieve the target of 60-per cent coverage of the population by 2016, urban sewerage coverage is expected to be extended by approximately 3.5 per cent annually. These contributions will go far beyond the achievement of the relevant Millenium Development Goal.

5.2.3 General assumptions

The main assumptions in this exercise were:

(a) CSA population projections, based on the Population and Housing Census of 1994, provide a reasonable basis for estimating urban and rural water demand.

(b) Water requirements for livestock are pro jected on the basis of projected livestock numbers and water requirements per live stock unit. In the highlands, both domes tic and livestock water supplies are con sidered together. In the lowlands, particu larly the nomadic regions where the sources of water were ponds, separate arrangements for domestic and livestock were made.

(c) The industries are assumed to provide their own water. Where it was not possible, industrial water supply requirements were incorporated into the domestic supply.

Table 5.1 National water supply targets and population to be served

No.	Region	Existing Situation 2001			End of 2006			End of 2011			End of 2016		
		Total Populatio-n ('000)	Cover-age %	Pop. To be Served ('000)	Total Populat-ion ('000)	Covera-ge %	Pop. To be Served ('000)	Total Populati-on ('000)	Covera-ge %	Pop. To be Served ('000)	Total Populati-on ('000)	Covera-ge %	Pop. To be Served ('000)
1	Addis Ababa	2,570	70	1,799	2,973	95	2,824	3,418	100	3,418	3,883	100	3,883
2	Afar	1,243	16.5	205	1,389	32.6	453	1,540	48.8	752	1,695	65.1	1,103
3	Amhara	16,748	30.7	5,136	19,120	43.2	8,266	27,175	55.5	12,045	24,484	67.3	16,476
4	Benishangul Gumuz	551	20.3	112	625	40.5	253	706	52.5	371	791	64.5	510
5	Dire Dawa	330	59.5	196	398	70.6	281	474	92.0	436	555	97.8	543
6	Gambella	216	17.6	38	247	28.0	69	279	44.2	123	311	53.0	165
7	Harar	166	22.7	38	196	29.5	58	228	78.7	179	265	90.6	240
8	Oromiya	23,023	31.2	7,175	26,553	47.6	12,632	30,410	65.8	20,019	34,476	83.2	28,685
9	Somali	3,797	13.0	464	4,329	23.6	1,023	4,919	40.8	2,006	5,537	56.9	3,151
10	South (SNNPR)	12,903	28.6	3,691	14,902	38.3	5,709	17,035	50.2	8,548	19,247	71.3	13,725
11	Tigray	3,797	34.1	1,296	4,335	52.9	2,293	4,923	72.2	3,557	5,551	92.3	5,122
	National	65,344	30.9	20,180	75,067	45.1	33,862	85,647	60.1	51,453	96,795	76.0	73,604

Table 5.2 Urban water supply targets and population to be served

No.	Region	Existing Situation 2001			End of 2006			End of 2011			End of 2016		
		Total Urban Population ('000)	Urban Coverage %	Urban Pop. To be Served ('000)	Total Urban Populat-ion ('000)	Urban Coverage %	Urban Pop. To be Served ('000)	Total Urban Populati-on ('000)	Urban Coverage %	Urban Pop. To be Served ('000)	Total Urban Populati-on ('000)	Urban Coverage %	Urban Pop. To be Served ('000)
1	Addis Ababa	2570	70	1799	2973	95	2824	3418	100	3418	3883	100	3883
2	Afar	103	44	45	126	59	74	154	74	114	186	90	167
3	Amharas	1759	96	1689	2195	99	2173	2754	100	2754	3411	100	3411
4	Benishangul Gumuz	50	43	22	62	63	39	77	73	56	94	83	78
5	Dire Dawa	239	68	163	296	78	231	362	100	362	435	100	435
6	Gambella	37	35	13	47	45	21	59	60	35	71	80	57
7	Harar	101	25	25	122	25	31	146	92	134	173	100	173
8	Oromiya	2782	75	2114	3523	84	2959	4432	100	4432	5520	100	5520
9	Somali	586	46	270	735	56	412	917	66	605	1133	76	861
10	South (SNNPR)	1008	83	837	1277	95	1213	1604	100	1604	1991	100	1991
11	Tigray	651	59	384	816	87	710	1019	100	1019	1262	100	1262
12	Urban National	9,886	74.4	7,360	12,172	87.8	10,687	14,942	97.3	14,534	18,159	98.2	17,838

Panel 5-1. Sources of rural water supply

Most of the domestic water supply in rural areas comes from groundwater sources. The total available groundwater in the country is not yet known with certainty. Rural communities mostly use unprotected springs and hand-dug wells. Other groundwater sources for some communities include shallow-drilled wells, deep-drilled wells, birka, ponds, lakes, streams, and rivers. Roof water-harvesting techniques are used to capture rainwater when there is rain.

Open wells are apt to become polluted. They also often run dry during drought periods when groundwater levels drop. Consequently, water must be carried long distances through much of the year, invariably by the women and children of the household. Improving this extremely low level of service in rural areas requires an enormous amount of work.

Hand-dug wells with hand pumps are relatively large in diameter. They may be up to 20 to 25 m deep and covered with concrete lids. Springs can be developed at source or channeled to point of use by gravity flow. Shallow-drilled wells are not more than 60 m deep and are operated with hand pumps. Deep-drilled wells are about 100 to 120 m deep and operated with submersible pumps and small piped systems.

Each type of facility is used by a certain number of users that is assumed to be high initially and to become lower after some time when they can afford more units. Table 5-4 shows estimated numbers of users per type of spring- or well-water facility for the three WSSDP plan periods.

Table 5-4 Estimated numbers of users per type of rural water source

Facility/Source	Planning Horizon	Service Level
1. Hand-dug Wells +HP	Short-term (2002 -2006) Medium-term (2007 - 2011) Long-term (2012 - 2016)	600 - 500 500-400 400-300
2. Spring Development	Short-term (2002 -2006) Medium-term (2007 - 2011) Long-term (2012 - 2016)	800 - 700 700-600 600-500
3. Shallow Wells	Short-term (2002 -2006) Medium-term (2007 - 2011) Long-term (2012 - 2016)	900 - 800 800-700 700-600
4. Deep Wells	Short-term (2002 -2006) Medium-term (2007 - 2011) Long-term (2012 - 2016)	1500 - 1200 1200-1000 1000-800

(d) Where conditions permitted, springs and wells were considered to be the sources of water for both urban and rural supply in order to avoid the need for water treatment.

The above general assumptions branched off to several secondary but specific assumptions, providing additional insights as to how water demands for different uses were estimated. These assumptions are discussed in the succeeding section.

5.2.4 Estimating urban and rural water demands

Communities with a population of at least 2,500 in the base year 2001 were considered urban. Also, regional, zonal, and woreda capitals were automatically classified as urban communities irrespective of their population. Urban communities were further categorized as: (a) large towns, with a population equal to or greater than 50,000; (b) medium towns, with a population equal to or greater than 10,000 and less than 50,000; and (c) small towns, with a population equal to or greater than 2,500 and less than 10,000.

Urban water demand was projected by estimating: domestic water demand (for residential units); commercial and institutional water demand (for commercial and public institutions); and industrial water demand (for industrial establishments).

Rural areas were defined as those having a population of less than 2,500 in the base year 2001. Rural water demand was calculated using the derived population projections of selected woreda, and demand for livestock watering. No allowance was made for commercial, institutional, and industrial water demand in rural water-demand projections.

Domestic water demand (DWD): Daily per capita water consumption is generally very low throughout the country. DWD is suppressed in almost all towns in the country because of supply shortages. Actual demand is expected to be greater than present consumption if greater supplies were available to the community.

In estimating DWD, general design standards were adopted: 30 to 50 liters per capita daily (lpcd) for urban centers and 15-25 lpcd for rural areas. For both rural and urban areas, the per capita water demand is assumed to increase over the program period. Since the majority of the urban population uses public fountains, a ratio of 60 per cent (of public fountain) to 40 per cent (of house or yard connections) is assumed.

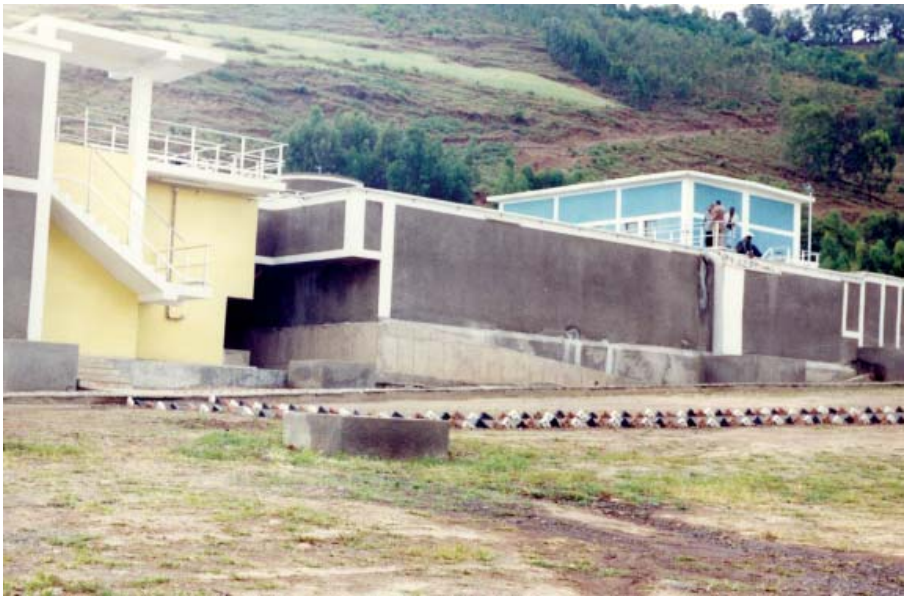
The urban DWD per day is thus projected as being: 30 lpcd for short term, 40 lpcd for medium term and 50 lpcd for long term. Similarly for rural water supply, the daily DWD is projected as being: 15 lpcd for short term, 20 lpcd for medium term and 25 lpcd for long term. Water demand for small towns (with fewer than 10,000 inhabitants) was estimated applying the rural standard.

Commercial and institutional water demand (CIWD): In addition to those of household consumers, the water requirements of towns include the needs of such commercial and institutional consumers as public schools, clinics, hospitals, offices, shops, bars, restaurants, and hotels. CIWD is usually linked directly to population size. For small- and medium-sized towns, it was estimated at 5 per cent of the DWD. For larger towns, the CIWD estimate was 10 per cent of DWD. Those allowances were applied to all towns. No allowances were made for CIWD from rural communities.

Industrial water demand (IWD): For planning purposes, a reliable IWD indicator was assumed to be the following percentages of DWD: 30 per cent of DWD in large and medium towns; and 10 per cent of DWD in small towns. Those allowances should cover all water uses for large, medium, and light industrial units. As far as possible, large- and medium-sized industries are assumed to provide water supply from own sources. No IWD al-

Table 5-3. Rural water supply targets and population to be served

No.	Region	Existing Situation 2001			End of 2006			End of 2011			End of 2016		
		Total Rural Population ('000)	Rural Coverage %	Rural Pop. To be Served ('000)	Total Rural Populat-ion ('000)	Rural Coverage %	Rural Pop. To be Served ('000)	Total Rural Populati-on ('000)	Rural Coverage %	Rural Pop. To be Served ('000)	Total Rural Populati-on ('000)	Rural Coverage %	Rural Pop. To be Served ('000)
1	Addis Ababa												
2	Afar	1140	14	160	1263	30	379	1386	46	638	1509	62	936
3	Amhara	14989	23	3447	16925	36	6093	18961	49	9291	21073	62	13065
4	Benishangul Gumuz	501	18	90	563	38	214	629	50	315	697	62	432
5	Dire Dawa	91	37	34	102	49	50	112	66	74	120	90	108
6	Gambella	179	14	25	200	24	48	220	40	88	240	45	108
7	Harar	65	19	12	74	37	27	82	55	45	92	73	67
8	Oromiya	20241	25	5060	23030	42	9673	25978	60	15587	28956	80	23165
9	Somali	3211	7	225	3594	17	611	4002	35	1401	4404	52	2290
10	South (SNNPR)	11895	24	2855	13625	33	4496	15431	45	6944	17256	68	11734
11	Tigray	3146	29	912	3519	45	1584	3904	65	2538	4289	90	3860
12	National Rural	55,458	23.1	12,820	62,895	36.8	23,175	70,705	52.2	36,919	78,636	70.9	55,765



lowance was made for rural communities.

Livestock water demand (LWD): The keeping of livestock is an integral part of rural community life, and water is an essential commodity for animals just as it is for humans. However, the use of improved domestic water sources for livestock is not encouraged. It is assumed that most of the animals will be watered from such natural sources as rivers, streams, lakes, ponds, and springs in the vicinity. If no such sources are available nearby for the livestock, the animals should be watered from cattle troughs sited below water sources for human consumption. In case potable water schemes are to be used for livestock watering, an allowance of 3 lpcd is made.

The water demand for livestock was estimated only for rural communities and small towns, in direct proportion with the human populations. Critical assumptions employed in the analysis were: (a) in the highland rural areas, the average daily LWD was considered to be 20 liters per livestock unit (LU), with an average of 1.7 l LU per person; and (b) in the lowland rural areas, the average daily LWD was considered to be 25 liters per LU, with an average of 3.0 LU per person.

While estimating LWD, relationship with size of population was captured as follows: (a) 60 per cent of the population in rural communities; (b) 30 per cent of the population of towns with fewer than 10,000 inhabitants; (c) 9 per cent of the population of towns with 10,000 – 50,000 inhabitants; and (d) 1 per cent of the population of towns exceeding 50,000 inhabitants.

System losses (SL): Losses from water supply systems vary considerably according to diverse factors. SL are a function of the quality of construction, the type and age of the pipes in the distribution network, and pressure within the system. SL can also originate in treatment plants. For *urban schemes*, SL equivalent to 25 per cent of the total domestic, commercial and institutional, and industrial water demand was assumed. For *rural schemes*, a nominal 5 per cent allowance was made to account for spillage at hand pumps. SL from treatment plants was considered negligible in rural areas, since groundwater sources supply most of the raw water there and the only treatment that might be required is disinfection.

Average daily demand (ADD): Urban ADD is considered to be the combined total of demand from domestic, commercial and institutional, industrial, and system losses. Rural ADD for water supply is the combined total of domestic demand, livestock demand and system losses.

Maximum daily demand (MDD): Daily water consumption in a town varies according to time of day, season, and climatic conditions. Within the entire country climatic conditions vary, although not to a wide extent. Variation in MDD is accordingly not very wide. To allow for increasing water consumption during the dry season, therefore, MDD was assumed to be 1.15 times the ADD for

Table 5-5. Urban water supply projects proposed under WSSDP

No.	Region	ST 2002-2006	MT 2007-2001	LT 2012-2016	Total
1	Addis Ababa				
	▪ Study and Design	2 Projects	1 Project	1 Project	4
	▪ Construction	1 Project	1 Project-	1 Project-	3
	▪ Rehabilitation	2 Projects			2
2	Afar				
	▪ Study and Design.	16 Towns	15 Towns	19 Towns	50
	▪ Construction	17 Towns	13 Towns	6 Towns	36
	▪ Rehabilitation & Expansion	7 Towns	4 Towns	10 Towns	21
3	Amhara				
	▪ Study and Design	36 Towns	43 Towns	5 Towns	84
	▪ Construction	28 Towns	53 Towns	6 Towns	87
	▪ Rehabilitation & Expansion	5 Towns	3 Towns	2 Towns	10
4	Benishangul-Gumuz				
	▪ Study and Design	9 Towns	4 Towns	5 Towns	18
	▪ Construction	8 Towns	4 Towns	5 Towns	17
	▪ Rehabilitation & Expansion				
	- Towns	8 Towns			8
	- Deep Wells	25 Wells	30 Wells	35 Wells	90
	- Shallow Wells	10 Wells	10 Wells1	10 Wells	30
	- Springs	10 Springs	10 Springs	10 Springs	30
	- HandDug Wells	25 Wells	25 Wells	25 Wells	75
5	Dire Dawa				
	▪ Sets of Site Study & Design in DD	1 set	1set	1 set	3
	▪ Rehabilitation and Expansion of DD W.S	5 BH	6 BH	2 BH	13
	▪ Rehabilitation and Expansion of Melka Jebdu W.S	1 Town			1
6	Gambella				
	▪ Study and Design				
	- Groundwater Study of Selected Area	1	-	-	1
	- Towns of W.S Study	5 Towns	-	-	5
	▪ Construction	7 Towns	-	-	7
	▪ Rehabilitation & Expansion	4 Towns	-	-	4
7	Harar				
	▪ Study and Design	-	-	1	1
	▪ Construction	1 Town	-	-	1
8	Oromiya				
	▪ Study and Design	77 Towns	65 Towns	-	142
	▪ Construction	46 Towns	109 Towns	-	155
	▪ Rehabilitation and Expansion	11 Towns	5 Towns	11 Towns	27
9	Somali				
	▪ Study and Design	10 Towns	8 Towns	2 Towns	20
	▪ Construction	4 Towns	16 Towns	3 Towns	23
	▪ Rehabilitation and Expansion	3 Towns		-	3
10	SNNPR				
	▪ Study and Design	Groundwater Study	Groundwater Study	Groundwater Study	
		39 springs	46 springs	48 springs	133
		43 water schemes	41 water schemes	46 water schemes	130
		21 Towns	18 Towns	-	39
	▪ Construction	18 Towns	25 Towns	-	
	▪ Rehabilitation and Expansion	5 Towns	-	-	43
					5
11	Tigray				
	▪ Study and Design	9 Towns	14 Towns	3 Towns	26
	▪ Construction	9 Towns	10 Towns1	9 Towns	28
	▪ Rehabilitation and Expansion	10 Towns	11 Towns	10 Towns	31

Table 5-6. Rural water supply projects proposed under WSSDP

No.	Region	ST 2002- 2006	MT 2007- 2001	LT 2012- 2016	Total
1	**Addis Ababa**	-	-	-	-
2	**Afar**				
	· Deep Well Drilling +SP	121	218	313	652
	· Hand Dug Wells + HP	136	367	547	1050
	· Spring Development	21	6	-	27
3	**Amhara**				
	· Deep Drilled Wells + SP	40	60	69	169
	· Shallow Drilled Wells + P	440	455	610	1505
	· Hand Dug Wells + HP	3530	3200	3750	10480
	· Spring Development	278	3475	3660	9915
	· Ponds & Root Water Harvesting	280	350	450	1080
4	**Benishangul-Gumuz**				
	· Deep Drilled Wells + SP	-	5	5	10
	· Shallow Drilled Wells + P	100	115	110	325
	· Hand Dug Wells + HP	200	165	125	490
	· Spring Development	15	5	10	30
	· Ponds + Roof Water Harvesting	5	5	10	20
5	**Dire Dawa**				
	· Deep Well Construction + SP	1	5	9	15
	· Shallow Wells + P	28	40	40	108
	· Spring Development	10	5	4	19
	· Cistern Construction	4	5	3	12
6	**Gambella**				107
	· Deep Wells + Pumps	38	32	37	149
	· Hand-Dug Wells + HP	52	46	51	127
	· Springs Development	35	44	48	
7	**Harar**				40
	· Shallow Wells + Pumps	15	10	15	36
	· Springs Development	13	10	13	53
	· Roof Water Harvesting	18	18	17	
8	**Oromiya**				
	· RWS Construction				
	· Deep Well Conductor + SP	500	650	850	2000
	· Shallow Well + P	800	1000	1100	2900
	· HDW + HP	2500	3500	3800	9800
	· Spring Development	500	800	900	2200
		200	350	600	1150
		155	120	235	510
		150	200	250	600
9	**Somali**				
	· Deep Well + SP	70	130	170	370
	· Shallow Well + P	70	110	140	320
	· HDW + HP	370	340	290	1000
	· Earth Dam + Sub-Surface Dams	10	15	20	45
	· River Intakes	15	20	25	60
	· Spring Development	20	25	25	70
10	**SNNPR**				
	· Water Well Construction				
	· Deep Well + Pump	232	300	400	932
	· Shallow Wells + Pump	362	629	500	1491
	· HDW + HP	509	350	400	1259
	· Spring Development	1182	1225	1300	3707
	· Improvements				
	· Deep Well	21	41	70	132
	· HDW	60	78	107	245
	· Spring Development	48	70	102	220
11	**Tigray**				
	· Construction of RWS for selected Villages	14	10	10	34
	· RWS construction for other rural areas	870	840	930	2640
	· Shallow Drilled Wells + Pumps	910	1000	1200	3110
	· HDW + HP	350	380	395	1125
	· Spring Development				

Table 5-6. Rural water supply projects proposed under WSSDP*...continued*

No.	Region	ST 2002- 2006	MT 2007- 2001	LT 2012- 2016	Total
9	**Somali**				
	· Deep Well + SP	70	130	170	370
	· Shallow Well + P	70	110	140	320
	· HDW + HP	370	340	290	1000
	· Earth Dam + Sub-Surface Dams	10	15	20	45
	· River Intakes	15	20	25	60
	· Spring Development	20	25	25	70
10	**SNNPR**				
	· Water Well Construction				
	· Deep Well + Pump	232	300	400	932
	· Shallow Wells + Pump	362	629	500	1491
	· HDW + HP	509	350	400	1259
	· Spring Development	1182	1225	1300	3707
	· Improvements				
	· Deep Well	21	41	70	132
	· HDW	60	78	107	245
	· Spring Development	48	70	102	220
11	**Tigray**				
	· Construction of RWS for selected Villages	14	10	10	34
	· RWS construction for other rural areas	870	840	930	2640
	· Shallow Drilled Wells + Pumps	910	1000	1200	3110
	· HDW + HP	350	380	395	1125
	· Spring Development				

Table 5-7. Livestock water supply projects proposed under WSSDP

No.	Region	ST 2002- 2006	MT 2007- 2001	LT 2012- 2016	Total
1	**Afar Region**				
	· Study and Construction of Stock Ponds				
	- Zone I	30	47	50	127
	- Zone II	48	75	90	213
	- Zone III	12	31	40	83
	- Zone IV	30	51	60	141
	- Zone V	30	51	60	141
	Total	150	255	300	705
2	**Gambella**				
	· Birkas and Ponds	35	42	49	126
3	**Oromiya**				
	· Birkas and Ponds	754	925	870	2549
4	**Somali Region**				
	· Cisterns/Ponds	1040	2200	2300	5540
5	**SNNPR**				
	· Construction				
	· Spring Development	23	8	-	31
	· Shallow Wells	87	22	15	124
	· Hand-dug Wells	91	21	14	126
	· Cattle Trough	156	42	29	227
	· Washing basin	18	3	-	21
	· Deep wells	5	-	-	5
	· Pond Construction	5	2	-	7
	· Rain water Harvesting	3	-	-	3
	· Rehabilitation				
	· Deep Well	17	-	-	17
	· Hand-dug Well	25	4	-	29
	· Pond	20	2	-	22

Table 5-8. Urban sanitation works proposed under WSSDP

No.	Region	ST 2002- 2006	MT 2007- 2001	LT 2012- 2016	Total
1	**Addis Ababa (A.A)**				
	· AA Sewerage Project	√			√
	· AA Sewerage Project, Component Ⅱ	√			√
	· AA Sewerage Project, Section Ⅲ		√	√	√
2	**Afar**				
	· Study and Design of US Projects	5 towns			5 towns
	· Construction of US Facilities	-	2 towns	3 towns	5 towns
3	**Amhara**				
	· Study and Design of Urban Sanitation	2 towns	3 towns	2 towns	7 towns
	· Construction of Urban Sanitation	1 town	3 towns	2 towns	6 towns
4	**Benishangul-Gumuz**				
	· Study and Design of Urban Sanitation	2 lge towns 7 sml towns	2 lge towns 8 sml towns	- 5 sml towns	4 lge towns 20 sml towns
	· Construction of WS Projects	- 5 sml towns	3 lge towns 6 sml towns	1 lge towns 7 sml towns	4 lge towns 18 sml towns
5	**Dire Dawa**				
	· Study and Design of DD Projects	1	-	-	1 town
	· Construction of DD Sanitation System	-	1	-	1 town
6	**Gambella**				
	· Study and Design of US	4 towns	-	-	4 towns
	· Construction of System	-	2 towns	2 towns	4 towns
7	**Harar**				
	· Study & Design of Harar Sanitation	1	-	-	1 town
	· Construction of Harar Sanitation System	-	1	-	1 town
8	**Oromiya**				
	· Study & Design of Sanitation	2 towns	4 towns	1 town	7 towns
	· Construction of Sanitation System	-	4 towns	3 towns	7 towns
9	**Somali**				
	· US Study and Design	4 lge towns 9 sml towns	1 lge towns 10 sml towns	- 7 sml towns	5 lge towns 26 sml towns
	· US Construction	1 lge towns 5 sml towns	3 lge towns 11 sml towns	1 lge towns 10 sml towns	5 lge towns 26 sml towns
10	**SNNPR**				
	· US Study and Design	3 lge towns 5 sml towns	4 lge towns 9 sml towns	- 10 sml towns	7 lge towns 24 sml towns
	· US Construction	- 2 sml towns	3 lge towns 4 sml towns	3 lge towns 5 sml towns	6 lge towns 11 sml towns
11	**Tigray**				
	· US Study and Design	3 lge towns 4 sml towns	4 lge towns 4 sml towns	9 sml towns	7 lge towns 17 sml towns
	· US Construction	- 2 sml towns	3 lge towns 4 sml towns	4 lge towns 4 sml towns	7 lge towns 10 sml towns

Panel 5-2. Urban Sewerage

Sewerage is completely neglected countrywide. The urban sewerage situation gives serious cause for concern since coverage is extremely low. Since the urban population is increasing very rapidly, sewerage could become much worse during the current planning period. Present conditions harbor the threat of major epidemics. Development of sewerage facilities deserves equal emphasis with water supply systems. There are no piped sewerage systems in any towns except for a small and very limited system in the capital, Addis Ababa. Major problems of sewerage have not yet been very severely felt because towns are relatively small and poorly developed.

Conventional sewerage systems are expensive to establish and maintain. They should only be introduced in areas that can afford to support them, such as the central areas or high-income residential areas of large towns. Also, piped sewerage requires large volumes of water; so, where water flow is low, a piped system will not function effectively. An appropriate on-site sewerage technology has to be promoted for the lower income areas of the towns where water supply is distributed by public fountains and yard taps. Complementing such physical measures, health and hygiene education should extend and improve awareness about health hazards that threaten communities in the absence of proper sanitation.

Not all water that is consumed ends up as wastewater for disposal by sewerage systems. Some goes into cooking, washing, or watering gardens. Much is lost through evaporation. The amount of water lost depends on the standard of housing and traditional water uses. For instance, in high-income dwellings, water consumption is high and results in higher wastewater production than in low-income dwellings.

Feasibility studies have been conducted for water supply and sewerage requirements of some towns of various sizes. The results indicate that provision of piped sewerage systems for some of those towns is not feasible at present. The studies recommend the provision of public sanitary facilities and the promotion of on-site facilities for individual dwellings where the piped sewerage systems cannot be used. For larger towns, the installation of piped sewerage system has been recommended in the central areas of the towns, and on-site sanitary facilities to serve the majority of the residents.

Several alternative forms of sewerage technology are available. Each is appropriate under specific circumstances. Every method cannot be successfully applied in all situations. Several factors affect the choice of technology, among which are: (a) soil conditions that affect the ease of excavation, the stability of the walls of pits, and the ability of the soil to dispose of the liquid waste through seepage; (b) service standards of the water supply that affect the operation of the system with minimum water requirements; (c) type and density of buildings to be served; (d) socio-cultural characteristics of the communities to be served; and (e) environmental impact of the type of sewerage.

Several sewerage technologies can be used in urban centers. Technologies that require use of water are considered here that accord with national water policy. Some of them are suitable in urban applications in areas of low and medium density. Most of them do not require complicated construction and their costs are reasonable. In the Ethiopian economy and culture, the following technologies that use water are preferred. Therefore, future sewerage studies for towns should concentrate on: pour-flush toilets; septic tanks, soakage pits; sewer-connected PF toilets and septic tanks; conventional sewerage. Where water is not made available, ventilated improved pit (VIP) latrines are preferred. Proper disposal sites and off-site treatment facilities for sludge must be made, and trucks must be provided for emptying septic tanks.

all towns. The MDD sets the water requirements from the sources within the system. Thus, the water demand for each urban center was calculated according to the above formula.

Water demand for sewerage: Normally, to calculate the amount of wastewater that a sewerage system must dispose of, the practice is to multiply the water consumption in a town by a sewage contribution factor. For urban-area planning purposes, a factor of 80 per cent is applied.

5.3 Program description

The WSSDP has identified a series of projects to meet the targets set in section 5.2.2 above that were subsequently translated into water demands over different planning horizons using the framework described in the previous section. In line with the conditions described in the methodological framework, many of the WSSDP projects were those that were being or about to be studied or implemented, and ending within the program period; or already defined in the current national and regional 5-year plans. Some projects were identified under the various basin master plan studies. Others had been studied but shelved for various reasons. Several were identified in consultations with Regional Governments.

The WSSDP consists of projects for urban water supply, rural water supply, livestock water supply, and sewerage. The projects include mainly hand-dug wells, spring development, shallow-drilled wells, deep-drilled wells, stock ponds, birka, subsurface dams, water harvesting, conventional sewerage, pour-flush toilets, septic tanks, and other recommended technologies. Projects activities consist of study and design, construction, rehabilitation and expansion, and operation and maintenance. The proposed projects are listed in tables 5-5 through 5-8 for different planning horizons.

5.4 Investment requirements and priorities

Total investment requirements for the WSSDP are estimated to be US$2,935.8 million. Region wise investment requirements over different planning horizons are shown in table 5-9 for various components of the program. Of the total investment requirements, rural water-supply projects account for US$ 2,086 million (or 71 per cent of the total), urban water supply for US$ 819 million (28 per cent), and urban sewerage for US$ 30 million (1.1 per cent). These investment requirements would achieve the growth and coverage targets set for the WSSDP. Regional Governments will finance WSSDP projects along with international donors, NGOs, the communities involved, external loan sources, and the “water fund”, expected to be established.

If funds are insufficient to achieve the envisaged physical targets, the following guidelines may be used to prioritize the investment plan.

- National water policy gives priority to water supply and sanitation over irrigation, hydropower, flood control, and other uses, implying that allocation of funding would likewise favor water supply and sanitation. Within the WSSDP subsector, however, various options could be considered in coping with the funding shortages.

- Priority may be given to rehabilitation of existing water schemes before launching of new ones. And those that have already completed a feasibility study and design stage, and have been recommended for implementation.

- Among the new schemes, priority may be give to schemes with lower unit costs to implement, such as hand-dug wells, spring development, and shallow wells.

- Priority may be given to drought-prone areas, less-developed regions, nomadic areas, and areas with very high water scar city for human and animal consumption.

- Projects that are on-going and whose implementation is expected to continue during the WSDP period may be good candidates for inclusion in the priority list.

Table 5-9. WSSDP investment schedule (in US$ millions)

Region	Short-Term				Medium-Term				Long-Term				Grand Total
	UWS	RWS	US	Total	UWS	RWS	US	Total	UWS	RWS	US	Total	
Addis Ababa	182.97			182.97	224.55			224.55	140.25			140.25	547.77
Afar	9.50	13.37	6.40	29.27	5.77	23.23	0.88	29.88	4.28	32.55	0.94	37.77	96.92
Amhara	36.05	127.69	0.33	164.07	13.36	144.52	0.65	158.53	9.06	164.04	0.68	173.78	496.36
Benshangul Gumz	4.92	1.68	0.31	6.91	2.22	1.91	0.65	4.78	1.43	2.05	0.43	3.91	15.6
Dire Dawa	1.92	1.09	0.06	3.07	2.02	1.29	0.6	3.91	0.8	2.46	-	3.26	10.24
Gambella	7.12	3.84	0.05	11.01	0.50	6.95	0.28	7.73	0.60	7.95	-	8.55	27.29
Harar	28.5	1.02	0.08	29.60	1.00	0.72	0.39	2.11	8.77	1.04	0.08	9.89	41.60
Oromiya	31.18	185.94	0.14	217.26	49.10	246.34	1.88	297.33	4.00	296.46	1.31	301.77	816.36
Somali	3.02	49.40	1.75	54.17	4.04	92.88	2.45	99.37	0.63	104.42	0.97	106.02	259.56
SNNPR	4.66	101.09	0.68	106.43	20.00	134.37	2.73	157.10	3.67	138.43	1.4	143.50	407.03
Tigray	6.26	64.83	0.4	71.49	6.55	63.94	2.09	72.58	0.63	71.07	1.25	72.95	217.02
Total				**876.25**				**1057.85**				**1001.65**	**2935.75**
F/C				630.90				761.65				721.19	2113.74
L/C				245.35				296.20				280.46	822.01

Chapter 6 Irrigation Development Program

At the close of the last millennium, Ethiopia was irrigating fewer than 200,000 hectares (ha) of farmland, although a total of 3.7 million ha had been classified as potentially irrigable. This gross underdevelopment of capacity to grow food and industrial crops has spurred the Irrigation Development Program (IDP) to put an additional 273,829 ha under irrigation, an increase of 135 per cent of currently irrigated farmlands, within its 15-year plan period of 2002-2016.

6.1 Goals

The central role of irrigated agriculture within the context of poverty reduction is well understood in Ethiopia. Extreme poverty and hunger push people into marginal lands and more fragile ecosystems, characterized by drought stress and low soil fertility. Therefore, irrigated agriculture is important in stimulating sustainable economic growth and rural employment and is the cornerstone for food security and poverty reduction. Accordingly, the IDP is attempting to increase food production, leading to improvements in nutritional status and economic well-being, through the following specific objectives.

(a) Increase production of agricultural raw materials for industries and export.

(b) Develop capacities for planning, imple menting, and operating irrigation projects.

(c) Exploit land and water resources to en hance sustainability of agriculture and ru ral livelihoods.

(d) Reduce dependence on rain-fed water sources for agriculture and vulnerability to erratic rainfall patterns.

(e) Expand rural employment opportunities through increased agricultural activity.

6.2 Methodological considerations

6.2.1 Planning

The IDP is an effort to promote sustainable agricultural development. In this context, it determined the new areas of irrigated cropland that would be required to satisfy the demand for agricultural products from the projected population at the end of each of the three 5-year periods of program (i.e., 2006, 2011, and 2016). Population projections by the Central Statistical Authority were used in estimating national demand for cereals, seed cotton, and sugar crops for three planning horizons. From those demand estimates, the expected crop production from rain-fed agriculture and areas already under irrigation was subtracted, yielding estimates of unmet demand. This is what poses the challenge for irrigation planners.

Table 6-1 presents the results of those calculations of unmet demand for crop production that translate into the need for new areas of irrigation. To meet its full cereal, fibre, and sugar requirements, Ethiopia would have to irrigate an additional 1.33 million ha of croplands in the short term, 1.56 million ha in the medium term, and 1.81 million ha in the long term.

In view of the existing and projected capacities (defined in terms of manpower needs, institutional requirements, and availability of financial resources), needs for major crops on that scale could never be met through expanded irrigation development within the planned time frame. Historical experience lends necessary support to this contention. The IDP, therefore, sets targets that are realistic and consistent with the objectives of the irrigation component of the current regional and federal development plan (2001-2005). These targets may appear to be overly ambitious if compared with past performances. However, they

Table 6-1. Project demand for cereals, cotton and sugar and estimates of required irrigated area over the planning horizon (2001-2016)

Year	Population (Million)	Incremental Demand (Million)						Total Irrigated Area Required (Million Ha)
		Cereals		Seed Cotton		Sugar		
		Tons	Ha	Tons	Ha	Tons	Ha	
2001	65.26	2.59	0.992	0.26	0.116	0	0	1.108
2006	74.83	3.62	1.117	0.49	0.194	0.210	0.019	1.330
2011	85.50	4.90	1.213	0.85	0.298	0.620	0.052	1.563
2016	96.34	6.25	1.250	1.41	0.441	1.420	0.118	1.809

appear to be more realistic when you take Ethiopia's strong commitment to bringing about a social revolution by reducing poverty. This commitment is deeply held and is based upon plans to utilize its resources in order to reduce continuous dependence on food-aid.

6.2.2 Target setting

The IDP has set the following average annual growth-rate targets for the development of irrigated area: (a) 4.5 per cent during the short-term period; (b) 5.5 per cent during the medium-term; and (c) 6.5 per cent during the long-term. These targets were set based on discussions held in a national workshop held to review and appraise the water sector targets, and subsequent consultations held between the Ministry of Water Resources and its consultants. These targets translate into irrigated area of 146,691 ha of large- and medium-scale irrigation schemes and 127,138 ha of small-scale irrigation schemes (table 6-2). According to these targets, new projects will add 273,829 ha to the 197,250 ha already under irrigation, resulting in a countrywide total of 471,079 ha of irrigated farmland by 2016.

Increases in agricultural production resulting from the new irrigation projects are expected to reduce the national cereals deficit by 11 per cent and the deficits in seed cotton and sugar crops by 24 per cent each. Those estimates are based on the assumption that 50 per cent of newly irrigated areas will be devoted to cereals and 50 per cent to cotton and sugar crops.

In the initial 5 years ("short term"), program activity will focus largely on small-scale projects and

Table 6-2. Targets for the Irrigation Development Program (2002-2016)

Description	Small-scale schemes	Large- and medium-scale schemes	Total area
Short-term 1st 5 years: (2002-2006):	40,319	13,044	53,363
Medium-term 2nd 5 years: (2007- 2012):	40,348	39,701	80,049
Long-term 3rd 5 years: (2012-2016):	46,471	94,729	141,200
Total area to be developed during 2002-2016:	127,138	147,474	274,612
Currently developed (approximate):	98,625	98,625	197,250
Grand total irrigated area by 2016:	225,763	246,099	471,862

Panel 6-1. Irrigation management in Ethiopia

Irrigation schemes in Ethiopia range in size from about 50 to 85,000 ha and are organized in 4 different ways:

- traditional small-scale schemes of up to 100 ha in area, built and operated by farmers in local communities
- modern communal schemes of up to 200 ha, built by Government agencies with farmer participation
- modern private schemes of up to 2,000 ha, owned and operated by private investors individually, in partnership, or as corporations
- public schemes of over 3,000 ha, owned and operated by public enterprises as state farms.

Small-scale: traditional communities. Traditionally, farmers have built small-scale schemes on their own initiative, with Government technical and material support. They manage them in their own users' associations or committees and irrigate areas of 50 to 100 ha, with the average ranging from 70 to 90 ha. A total of 1,309 such schemes existed in 1992, covering an estimated 60,000 ha.

Farm families use traditional systems in irrigating such crops as cereals, pulses, oilseeds, sugarcane, vegetables, fruits, and chat, over areas ranging from 0.2 to 0.5 ha. The average farm size for current planning purposes has been set at 0.25 ha.

Water users' associations have long existed to manage traditional schemes. They are generally well organized and effectively operated by farmers who know each other and are committed to cooperating closely to achieve common goals. Typical associations comprise up to 200 users who share a main canal or branch canal. They may be grouped into several teams of 20 to 30 farmers each. Such associations handle construction, water allocation, operation, and maintenance functions.

Small- to medium-scale: modern communal schemes. Normally the government constructs communal schemes with farmer participation for areas extending from 20 to 200 ha. Modern communal schemes were developed after the catastrophic drought of 1973 as a mean to improve food security and peasant livelihoods by providing for cash income through production and marketing of crops. There are 288 modern communal schemes in Ethiopia that are capable of irrigating a total of approximately 30,000 ha.

Modern communal schemes are generally based on run-of-river diversion of streams and rivers, and may also involve micro-dams for storage. Beneficiary farmers usually operate and maintain them through users' associations with, in some regions, on-farm support from zonal departments of agriculture and support for headworks and main canals by zonal departments of water, mines, and energy. Irrigation commissions or authorities provide technical support in such regions as Amhara, the Southern Nations Nationalities and Peoples Region (SNNPR), Oromiya, Tigray, and Affar.

Medium- to large-scale: private enterprise. Private estates pioneered the development of medium and large-scale irrigation projects in the Upper Awash region during the 1950s and 1960s. They were unexpectedly nationalized in the mid-1970s. During the 1990s some private schemes, mostly in the form of limited companies, re-emerged with the adoption of market-based economic policy but have expanded relatively slowly.

Currently 18 modern private irrigation projects are operating in some form over a total area of 6,000 ha. They are located in the Oromiya, SNNPR, and Affar regions.

Large-scale: public schemes. The history of public involvement in large-scale irrigation is relatively recent, having started late in the 1970s. Others, notably Gode West, Omo Ratti, and Alwero-Abobo, began late in the 1980s and early in the 1990s, but have not yet been completed. Most large-scale schemes, excepting the Finchaa Sugar Estate (currently operating successfully), have been suspended because public involvement was withdrawn as a result of Government changes. The recently issued water management policy has, however, committed the Federal Government to small- and large-scale project development in the new millennium.

Large-scale schemes being operated by public enterprises extend over an area estimated at 61,000 ha. Two regions, Oromiya and Affar, account for nearly 87 per cent of all public irrigation schemes, with 73 per cent being located in the Awash Valley. The SNNPR and Somali regions contain 9.9 and 3.3 per cent, respectively, of public schemes.

capacity building in the study, design, and implementation of projects. Work on medium- and large-scale projects will be developed increasingly during the second and third 5-year periods (the medium- and long-terms, respectively).

6.2.3 Project identification and screening

There are two types of schemes/projects that will contribute to the targets set under the IDP: small-scale irrigation development projects—SSIDP (to be implemented at Regional level) and large and medium scale irrigation development projects—LMSIDP (to be implemented at Federal/Regional levels). Figures regarding area to be developed under SSIDP were taken from the existing 5-year regional development plans, and are shown in table 6-3. The list also included projects those were supported by the International Fund for Agricultural Development (IFAD) and the French Agency for Development (AFD) and those built by non-governmental organizations (NGOs). These projects were not screened or evaluated because they were already included in the short-term regional development plans.

Screening, however, became necessary because all the LMSIDP projects scheduled in the current 5-year development plans could not be included in the WSDP. Schemes in the inventory of master plans alone comprised 98 large- and medium-scale projects that have generally been studied at reconnaissance (pre-feasibility) or feasibility levels. A shortlist of 36 large- and medium-scale irrigation schemes for final selection was established using the following criteria:

(a) All previously suspended irrigation schemes took precedence over new projects and made the final selection; specifically, Omo Ratti, Alwero-Abobo, and Gode.

(b) All the Nile Basin Initiative (NBI) projects were included in the list. Most are multi purpose in nature. The irrigation compo nent of their budget was allocated for IDP purposes.

(c) All schemes with a benefit/cost ratio greater than 1, an internal rate of return (IRR) greater than 10 per cent, or a unit investment cost of US$ 9,500 per hectare or less were included in the list.

(d) Multipurpose projects included in the Hy dropower Development Program were also included in the list.

The above criteria yielded a short list of 36 large- and medium-scale projects that were subjected to an evaluation and ranking exercise, resulting in the final selection of 16 projects. Large-scale projects previously suspended during implementation, including Omo Ratti, Alwero-Abobo, and Gode also made it to the final list. (See table 6-4.)

6.2.4 Assumptions

The IDP incorporates the following assumptions in the relevant program components. Some specific assumptions used in estimating the cost of small-scale irrigation schemes are outlined in section 6.4.3.

(a) The average size of each small-scale scheme is between 70 and 90 ha.

(b) It was assumed that a larger number of small-scale schemes would be studied earlier, rather than during their successive stages.

(c) Three large-scale irrigation projects (Alwero-Abobo, Omo Ratti, and Gode) have feasibility documents as well as some design documents.

(d) The three groups of NBI irrigation projects (Humera, Didessa, and Anger-Nekemt projects) are considered for implementa tion.

(e) The Baro Right Bank (RB)/Baro Dam and the Upper Beles multipurpose schemes are to be studied to feasibility level.

6.3 Program description

6.3.1 Main IDP components

The IDP will be implemented by governmental agencies at the Federal and Regional levels. The Federal Government is responsible for the planning and implementation of LMSIDP. (The single exception in this latter category is the large-scale Gode project that is under implementation by the Somali Region.) Regional governments are responsible for the SSIDP. No interregional irrigation project has been identified.

Governmental agencies that are responsible for study, design, and implementation of small-scale schemes are regional water, mines, and energy bureaus and commissions for sustainable agricultural and environmental rehabilitation, together with their zonal branches. Operation and maintenance of irrigation schemes are coordinated by zonal departments of agriculture that also support agricultural production through, for example, extension services.

The main components of the IDP are:

(a) Construction of 23 large- & medium-scale irrigation projects and 1,606 small-scale schemes.

(b) Engineering design of 20 large- and me dium-scale projects and 1,729 small-scale ones.

(c) Feasibility studies of about 2,378 small-scale irrigation systems and 20 large- and medium-scale irrigation projects.

(d) Pre-feasibility studies of 13 large- and me dium-scale schemes.

(e) Reconnaissance studies of 3,415 small-scale schemes.

(f) Reappraisal and updating of the feasibility studies and designs of 3 large-scale schemes prior to implementation (Omo Ratti, Alwero-Abobo and Gode).

(g) Capacity-building and human-resources development at Federal and regional lev els.

6.3.2 Large- and medium-scale projects

With reference to table 6-4, the LMSIDP components of the IDP consist of 14 large-scale and 3 medium-scale projects that will be fully implemented over the 15-year time frame. In the short-term period 13,044 ha of those projects will be completed (Omo Rati and Koga project). In the medium term, implementation of four large and two medium scale schemes will lead to the development of 34,236 ha of irrigated area. Schemes include: Alwero Abobo, most of Gode West, small part of Gode South, Koga, Megech, Nargii Beach, and Azena/Ayo. By the end of the long term, the remaining 70,676 ha are targeted for completion. Work on NBI projects to develop 29,518 ha of irrigated farmland will be only partially executed by 2016.

6.3.3 Small-scale projects

The regional governments have clearly defined their SSIDP activities for the short-term period, but have yet to define their medium- and long-term period activities. Also, their annual implementation schedules have not yet been set.

Most regional programs have already listed their small-scale irrigation schemes according to the level of study. Table 6-5 presents a summary list

Table 6-4. Regional Targets for IDP small-scale projects

		Short-Term (2002-2006)			Medium-Term (2007-2011)			Long-Term (2012-2016)		
No.	**Region**	Schemes	Area (Ha)	Beneficiaries	Schemes	Area (Ha)	Beneficiaries	Schemes	Area (Ha)	Beneficiaries
1	Tigray	38	3,680	14,720	37	3,600	14,400	42	4,028	16,100
2	Afar	3	500	2,000	3	617	2,468	3	570	2,250
3	Amhara	107	9,711	38,307	104	9,500	38,000	118	11,250	45,000
4	Oromiya	122	9,422	35,900	121	9,400	37,600	133	11,750	47,000
5	Somali	3	500	2,000	4	500	2,000	4	500	2,000
6	SNNPR	172	10,685	42,100	165	10,000	40,000	171	11,383	45,500
7	Benshangul	7	706	2,824	6	600	2,400	6	600	2,400
8	Gambella	5	500	2,000	5	500	2,000	5	500	2,000
9	Harar	2	200	800	2	200	800	2	200	800
10	Dire Dawa	3	300	1,200	6	381	1,524	5	351	1,400
11	Addis Ababa	38	615	2,460	-	-	-	-	-	-
12	All (NGO-Supported)	46	3,500	14,000	58	5,050	20,000	60	5,339	21,350
	Total	546	40,319	158,311	511	40,348	161,192	549	46,471	185,800

Table 6-4. Large and medium-scale projects selected for the IDP

No	Name of Project	River Basin	Region	Net Area (Ha)	Invest. Cost in 001 (MUS$)	Invest. Cost/ha in 2001(MUS$)	O$M Cost in 2001 (US$/ha)	B/C Radio	IERR (%)	Score	Rank
	Feasibility Study:										
1	Alwero Abobo	Baro-Akobo	Gambela	10,400	97.0	9,327	81	-	11.4	1.65	5
2	Omo Ratti	Omo Gibe	SNNPR	8,700	35.4	4,070	115	-	19.1	2.52	1
3	Koga	Abbay	Amhara	6,000	49.3	8,216	109	-	17.4	2.52	1
4	Dabus	Abbay	Benshan-gul-Gumuz	4,335	19.4	4,470	67	-	10.0	2.17	2
5	Gode	WabeShebele	Somali	15,200	110.6	7,279	137	-	8.6	1.68	4
	Pre-Feasibility:										
6	Ribb	Abbay	Amhara	15,045	150.0	9,971	81	0.56	6.2	2.21	6
7	NE Lake Tana	Abbay	Amhara	3,903	24.1	6,168	170	1.17	13.0	2.27	4
8	Megech	Abbay	Amhara	10,018	43.2	4,311	114	1.80	19.6	2.49	3
9	Gilgel Abbay 5	Abbay	Amhara	1,994	11.7	5,880	92	-	13.4	2.57	2
10	Upper Guder	Abbay	Oromia	3,559	14.5	4,076	62	1.50	16.3	2.25	5
	Reconnaissance Study:										
11	NW Lake Tana	Abbay	Amhara	6,720	50.8	7,562	170	-	-	2.13	7
12	Gumara	Abbay	Amhara	13,776	102.0	7,401	116	-	-	2.20	5
13	SW Lake Tana	Abbay	Amhara	5,132	43.0	8,382	128	-	-	2.24	4
14	Tis Abbay Pump	Abbay	Amhara	4,132	30.9	7,478	118	-	-	2.30	3
15	Dipa Hayk	Omo	SNNPR	5,880	23.9	4,070	115	-	19.1	2.52	1
16	Nargi Beach	Omo	SNNPR	2,070	8.4	4,070	115	-	19.1	2.52	1
17	Azena/Ayo	Abbay	Amhara	1,092	8.5	7,782	102	-	-	2.35	2
	Total:			117,956	822.7						

Table 6-5. Small-scale irrigation schemes in the IDP, by level of study

Project Study Level	Region															
	Tigray		Afar		Amhara		Oromia		SNNPR		Bensha-ngul		Dire Dawa		Total	
	#	Ha	#	Ha	#	Ha	#	Ha	#	Ha	#	Ha	#	Ha	#	Ha
Design	41	1149	3	617	77	5826	7	292	11	1380	-	-	-	-	139	9264
Feasibility	-	-	-	-	-	-	1	25	-	-	1	60	4	186	6	271
Reconnaissance	3	N.A.	3	530	201	16436	-	-	13	1490	27	1615	3	N.A	250	20071
Total	44	1149	6	1147	278	22262	8	317	24	2870	28	1675	7	186	395	29606

of projects by level of study for 7 regions. The 3 regions of Somali, Gambella, and Harar have no studied schemes.

A countrywide total of 395 schemes covering a combined area of 30,000 ha may be noted in table 6-5. Of that total, 139 schemes with a combined area of 9,264 ha have been designed, while most of the remaining 256 schemes (20,736 ha) are still at reconnaissance stage.

Most regions thus have a considerable number of projects designed and prepared in advance of the short-term implementation period. With two thirds of listings being concentrated in Amhara, however, the regional distribution of the schemes appears uneven, suggesting that the other regions must complete their project preparation and design in order to meet requirements of the WSDP.
.

6.4 Investment requirements and priorities

Investment requirements for the IDP are presented at four levels: national, federal, regional, and short-term projects included in the regional plans.

6.4.1 National-level investment plan

A summary of the national investment requirements for IDP is presented in table 6-6. The figures combine totals of Federal large- and medium-scale projects in the LMSIDP and regional small-scale projects of the SSIDP. Total investment requirements are estimated to be US$ 1,683.1 million. The short-term plan will cost US$ 307.9 million (18 per cent), while investment requirements in the medium- and long-term plans will be US$ 456.9 million (27 per cent) and US$ 956.8 million (55 per cent), respectively. The foreign currency component will represent a little over 50 per cent of the total investment requirements. Investment priorities of the Federal Government regarding development of irrigation systems reflect economic and other policy priorities. The hierarchy of investment priorities is listed in table 6-7 and categorized as follows:

- The Federal Government attaches the highest priority to the regional SSIDP projects, given the importance of the cur rent Poverty Reduction Strategy for the country. The Region-based SSIDP aims to provide irrigation over 127,138 ha for an investment of US$ 599.4 million.

- Second in priority for investment consid eration, reflecting the Federal Government's international commitments, are the NBI irrigation projects (of the ENSAP), with an area of 84,112 ha for an investment of US$ 686.8 million.

- Three suspended national schemes have third place in priority, covering 34,300 ha in area for an investment of US$ 220.4 million. (In discussions about that position in the hierarchy of priorities, it has been argued that the three "suspended schemes" should precede the ENSAP schemes because they are more cost-effective.)

- Fourth priority goes to other LMSIDP schemes that will be implemented over 29,062 ha for an investment of US$ 166.6 million. The Federal LMSIDP investment plans were based on the schemes listed in table 6-4.

- Last but not least, a study of two multipur pose schemes to cover 124,626 ha will be undertaken at a cost of US$ 10.2 mil lion.

6.4.2 Federal-level investment plan (LMSIDP)

Table 6-8 presents the yearly investment schedule of Federal investment plan for the LMSIDP.

Table 6-6. Summary of national investments proposed for all irrigation development (US$ millions)

No.	Project Items	Short term (2002-2006)			Medium term (2007-2011)			Long term (2002-2016)			Program Total (2002-2016)		
		Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C
1	**Federal Projects**	114.7	64.4	50.1	268.1	160.6	107.5	700.9	420.5	280.4	1,083.7	645.7	438.0
1.1	Implementation Studies & designs	90.6	48.7	41.9	223.0	133.6	89.4	686.7	412.0	274.7	1,000.3	594.3	406.0
1.2	a) Program Scheme	8.0	6.2	1.8	16.3	9.7	6.6	4.3	2.6	1.7	28.6	18.5	10.1
	b) Nile Initiative Schemes (W/o Tana Shores Schemes)	16.1	9.7	6.4	28.8	17.3	11.5	-	-	-	44.9	27.0	17.9
	c) Multi-purpose Schemes	-	-	-	-	-	-	9.9	5.9	4.0	9.9	5.9	4.0
2.	**Regional Projects**	193.2	74.8	118.4	188.8	73.0	115.8	217.4	84.1	133.3	599.4	231.9	367.5
2.1	Implementation	188.3	74.3	114.0	184.0	72.5	111.5	211.9	83.5	128.4	584.2	230.3	353.9
2.2	Studies & Designs	4.9	.05	4.4	4.8	.05	4.3	5.5	0.6	4.9	15.2	1.6	13.6
	Total	307.9	139.4	168.5	456.3	223.6	223.3	918.3	504.6	413.7	1683.1	877.6	805.5

Table 6-7. Summary of national investments by type of project

Program / Project	Area (Ha)	% of Total Area	Investme-nt (MUS$)	% of IDP Investment
Regional SSIDP	127,138	46.43	599.4	35.6
Nile Basin Initiative: 6-schemes of Tana Shores 6- Other NBI schemes	84,112 (54,594) (29,518)	30.63 (19.88) (10.75)	686.8 (413.4) (273.4)	40.8 (24.6) (16.2)
3 Suspended Schemes	34,300	12.58	220.4	13.1
7 Other LMSID Projects	29,062	10.58	166.6	9.9
2 Multipurp. Sch. (Studies)	(124,626)	-	10.2	0.6
Total	274,612	100.0	1,683.1	100.0

The plan calls for total investment of US$ 1,114.3 million over the 15-year IDP. The requirements in the 3 program periods are US$ 114.4 million in the short-term, US$ 260.5 million in the medium-term, and US$ 739.4 million in the long-term. The foreign currency component makes about 60 per cent of that investment figure, or US$ 664.1 million. That component includes study, design, and construction works.

Unit costs of 2001 were used in estimating LMSIDP investment requirements. Unit costs were assumed to include all cost components except training and capacity building, which are accounted for under “Institutional Aspects” of the WSDP (Chapter 9). Investment cost component was assumed to include all construction costs and the costs of reconnaissance surveys.

The costs of pre-feasibility and feasibility studies, surveys, and investigations were assumed to represent as 1.5 per cent of the total construction costs. The research and data collection costs constituted as 1 per cent; engineering design as 4 per cent; construction supervision, management, and monitoring and evaluation as 7.5 per cent; and physical and price contingencies as 15 per cent.

In the short-term period of the IDP (2002-2006), the following projects or activities will be implemented concurrently:

(a) Omo Ratti and Koga projects (of 8,700 and 4,344 ha, respectively).

(b) Pre-investment tasks of the Alwero (10,400 ha), Gode (15,200 ha), Koga (6,000 ha), and Megech (10, 018 ha) projects, including study updating, design approval and completion, and tendering of the first 3 projects; and feasibility, design, and tendering of the last project. Also, 6 NBI/ENSAP projects will be studied to the feasibility level.

(c) Securing of financing for the implementa tion of the IDP.

(d) Human resource development—to be continued in the long-term.

During the medium-term period (2007-2011), 4 large-scale and 1 medium-scale irrigation projects (for a total of 32,166 ha) will be implemented. Project preparation, design, and tendering of 7 large-scale projects (for 51,287 ha) will be completed. Project design and tendering of 6 ENSAP projects (for 122,118 ha) will be executed and work

on the Humera project (for 5,465 ha) will commence.

The long-term period (2012-2016 ha) will see implementation of 10 large-scale and 1 medium-scale irrigation schemes (for a total of 71,963 ha) and the preparation, design, and tendering of 4 large-scale and 1 medium-scale projects. Other project work includes study of 2 large-scale multipurpose projects to the feasibility level, starting implementation of 5 ENSAP projects (for 16,518 ha), and continuation of construction of the Humera scheme (for 10,000 ha).

6.4.3 Regional-level investment plan (SSIDP)

Table 6-9 presents the regional investment plan for the SSIDP. The plan proposes a total investment of US$ 599.4 million over the 16-year IDP, of which the foreign exchange component is US$ 231.9 million (almost 39 per cent of the total). The requirements in the 3 program periods are US$ 193.2 million in the short term, US$ 188.8 million in the medium term, and US$ 217.4 million in the long term.

A number of assumptions were employed in arriving at the estimates of the SSIDP. These assumptions are listed below.

Exchange rate: The exchange rate used in estimating SSIDP costs for the short-term development period is US$ 1.00 = Birr 8.30. That was the prevailing rate when regional plans were prepared. For the medium- and long-term periods, the exchange rate is that which prevailed during the first week in June 2001, i.e., US$ 1.00 = Birr 8.44.

Unit investment cost: Small-scale irrigation schemes generally utilize surface-water resources. In some regions, such as Tigray, a few schemes are based on groundwater resources. In this IDP, the assumption is that 40 per cent of the small-scale projects are being based on small earth storage dams and 60 per cent on run-of-river diversion weirs. With this premise, an average unit investment cost of about Birr 40,000 per hectare has been used in projecting the total investment cost for the medium- and long-term periods of the SSIDP.

Regions with no investment plans: In estimating the SSIDP costs for regions that have made no investment plans of their own, the weighted average base cost of the 4 regions having the greatest proportion of operations has been adopted in establishing costs for short-term programs. (Those regions are Amhara, the Southern Nations Nationalities and Peoples Region [SNNPR], Oromia, and Tigray.) The estimated base cost is calculated at Birr 31,274 per ha and total unit investment cost is calculated at Birr 37,216 per ha. To reflect the costs of new schemes, the estimate of Birr 5,000 per ha has been deducted from the base cost of every region that has a rehabilitation component in its program.

Cost composition: In the absence of cost breakdowns of the regional small-scale investment plans, the total investment costs are assumed to include all costs. These include costs of studies, designs, construction, machinery and equipment, labour, supervision and management, repairs and rehabilitation, and contingencies, as well as research, data collection, and monitoring and evaluation.

Since the cost component of training and capacity building is accounted for under “Institutional Aspects” of the WSDP, this component is omitted from the investment plan for the SSIDP. The distribution of costs as percentages of the base construction cost has been set as follows: study and design (3 per cent); supervision and management (4 per cent); data collection, research, and monitoring and evaluation (1 per cent); contingencies (10 per cent); and training and capac-

Table 6-8. Federal investment schedule for large and medium scale irrigation development, by project (US$ millions)

		Short Term (2002-2006)						Medium Term (2007-2911)						LongTerm (2007-2911)						Program Total(2007-2911)				1.
No	Project	02	03	04	05	06	F/C	07	08	09	10	11	F/C	12	13	14	15	16	F/C	Ha	Total	F/C	L/C	2.
A	Prep. Activity:																							
1	Approv& Fund	-	-																					
B	Study/Des&Impl	-	-	-	-	-	-																	
2	Train & Cap. B							-	-	-	-	-	-	-	-	-								
3	Alwero Abobo 1			0.8	0.8	0.8	1.5	14.7	14.7	14.7	14.7	17.6	45.8							10,400	78.8	47.3	31.5	Susp.
4	Omo Ratti	3.3	7.7	8.1	8.1	8.2	21.2													8,700	35.4	21.2	14.2	„
5	Gode 2	2.4	2.4	2.4	2.4	2.4	7.2	9.3	9.3	12.4	12.4	12.4	33.5	12.4	12.4	13.6			23.0	15,200	106.2	63.7	42.5	Current
6	Koga3	5.7	4.4	28.8	4.5	3.2	23.7	2.7					1.4							6,000	49.3	25.1	24.2	New
7	Dabus													0.3	0.3	5.8	6.5	6.5	11.6	4,335	19.4	11.6	7.8	New
8	Ribb									2.1	2.1	2.2	3.8	28.6	28.6	28.6	28.7	29.1	86.2	15,045	150.0	90.0	60.0	NBI
9	NE Tana										0.3	0.7	0.6	11.3	11.8				13.9	3,903	24.1	14.5	9.6	„
10	Megech			0.6	0.6	0.7	1.1	8.2	8.2	8.2	8.3	8.4	24.8							10,018	43.2	25.9	17.3	„
11	Gilgel Abbay-5													0.5	5.6	5.6			7.0	1,994	11.7	7.0	4.7	New
12	Upper Guder										0.3	0.3	0.4	6.1	7.8				8.3	3,559	14.5	8.7	5.8	Multip.
13	NW Tana										0.4	0.9	0.8	0.9	10.8	10.9	10.9	16.0	29.7	6,720	50.8	30.5	20.3	NBI
14	Gumara									1.4	1.5	1.5	2.6	17.7	17.7	17.7	17.7	26.8	58.6	13,776	102.0	61.2	40.8	„
15	SW Tana													0.9	0.9	9.1	16.0	16.1	25.8	5,132	43.0	25.8	17.2	„
16	Tis Abbay Pum.										0.5	0.9	0.8	14.2	15.3				17.7	4,132	30.9	18.5	12.4	New
17	Tis 3-5											1.3	0.8	1.3	9.9	16.9	16.9	16.9	37.1	7,167	63.2	37.9	25.3	,,
18	Azena/Ayo										0.3	8.2	5.1							1,092	8.5	5.1	3.4	,,
C	Study/Part Imp:																							
19	Arjo-Didessa				1.2	1.2	1.4		3.1	3.2			3.8				17.4	20.4	22.7	2,780	46.5	27.9	18.6	NBI
20	Negesso				1.0	1.1	1.3		1.8	2.9			3.4				10.1	11.6	13.0	2,815	29.5	17.7	11.8	„
21	Dabena				0.9	1.0	1.1		2.5	2.6			3.1				13.5	14.5	16.8	2,888	35.0	21.0	14.0	„
22	Angar			0.7	0.9		1.0	2.1	2.1				2.5				12.9	13.3	15.7	2,959	32.0	19.2	12.8	„
23	Nekemte			0.6	0.7		0.8	1.8	1.8				2.2				11.0	14.7	15.4	2,620	30.6	18.4	12.2	„
24	Humera			1.4	1.5	3.9	4.1	3.9	5.4	8.4	8.4	8.4	20.7	11.7	11.7	11.7	11.7	11.7	35.1	15,465	99.8	59.9	39.9	„
25	BaroRB,Baro D.													2.4	2.5				2.9	50,900	4.9	2.9	2.0	Multip.
26	Upper Beles														2.5	2.5			3.0	53,720	5.0	3.0	2.0	„
	Total	11.4	14.5	43.4	22.6	22.5	64.4	42.7	49.9	55.9	49.2	62.8	156.1	108.3	137.8	122.4	173.3	197.6	443.5		1114.3	664.0	450.3	

1. The current cost of the Alwero Dam has been deducted.

2. The estimated cost of the weir and head-works of the Gode Project have been deducted. The main irrigation system of Gode is expected to be completed during the short-term period.

3. The investment schedule is according to ADF's Koga Irrigation and Watershed Management Project Appraisal Report, February 2001.

Table 6-9. Regional Investment plan for small-scale irrigation devlopment (US$ millions)

No.	Region	Short-term (2002-2006)	Medium-term (2007-2011)	Long-term (2012-2016)	Program total (2002-2016)
1	Tigray	26.6	16.9	18.8	62.3
2	Affar	2.2	2.9	2.7	7.8
3	Amhara	66.7	44.4	52.6	163.7
4	Oromia	34.5	43.9	55.0	133.4
5	Somali	2.3	2.4	2.4	7.1
6	SNNPR	37.0	46.8	53.2	137.0
7	Benshangul- Gumuz	3.2	2.8	2.7	8.7
8	Gambela	2.2	2.4	2.4	7.0
9	Harar	0.9	1.0	0.9	2.8
10	Dire Dawa	1.3	1.8	1.7	4.8
11	Addis Ababa	0.8	-	-	0.8
12	NGO-supported (all regions)	15.5	23.5	25.0	64.0
	Total	193.2	188.8	217.4	599.4

ity building (1.5 per cent).

6.4.4 Short-term regional investments

Some 83 per cent of the total regional investment is targeted at the 4 regions of Amhara, SNNPR, Oromia, and Tigray. They have formulated plans for SSIDP activities in the short-term period that are briefly described in the following paragraphs. The projects are multifaceted and include:

(a) Study and design of small-scale irrigation schemes (reconnaissance, feasibility, and engineering design).

(b) Study of integrated river-basin proposals.

(c) Construction of new schemes.

(d) Rehabilitation of old schemes.

(e) Watershed management.

(f) Drainage works.

(g) Training of professionals and farmers.

(h) Acquisition of construction machinery and vehicles.

Amhara. The second 5-year development program of Amhara has set the following targets for small-scale irrigation development. The budget for the 5-year Amhara program is Birr 467,668,438 (US$ 56,345,595).

- construction of 75 small-scale schemes with a total area of 7,050 ha
- rehabilitation of 15 small-scale schemes
- design of 120 small-scale schemes
- feasibility study of 172 small-scale projects
- reconnaissance study of 264 small-scale schemes.

Some 937 skilled personnel will be deployed in the project, including 137 engineers and technicians.Equipment and vehicles for implementing the program include 88 items of construction machinery, 93 trucks, and 50 field vehicles.

AFD and IFAD will support 32 schemes that cover an area of 2,661 ha. AFD's program in Amhara comprises 6 small-scale schemes with earth dams (529 ha) for a total investment of Birr 18,941,099 (US$ 2,282,060). IFAD's program in Amhara includes 26 small-scale schemes to irrigate an area of 2,132 ha. The estimated investment cost of Birr 71,038,240 (US$ 8,558,824) is based on the assumption that 60 per cent of the schemes are diversion schemes, at a basic unit cost of Birr 20,000 per ha, and 40 per cent are for earth dams at a basic unit cost of Birr 40,000 per ha.

The Southern Nations Nationalities and Peoples Region (SNNPR). The regional investment plan for irrigation envisages the following targets:

- construction of 54 new schemes to irri gate 6,215 ha
- construction of 105 pond schemes to irri gate 3,150 ha
- rehabilitation of 60 irrigation schemes for an area of 3,000 ha
- engineering design of 240 projects cov ering an area of 34,615 ha
- feasibility studies of 249 schemes to irri gate a total area of 38,085 ha, including 82 small-scale schemes (9,430 ha), 25 medium-scale schemes (21,250 ha), 105 ponds (3,150 ha), and 37 old schemes for rehabilitation (4,255 ha)
- short- and long-term training for 62,930 beneficiary farmers, 106 development workers, 125 professionals, and 196 me chanics, drivers, and equipment operators
- procurement of Birr 59,339,200 worth of construction machinery, vehicles, survey ing and drafting equipment, soils lab equip ment, and camping equipment.

The SNNPR program will benefit 49,260 farm families. The planned budget amounts to Birr 282,081,825 (US$ 33,985,762). Skilled manpower requirements call for an additional 318 personnel, comprising 93 for study and design, 118 for construction, and 107 for support.

IFAD and AFD programs will support 13 additional schemes to irrigate 1,320 ha. The AFD program will support 5 schemes (650 ha for an investment of Birr 7,552,351 (US$ 909,922). Based on SNNPR's investment cost for the short-term SSIDP, IFAD's program of 8 schemes (670 ha) is estimated at Birr 15,485,710 or US$ 1,865,482.

Oromia. The 5-year development plan of Oromia has scheduled new irrigation investment worth Birr 261,976,000 (US$ 31,563,372) that includes work on 100 new small-scale schemes on a combined area of 7,865 ha. Under the plan, Oromia will also undertake:

- 348 reconnaissance studies
- 224 feasibility studies (for 17,440 ha)
- 182 engineering design studies
- 88 rehabilitation studies
- 84 rehabilitation works
- establishment of 45 forestry and horticul tural nurseries
- training of 135,625 beneficiary farmers in project study, construction, and watershed management
- mobilization of 65,864 beneficiary farmers for participatory development, including ir

rigation construction and watershed man agement
- establishment of 698 water committees
- training of 1,570 water committee mem bers
- establishment of 100 water users' associations
- co-ordination of operations and mainte nance of 204 modern communal irrigation schemes.

IFAD and AFD will support 22 schemes (covering 1,557 ha) in the short-term period of the Oromia SSIDP. The AFD program for Oromia, for an estimated total investment of Birr 7,405,019 (US$ 892,171), envisages the development of 8 small-scale schemes with a combined area of 532 ha that will benefit 1,719 farm families. IFAD supports 14 small-scale irrigation schemes that cover 1,025 ha. Based on the investment cost of the Oromia SSIDP, the total cost of the IFAD schemes is estimated at Birr 27,628,875 (US$ 3,328,780).

Tigray. The regional SSIDP consists of construction of 19 new schemes to irrigate an area of 3,044 ha and the repair of 10 earth dam schemes at a total cost of Birr 204,721,956 (US$ 24,665,296). The investment also includes feasibility studies of 3 river basins (1,926 km2).

In addition, the IFAD program envisages the implementation of 19 small-scale schemes (636 ha) that would benefit up to 2,544 households. The investment cost is estimated at Birr 12,720,000 (US$ 1,532,530) with the assumption that 60 per cent of the schemes are diversion schemes and 40 per cent are based on earth dams. The average investment cost of both types of schemes is Birr 30,400 per ha. The total investment cost of the IFAD program is estimated at Birr 19,334,400 (US$ 2,329,446).

Chapter 7 Hydropower Development Program

Preparation of the Hydropower Development Program (HDP) for the period 2002-2016 required a comprehensive sector review, development of a program strategy, and identification of projects to achieve the planned targets, together with assessment of the investment implications. The HDP targets were framed primarily to meet domestic electricity demand of approximately 5,000 GWh, within the main supply system of the Ethiopian Electric Power Corporation (EEPCo), and small-scale hydropower development needs in rural areas. The HDP also examines the possibilities for electricity export.

7.1 Goals and scope

The HDP aims to promote the achievement of national socio-economic goals through efficient and sustainable development of water resources to produce hydroelectricity, in order to satisfy domestic energy demand and to market the excess production to neighboring countries to earn much-needed foreign exchange. Provision of sustainable energy services is key for the promotion of economic growth, as well as the elimination of poverty, and the HDP was designed to contribute to this overarching goal by ensuring that:

- hydropower-generation program plans are developed well ahead of time
- relevant hydropower projects are studied with sufficient lead time to design and develop appropriate solutions
- hydropower development projects have an economically viable basis while maintaining acceptable technical, environmental and safety standards
- negative environmental impacts are mitigated to the furthest extent possible, and positive environmental impacts are exploited as far as possible
- technical capacities for hydropower planning and development are strengthened
- private-sector participation in hydropower development schemes is encouraged
- hydropower development on transregional rivers is promoted on the basis of mutual understanding and cooperation.

7.2 Methodological considerations

7.2.1 Planning

Preparation of the HDP started with an in-depth review of all issues surrounding demand for power, including local and export markets. In this context, two recent studies, one by Acres International Limited (2000) and the other by EEPCo, provided the essential basis to set the future targets. EEPCo, while examining the Acres study, concluded that the growth rates it adopted for national GDP as well as electricity demand were unrealistically low. EEPCo therefore developed its own demand forecast on the basis of average GDP growth of 4.4 per cent for the year 2000 and 6.6 per cent per year for the period 2001-2025.

Since the Federal Government envisages annual GDP growth of 7 per cent in the long term, the generation target in the formulation of the HDP is based on EEPCo's forecast. Apart from the assumption of a 6.6 per cent annual growth rate, urban population growth was assumed to follow the projections established by the Central Statistical Authority.

Panel 7-1. Ethiopia's power potential

Ethiopia is endowed with vast, unexploited energy resources in the form of hydro, biomass, coal, natural gas, and geothermal and solar energy. The hydroelectric energy potential has been estimated at 650 TWh per year (Cesen, 1986), of which 145 TWh (some 22 per cent) would be economically feasible to be exploited for power. Other estimates of potential power sources include 70 billion cubic metres of natural gas, 1,000 MW of geothermal power, and several hundred million tons of coal and oil shale.

Studies have concurred with the above estimate. To establish the economic potential of energy in Ethiopia, water regulation options were considered that require dam/diversion weir lengths below 750 metres and dam heights below 120 metres (WAPCOS, 1990). Installed capacity corresponding to output of 145,000 GWh per year, at an average plant utilization factor of 0.6, would be about 27,000. That would put the economic hydroelectric potential at nearly 1,000 times the current demand for electricity. Hydroelectric energy development in Ethiopia is thus a highly sustainable proposition

Panel 7-2. Electricity in the energy picture of Ethiopia

Of Ethiopia's total energy production, 95 per cent comes from such traditional resources as fuel wood, dung, crop residues, and human and animal power. The remaining 5 per cent comes from electricity and petroleum products of which 90 per cent is hydroelectricity from local generating stations.

Annual per capita energy consumption in Ethiopia is about 25 kWh of electricity, 16 kg of petroleum and 276 kg of oil equivalent of other energy sources, mainly biomass. Ethiopia's per capita electricity consumption is among the lowest in the world, and oil consumption is similarly low, in comparison with the world average of about 600 kg per person per year. The household sector consumes the bulk (82 per cent) of the country's energy production. The transport sector uses more than 70 per cent of imported oil, while agriculture uses only 3 per cent. According to a recent assessment, 9 per cent of the Ethiopian population has access to hydroelectric power supply, while 1 per cent has access to diesel-powered electricity supply.

The Ethiopian Electric Power Corporation (EEPCo) is the national agency responsible for generating, transmitting, distributing, and selling electricity countrywide. EEPCo operates 2 systems: the "interconnected system" (ICS) and the "self-contained system" (SCS). ICS has an installed capacity of 453 MW: 7 hydropower stations provide 444 MW and diesel stations contribute 9 MW, yielding a total output capability of about 2,121 GWh per year. Peak loads for 1995 and 1999 were 285 MW and 318 MW, respectively. Annual per capita production of electricity is low even by regional standards — Ethiopia's per capita generation of electricity during 1996 was 26 kWh, while Uganda's was 40 kWh, the Sudan's 50 kWh, and Kenya's 150 kWh.

The supply system is constrained by its low capacity relative to demand. Low rainfall levels in recent years have worsened the production picture. Reservoir siltation in older plants has reduced storage capacity, exacerbating the water shortage in dry years and spillage requirements when floods occur.

Areas outside the ICS reach are supplied by the SCS with its aggregate capacity of 38 MW, 84 per cent of which comes from diesel-powered stations. A few small private generating facilities operate outside of the EEPCo system, accounting for less than 5 per cent of the national supply.

Table 7.1.. Electricity demand in the HDP plan period (Figures in GWh)

Targets/Consumer Categories	Existing Situation	End of Short Term (2006)	End of Medium Term (2011)	End of Long Term (2016)
· Domestic	441	636	857	1 152
· Services	311	507	750	1 124
· Industries	562	836	1 163	1 619
· Rural	-	24	70	145
Total	**1 314**	**2 003**	**2 840**	**4 040**

Table 7-1 presents EEPCo's benchmark projections from the year 2000 of countrywide electricity demand at the end of each of the 3 sub-periods (short-term, medium-term, and long-term) of the WSDP planning horizon of 2002-2016. In formulating those projections, the generation requirement is set at 20 per cent greater than projected consumption, owing to expected delivery system losses.

7.2.2 Target setting

In setting targets for the 15-year WSDP planning horizon, the HDP has targeted the needs of the whole Ethiopian population for hydroelectric power coverage, as shown in table 7-1. While setting future targets, three important demand considerations were taken into account: (a) local demand for electricity; (b) export demand for electricity; and (c) demand for small hydro development in rural areas. Various factors and assumptions considered under these three demand categories are discussed below.

(a) Local demand for electricity: EEPCo's forecast of demand in table 7-1 indicates that the generation requirements within its Interconnected System (ICS) for distribution will be: 2,438 GWh in 2006, 3,455 GWh in 2011, and 4,916 GWh in 2016.

The corresponding ICS generation capacity, with an appropriate reserve margin, should be as indicated in table 7-2. Reserve margin for power generation capacity in terms of megawatts is taken as equal to the rated capacity of the largest generating unit in the system. Reserve margin for energy generation "capability" in terms of gigawatt-hours is taken as the rated energy-generation capability of the largest unit at the assumed system load factor. Generation reserve margin is a technical necessity, representing a reserve capacity to be set aside and used in times of failure of any of the units that are normally scheduled for operation.

A system load factor of 60 per cent is assumed throughout the plan period. This assumption is based on the present level of the EEPCo system load factor that stands at about 60 per cent. The load factor for a supply system does not normally change drastically, or suddenly at any one time, unless deliberate measures are taken to alter the daily or seasonal demand curves. EEPCo's system load factor varied between 53 and 63 per cent during the 30-year period (1967-1997) without any perceptible trend. As such, it is assumed that the demand curve will not alter beyond a certain level for a given socio-economic and climatic setting.

Higher load factors mean more efficient utilization of installed generation capacity. Conversely, lower load factors mean greater capacity set aside for peak-hour demand. The later case implies a

more expensive operation. However, higher load factors cannot be achieved without control and monitoring costs, nor without inconvenience to the consumer. To improve economic and operational efficiency, higher load factors could be encouraged, but should not be imposed on the consumer.

The largest unit in the system is assumed to be 60 MW for the period 2002-2006 and 75 MW for 2007-2016. These unit capacities correspond to those of the Gilgel Gibe and Tekeze plants, respectively. They represent future minimums of unit capacities for the system. Power plants coming on stream after Tekeze may have different unit capacities. However, the unit capacities are not expected to exceed 75 MW, because Tekeze represents an upper limit for medium-sized hydro plants.

According to EEPCo 5-year development plan (1993-1997, Ethiopian calendar), firm generation capacity was 327 MW and capability (in terms of energy output) in the ICS was 1,367 GWh in year 2000. Thus, requirements for megawatt and gigawatt-hour additions to meet local demand in the ICS would be as shown in table 7-2. The calculations in panel 7-3 show how additions to generation capacity were computed.

In computing the required additions, the assumption was that the existing plants (Koka, Awash I, Awash II, Melka, Wakena, and Finchaa) would continue to deliver at least the same level of output that they delivered in 2000. Any sustained decrease would have to be offset by new plants or generating units. Generation-capacity targets and hydropower plants that must be commissioned in order to meet the generation-capacity additions indicated in table 7-3 are presented in table 7-4. The investment plans for generation projects in the HDP period are tailor-made to the generation targets shown in table 7-4.

(b) Export demand for electricity: Interest in power trade between Ethiopia and the Sudan and Djibouti has revived. An Ethiopian team of EEPCo repre-

Table 7.2. ICS generation-capacity targets for meeting local electricity demand

Year	Generation requirement GWh	Generation capacity without reserve, MW	Reserve MW	Generation capacity with reserve, MW	Generation capability with reserve, GWh
2006	2 438	463	60	523	2 750
2011	3 455	656	75	731	3 842
2016	4 916	934	75	1 009	5 303

Table 7.3. Required additions in ICS generation capacity

Period	MW additional equirements	GWh additional equirements
2000-2006	196	1 383
2007-2011	208	1 092
2012-2016	278	1 461

Panel 7-3. Computing hydropower generation-capacity requirements

Additions for the period 2000–2006 = generation capacity in megawatts required in 2006

– generation capacity in megawatts required in 2000

= 523 – 327 = 196

Gigawatt-hours additions for period 2000–2006

= capability in gigawatt-hours required in 2006 – capability in gigawatt-hours required in 2000

= 2,750 – 1,367 = 1,383

Generation capacity without reserve for 2006 in megawatts

$$= \frac{\textit{Energy demand for year 2006, in gigawatt-hours} \times 1000}{\textit{Assumed load factor} \times \textit{no. of hours in a year}}$$

$$= \frac{2{,}438 \times 1{,}000}{0.6 \times 8{,}760} = 463$$

Energy generation capability with reserve, in gigawatt-hours, for 2006

= *Generation capacity with reserve, in megawatts, for 2006 x load factor x number of hours in a year ÷ 1,000*

= *523 x 0.6 x 8,760 ÷ 1,000 = 2,748.9 (i.e., approximately 2,750)*

sentatives recently visited Sudan and Djibouti. The parties agreed to update the study and design of the Ethiopia-Sudan and Ethiopia-Djibouti interconnection transmission lines. The following paragraphs highlight the substance of previous studies on those schemes.

Ethiopia-Sudan interconnection: The Ethiopia-Sudan interconnection feasibility study was conducted in 1987 by IVO International Ltd. Consultants. The objective of the project was "transmission of Ethiopian surplus hydroelectricity to Sudan, where it would replace oil-fired power generation. Ethiopia would earn foreign currency for the otherwise unutilized resources and Sudan would save through a decrease in the import of oil."

The maximum amount of energy envisaged for transmission to Sudan during any single year was 665 GWh, while the maximum power transmission was set at 100 MW. The study recommended that the power transfer follow a Debremarkos-Injibara-Roseires route on a 230-kV transmission line. The length of the line would be 430 km. The total cost of line construction was estimated at US$ 61.3 million, of which US$ 46.1 million would be invested in Ethiopia.

The internal economic rate of return (IERR) on the project investment depended largely on the amount of energy transmitted over the lifetime of the transmission line. Nevertheless, the project was shown to be economic even if a total of only 2,722 GWh were to be transmitted during the first 7 years and operations were to cease thereafter.

The IERR, under such conditions, was shown to reach 31.65 per cent

Ethiopia-Djibouti interconnection: The Ethiopia-Djibouti interconnection feasibility study was conducted by Acres International Ltd in 1989. As with the case of Sudan, exportation of surplus hydroelectricity was considered for Djibouti. Such surplus energy was expected to become available from excess capacity created on the commissioning of new plants and through utilization of spillage water in the wet season (Acres, 1989). The average annual energy export to Djibouti was estimated at about 320 GWh. The peak power requirement was calculated at less than 50 MW. The energy export was expected to be sustainable during the period 1993-2015.

The investment on construction of the transmission line was estimated at US$ 28.7 million, of which US$ 16.8 million would be invested in Ethiopia. The IERR for the best case (Dire Dawa PK12, "Southern route - case 211") is estimated to reach 19.8 per cent, equivalent to a project net benefit of $US 20.3 million over a 22-year period. The IERR indicated for the Ethiopia-Djibouti inter-connection project is thus smaller than for the Ethiopia-Sudan interconnection.

Moreover, the Ethiopia-Djibouti interconnection project appears to assume a sustained export of surplus hydroelectricity for at least 2 decades. Surplus electricity can possibly be guaranteed only during the Ethiopian wet months of July-September, however. Such a unique arrangement requires further realistic review and discussion between the 2 countries. Precise targets on export levels can be set only thereafter.

Other export possibilities: Discussions with respect to power trade between Nile riparian countries as well as with member countries of the NBISAP are at an exploratory stage. No export targets can be set as yet on power trade in those areas.

(c) Meeting small-hydro development targets for rural areas: Site-specific, reconnaissance-stage studies for small-hydropower development are available for Tigray, Amhara, Oromiya, and Southern Nations Nationalities and Peoples (SNNP) Regions. Regions such as Amhara, Oromiya, and SNNP Regions have set targets for small-hydropower development for the plan period 1993-1997 (Ethiopian calendar). However, physical as well as financial limits in implementation capacity have to be considered in order to form realistic targets for small-hydro development. It would be realistic to assume that on an average, pre-feasibility studies may possibly be conducted for 1 site every year; and feasibility and design-stage studies for 1 site every 2 years, for those sites that have already completed reconnaissance studies.

Likewise, it may be realistic to plan for the construction and commissioning of 1 site every 3 years, for sites with feasibility and design studies already completed. A maximum of 10 sites could therefore be studied at feasibility and design stages during the 15-year plan period in a region. Likewise, a maximum of 5 sites could be constructed in the plan period in a given region.

7.2.3 Project identification and screening

The project identification itself was based on an extensive review of master plan studies for various river basins. In addition, EEPCo's development plan, WAPCOS' plan, many other studies by different consultants and organizations—covering reconnaissance, pre-feasibility and feasibility studies of individual sites—were reviewed. The inventory could be classified into three broad categories of on-going projects, planned projects and studied projects.

The list of *on-going projects* contains all construction and study projects under implementation. They are largely hydropower development projects being implemented by EEPCo. On the other hand,

Table 7.4. Generation capacity requirements and power plants to be commissioned for meeting generation targets

	Generation capacity target with reserve*		Generation plants to be commissioned	Expected output additions		ICS Generation cumulative total capacity	
Year	MW	GWh		MW	GWh	MW	GWh
2001	-	-	-	-	-	407*	2121**
2002	411	2160	Finchaa	34	137	441	2258
2003	439	2307	Gilgel.Gibe	180	720	621	2978
2004	466	2450	-	-	-	621	2978
2005	493	2591	-	-	-	621	2978
2006	523	2750	-	-	-	621	2978
2007	571	3001	Tekeze	225	981	846	3959
2008	607	3190	Gojeb	105	364	951	4323
2009	645	3390	-	-	-	951	4323
2010	688	3615	-	-	-	951	4323
2011	731	3842	-	-	-	951	4323
2012	781	4103	-	-	-	951	4323
2013	833	4376	PP1 after Gojeb	200	800	1151	5123
2014	888	4665	-	-	-	1151	5123
2015	948	4980	-	-	-	1151	5123
2016	1009	5303	-	-	-	1151	5123
2018	1151	6050	PP2 after Gojeb	200	800	1351	5923

- See table 7-1 for years 2006, 2011, and 2016. The target figures for the other years have been worked out similarly to the demand forecast shown in table 7-2.

- Already acheived in 2001 due to Tis Abbay II commissioning and rehabilitation of existing plants. PP1, PP2 refer to Power Plant 1, Power Plant 2.

the list of *planned projects* embodies all study and construction projects whose implementation is due to start during the next 5 years. The list is derived from the development program drafted by various institutions for the plan period 2001-2005. Since only EEPCo projects have been referred to specifically by names of projects/sites, the list has been limited to EEPCo projects.

Studied projects constitute the majority of projects in the inventory. Most of the studied projects have been extracted from basin master-plan studies for Baro-Akobo, Omo-Ghibe, Abbay, and Tekeze. However, hydropower development schemes from other studies by the Federal and Regional Government institutions have also been included to make the list as comprehensive as possible.

Project identification and initial screening were based on the following considerations:

(a) Studies conducted prior to 1982 have largely been reviewed and included in studies done since then.

(b) Hydropower schemes not included in higher-stage studies since 1982 are deemed not attractive and therefore dis carded for practical considerations.

The initial list identified 225 hydropower development projects that comprised: 30 large-hydro sites, 120 medium-hydro sites, and 75 small-hydro sites. Among other items, the estimates of installed capacities, investment costs, and unit costs of production were compiled and tabulated for all those sites. Identified and screened projects were categorized by type of study; i.e., according to whether they were to be: feasibility studies or pre-feasibility studies or reconnaissance studies or identification studies. The screening criteria and other special considerations (elaborated in the succeeding sections) resulted in short listing of 60 projects at different levels of study as per following details (see table 7-5):

- 18 large-scale hydropower (>200 MW) projects: 3 for construction, 7 for feasibil ity studies, and 8 for pre-feasibility stud ies.
- 20 medium-scale hydropower (10-200 MW) projects: 8 for feasibility studies, and 12 for pre-feasibility studies.
- 22 small-scale hydropower (<10 MW) projects: 7 for construction, and 15 for re connaissance studies (as defined by WAPCOS).

Categorization of hydropower development projects by executing body was neither necessary nor possible for the following reasons:

(a) For small-hydro schemes (of less than 10 MW), the executing body is the relevant Regional bureau. The hydropower devel opment schemes in this category are listed in table 7-5.

(b) For studies of medium- and large-hydro schemes, the executing body is MoWR. Schemes under this category are listed in table 7-5. Exceptions are the studies of Neshe and Awash IV schemes that may be studied by EEPCo.

(c) Hydropower development schemes to be developed under interregional programs cannot be defined at this stage.

7.2.4 Evaluation and ranking

Step 1. Bringing projects to uniform basis: The degree of accuracy in estimates of all costs, including those of engineering, civil works, equipment and machinery, operation and maintenance, and environmental costs, depend mostly on the level of study (identification, reconnaissance, pre-feasibility or feasibility) of hydropower schemes. Therefore, production cost per kilowatt-hour

Notes to table 7-5:

1. Cascade scheme with upstream Halele Reservoir TWL 1565.

2. Cascade scheme with upstream Gilge Gibe Reservoir TWL 1565.

3. Candidate projects recommended for ICS connection or energy export by the Baro-Akobl RBIDMS during the master plan period.

D. Based on draft reports; hence, values are likely to be changed in the final reports.

E. Candidate projects recommended for energy export.

I. Identified in a master-plan study.

** Includes cost of transmission lines.*

*** Does not include cost of transmission lines.*

Table 7-5. Short listed hydropower development projects with unit costs of energy production, at 2001 prices

PROJECT NAME	Installed capacity MW	Firm energy GWh/y	Investment cost US$M @ yr of study	Unit cost of firm energy @ yr of study	Cost/ benefit ratio	Year of study	Investment cost US$M @ year 2001 prices	Unit cost of firm energy US¢/kWh @ year 2001 prices
1	2	3	4	5	6	7	8	9
LARGE-SCALE HYDROPOWER (> 200 MW)								
FEASIBILITY LEVEL (Candidates for constructions)								
Aleletu West	214	983	544.8	9.8		1995	611	11.00
Aleletu East (Ultimate1)	204	917	515.7	9.9		1995	579	11.11
Beles	220	1 540	266	3.4	1.46	2000	271	3.47
PRE-FEASIBILITY LEVEL (Candidates for feasibility studies)								
Baro 2 + reservoir dam (BA2)	475	2 094	442	3.07	1.4	1999	460	3.19
[3]Baro 1+2 + DamE	669	2 741	544	2.95	1.4	1999	566	3.07
[3]Geba 1+Geba 2 + DamE	254	1 633	332	3.15		1999	345	3.28
Werabesa(DS3A)	280	1 222	519	4.67		1996	540	4.86
Werabesa(DS3A)1	415	1 812	888	5.39		1996	924	5.61
Halele Werabissa Stage II	294	1 419	345	3.69		1999	359	3.84
Halele Werabissa Stage I & II	390	1 879	561.6	4.34		1999	584	4.52
RECONNAISSANCE LEVEL (Candidates for pre-feasibility studies)								
Gojeb (OM 12)	425	1 864	705	4.16		1996	777	4.58
Derbu(DS5)	250	1 092	390	3.9		1996	430	4.30
Fofa (DS8A)2	258	1 130	494	4.81		1996	544	5.30
Border	1 440	6 307	1 487.1	4.4		1998	1 547	4.58
Karadobi (w/o Tana diversion	770	3 373	1 195.2	6.3		1998	1 243	6.55
Mendaia (w/o Tana diversion)	1 255	5 497	1 285.2	4.2		1998	1 337	4.37
Genale (GD4)	300	1 299	431.6	3.85	1.63	1997	462	4.12
Gojeb (OM21)	540	2 369	888	4.12		1996	978	4.54

Table 7-5. Short listed hydropower development projects with unit costs of energy production, at 2001 prices... *(continued)*

PROJECT NAME	Installed capacity MW	Firm energy GWh/y	Investment cost US$M @ yr of study	Unit cost of firm energy @ yr of study	Cost/ benefit ratio	Year of study	Investment cost US$M @ year 2001 prices	Unit cost of firm energy US¢/kWh @ year 2001 prices
1	2	3	4	5	6	7	8	9
MEDIUM-SCALE HYDROPOWER (10> 200 MW)								
PRE-FEASIBILITY LEVEL (Candidates for feasibility studies)								
[3]Gumero	51.6	225	99.78	4.9	11.4	1997	107	5.25
Genale 3 (GD3)	164	1 215	234	2.69	1.8	1999	243	2.80
Guder	100	361	132	4.88	1	1999	137	5.08
Barol - reservoir dam (BA1)	194	647	104	2.28	1.7	1999	108	2.37
(Geba 1 GB1) reservoir dam	154	857	279	4.74	1	1999	290	4.93
Geba 2- reservoir dam	100	776	85	1.5	2.7	1999	88	1.56
Halele (OM4)	105	454	236	5.72		1996	260	6.30
RECONNAISSANCE LEVEL (Candidates for pre-feasibility studies)								
Fetam	125	550	204.5	6.5		1998	213	6.76
Alati (OM5)	160	697	304	4.8		1996	335	5.29
Abelti (OM3)	145	635	272	4.71		1996	300	5.19
OM6	130	574	213	4.08		1996	235	4.49
3Birbir A[3]	95	529	130.42	4.5		1997	140	4.82
[3]Kashu	60	298.5	80.79	4		1997	87	4.28
[3]Sor	65	342	127.57	5.9		1997	137	6.32
Ner 1 Jinka	58	255	80	3.45		1996	88	3.80
Daka (OM)[2]	68	299	96	3.53		1996	106	3.89
Neshe B	21.8	95	41.3	6.9		1998	43	7.18
Upper Guder	20	88	41.2	7.5		1998	43	7.80
Awash IV	34		75.41			1998	78	0.00

Table 7-5. Short listed hydropower development projects with unit costs of energy production, at 2001 prices... *(continued)*

PROJECT NAME	Installed capacity MW	Firm energy GWh/y	Investment cost US$M @ yr of study	Unit cost of firm energy @ yr of study	Cost/ benefit ratio	Year of study	Investment cost US$M @ year 2001 prices	Unit cost of firm energy US¢/kWh @ year 2001 prices
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
SMALL-SCALE HYDROPOWER (<10 MW)								
FEASIBILITY LEVEL (Candidates for construction)								
Achani	2.5							
Neri	4							
Weyib Go - 3	9							
Kettar	0.54	3.642	1.072	7.38	0.8	1999	1	7.68
Senqole-Hora	0.22	2.108	0.739	13.62	0.8	1999	1	14.17
Ketto	0.44	4.576	1.16	13.38	0.6	1999	1	13.92
Mogor	0.17	1.877	0.821	16.38	0.5	1999	1	17.04
WAPCOS IDENTIFIED PROJECTS (Candidates for reconnaissance studies)								
Aw1	23.5	145	52.2	4.34		1990	64	4.87
AW5	29	178	70.6	4.37		1990	79	4.90
AW7	25.3	155	89.5	4.3		1990	100	4.82
AW9	36	227	89.5	4.3		1990	100	4.82
AW14	39	226.8	94.5	4.38		1990	106	4.91
GD6	117	7 171	245.9	3.8		1990	276	4.26
GD7	188	1 299	431.6	3.85		1990	484	4.32
GD16	92.4	566.3	194.5	3.78		1990	218	4.24
GD25	22.7	140	53.48	4.2		1990	60	4.71
MG1?	0.66	4.1		1.85		1990	0	2.08
WS2	29.3	149.1	53.8	3.97		1990	60	4.45
WS13	74	458.3	157.38	3.78		1990	177	4.24
WS14	75	459.2	157.88	3.78		1990	177	4.24
TK15	4.6	28	12.91	4.43		1990	14	4.97
TK16	4.4	28	12.35	4.23		1990	14	4.75

serves as a useful indicator for ranking of hydropower development schemes.

Estimates of costs of electricity production per kilowatt-hour are available in the source documents for most of the projects identified in the initial list. However, these costs refer to different base years, as adopted by the individual consultants undertaking the studies. Therefore, the production costs have been adjusted to the year 2001.

Step 2. Evaluation criteria: The sole criterion used for ranking projects (to be further studied at higher level) was the "normalized" (updated) production cost per kilowatt-hour. Based on this criterion, most promising hydropower development schemes for further study were identified in the investment plan. That applies mostly for Federal projects of medium and large hydropower schemes.

Regional projects (for small hydro schemes) lacked data on production cost per kilowatt-hour, so it was not possible to identify individual projects in the same way as larger schemes. Therefore, the issue was approached from a different perspective—by selecting the number of sites to be studied or constructed in the various regions during the short, medium, and long term.

Hydropower development schemes that would begin construction in the long term (in either Federal or Regional projects) could not be specified by name, because selection would depend on the outcome of feasibility studies yet to be undertaken for candidate sites.

Panel 7-4. Comparative power planning approaches: HDP and EEPCo

EEPCo recently commissioned a master plan study for expansion of the power sector. The master plan describes a development path for the power sector from 2001 to 2005. Differences in the scope of work and approaches between the master plan study and HDP plan formulation have resulted in different outcomes in those 2 exercises.

The HDP plan provides more details about the options available for hydropower development, having benefited from master plan studies conducted to date for various river basins. Using the hydro resource base identified in the River Basin Master Plans, the HDP provides a wider opportunity for the study and subsequent choice of hydropower projects to ensure that the most feasible projects are implemented first. With the exception of ongoing and committed projects, the HDP does not identify projects for future construction by name.

The Power Sector Expansion Master Plan, on the other hand, limits itself to the selection of prefeasibility and feasibility studies without giving much attention to what has been defined in the River Basin Master Plan studies. As such, the EEPCo Plan has, a priori*, specified which projects must be implemented during the master plan period, on the basis simply of current knowledge about projects.*

The HDP is believed, therefore, to provide a better foundation for the development of the country's hydropower resources. It does not dispute the planned outcomes of the Power Sector Expansion Master Plan in any major way, but it does place hydropower development in a broader and much stronger perspective.

Further discussion about how the 2 power plans differ follows below.

(a) Non-hydro generation sources

Hydropower is obviously the HDP focus. The backbone of electricity generation in Ethiopia is and will continue to be hydropower. Other resources for energy generation (diesel, coal, and gas) will figure only as small "gap-fillers." In the HDP view, such gaps can eventually, with appropriately planned measures, be covered by small hydro systems.

The rationale for sustaining and promoting hydropower generation is based on the cost-effectiveness of the hydro option, Ethiopia's huge hydro endowment, and the potential for multipurpose use of water that is regulated for hydropower generation. Ethiopia's hydro resources are widely distributed over various climatic zones, including areas of almost year-round rainfall as in the southwest. Sites in such areas can be rationally developed to mitigate effects of drought elsewhere. Hence, the HDP essentially follows an "all-hydro" approach. Some changes can, of course, be made during actual implementation of the program, depending on the cost-effectiveness of various modes of generation in the future. Notwithstanding the primary HDP focus on hydropower development, the demand forecast used in HDP is basically that of the Power Sector Expansion Master Plan.

(b) Differences in investment figures

With respect to the investment plan (see section 7.4), there are projects that have been included in the HDP that were excluded in the Power Sector Expansion Master Plan, and vice versa.

The HDP has included projects and investment in: (a) hydropower development studies, (b) regional projects (i.e., projects within various regional states of Ethiopia), and (c) projects for export production and for the Eastern Nile Subsidiary Action Program (ENSAP). The Master Plan did not include these investments. On the other hand, the Master Plan did include transmission line and substation projects that are not included in the HDP, which considers only generation.

7.2.5 Short-listing of projects: additional considerations

This section describes various factors and assumptions those were taken into account while short-listing projects from the original inventory. Assumptions of more generalized nature are outlined in section 7.3 below, but this section highlights the procedures and conditions as they apply to short-listing of federal and regional projects, projects outside of generation-capacity additions, and projects within the Nile Basin Initiative.

(a) Federal projects

Construction projects. These include the either ongoing or committed projects of Gilgel Gibe, Fincha IV, Gojeb, Tekeze, Aweto, Bonora, and Hoha. Other projects that entered the construction phase during the HDP period would be defined after thorough comparison of projects whose feasibility studies were completed by about 2010. Those projects cannot therefore be identified at present stage. In the investment plan they have been referred to as the "first and second medium-scale projects after Gojeb and Tekeze."

In the shortlist of projects, all medium and large hydro schemes studied to feasibility stage have been retained for subsequent comparison with other sites to be studied during the HDP period. The energy production costs for those sites range between 3.47 US¢ / kWh (for Beles) and 11.11 US¢ / kWh (for Aleltu East), at 2001 prices. Also, 4 small hydropower schemes with feasibility studies have been retained for subsequent comparison with other schemes in the small-hydro range.

Study projects. In the HDP strategy, the number of medium and large hydro sites to be studied by Federal institutions at feasibility, pre-feasibility, and reconnaissance stages is set at 1 site per year for each type of study. This rate of study of promising sites is expected to remove the current problem of a paucity of feasibility and design studies from which to select sites for construction. The most promising sites for feasibility, pre-feasibility, and reconnaissance studies have been selected for shortlisting on the following bases.

- For feasibility studies, 14 sites (medium and large hydro sites) with unit production costs below 6.35 US¢ / kWh, at 2001 prices, have been selected from available pre-feasibility studies in the medium and large hydro ranges. A commitment exists to undertake feasibility studies at 3 of those sites (Geba 1, Baro1, and Genale 3). The shortlist of pre-feasibility projects will be expanded by entrants from pre-fea sibility studies of projects currently at re connaissance stage.

- For pre-feasibility studies, 10 sites with unit production costs below 4.7 US¢ / kWh, at 2001 prices, have been selected from available reconnaissance studies. In ad dition, Birbir, Fofa (DS8A), Fetam, Alati, Abelti, Sor, Upper Guder, and Karadobe (under NBISAP) have been included in the shortlist for pre-feasibility studies under special consideration. Neshe (as part of Amarti) and Awash IV sites have also been listed because EEPCo is already commit ted to further studies on those sites. Thus, 20 sites have been shortlisted for pre-fea sibility study.

- For reconnaissance studies, 15 sites iden tified in the WAPCOS study having unit pro duction costs below 5.0 US¢ / kWh, at 2001 prices, have been selected.

To update reconnaissance studies undertaken in various master-plan studies, 15 more sites with potential for multipurpose development and of optimum size (100-200 MW) for interconnection with the ICS will be selected during HDP implementation. MoWR is expected to do the updating in parallel with new reconnaissance studies on other sites. Table 7-5 presents the short-listed

projects.

(b) Regional projects

Ideally, a shortlist of regional small hydropower development projects would exist with a realistic number of sites that could be studied and constructed during the HDP period. However, it has not been possible to shortlist regional hydropower development projects by name at present, because the essential data on the sites are not available. Regions can set their own criteria, based on unit cost of electricity production and the prospects for multipurpose development, and set the sequence of study and construction of the various sites. Hence, regional hydropower development projects have been identified generally by number of sites only. The total numbers of such projects to be studied and to be constructed are 65 and 12, respectively.

(c) Projects outside of generation-capacity additions

Hydropower projects outside of generation-capacity additions include those that:

- Strengthen institutional capacity in hydropower development at Federal and Regional levels.
- Assist database development for hydro power development.
- Enhance human resources development at Federal and Regional levels.
- Enhance local manufacture of equipment and materials used in hydropower generation, transmission, and distribution.
- Promote power export to neighboring countries.
- Promote improvement of technical efficiency in hydropower supply and consumption.

(d) Projects within the Nile Basin Initiative

Projects that Ethiopia has proposed for inclusion in ENSAP are:

(a) Ethiopian-Sudan interconnection transmission line—although the investment requirement for the construction can be established only after the study has been completed. However, tentative investment requirements are indicated.

(b) Study and design for hydropower schemes on Birbir, Geba, Baro, and Karadobi sites— investment for the study and design has been indicated in the investment plan (see table 7-8).

(c) Hydropower plant construction under NBISAP—the best site or sites will be determined on the basis of feasibility studies. Tentative investment requirements for such construction are shown separately as “hydropower plant construction under the Nile Basin Initiative.”

7.3 Assumptions

Although some of the specific assumptions employed in the development of HDP have been discussed above under the relevant topics, this section recaptures some of those assumptions as well as those apply to the whole HDP.

- Although the basic criterion used in hydropower project screening, ranking, and selection is the unit cost of electricity production for each project, ongoing and committed projects under MoWR and EEPCo have been short-listed without any re-evaluation.
- ENSAP projects have been included without screening, since they were selected and presented in their own appropriate

forums. Such criteria as environmental impact are assumed to have been built into the unit cost of production and have not been separately applied. In any case, most hydropower development projects are studies, so environmental impact and other features will be examined in detail during the program implementation.

- Average GDP growth rate of 4.4 per cent for 2000 and 6.6 per cent per year for the period 2001-2016 (following EEPCo meth odology for forecasting electricity demand) is assumed.

- Urban population growth rate was as sumed to be the same as used by the Central Statistical Authority.

- The analysis is based on a system load factor of 60 per cent throughout the WSDP planning horizon, based on the present level of the EEPCo system load factor.

- Size of the largest unit in the ICS is 60 MW for 2002-2006 and 75 MW for 2007-2016.

- Existing plants will continue to deliver at least the same level of output as in 2000.

- Neighboring countries will continue to express an interest in power trade with Ethiopia; namely, the Sudan, Djibouti, and some NBI member countries.

- As far as possible, previous experience with similar projects has been used to draw up the investment schedule. With respect to costs of newly identified projects for which cost indications were not available from previous studies, cost estimates were developed based on records of costs actually incurred or esti mated for similar projects in various stud ies. Table 7-6 shows estimated costs that have been used for some categories of hydropower development projects.

7.4 Program description

In order to achieve the planned targets (section 7.2.2), a series of projects were identified, evaluated and short-listed in the light of discussion presented in sections 7.2.3 through 7.2.5 and 7.3 above. Final list of projects that constituted main part of the HDP are classified below under three components defined as: construction projects, studies, and miscellaneous outcomes.

Hydropower plant construction: Main projects making this category will include the following.

(a) 6 medium hydro plants with an aggregate installed capacity of about 950 MW:

- Gilgel Gibe (180 MW)
- Finchaa IV unit (34 MW)
- Tekeze (225 MW)
- Gojeb (105 MW)
- first medium hydro plant after Tekeze and Gojeb (200 MW)
- second medium hydro plant after Tekeze and Gojeb (200 MW).

(b) 15 small hydro plants (<10 MW each).

(c) 12 small hydro plants in 4 regional states:

- 3 sites in Tigray Region
- 3 sites in Amhara Region
- 3 sites in Oromiya Region
- 3 sites in the SNNP Region.

(d) Small hydro plants at Hoha, Aweto and Bonora, by EEPCo.

Hydropower plant studies: Major studies to be carried out as part of the HDP over the next 15 years are mentioned below. Both the level of study and the region in which these studies are to be

Table 7-6. Cost assumptions for hydropower development projects

	Project category	Estimated costs in US$
A.	**Small hydro schemes**	
1.	Reconnaissance studies	Not used
2.	Pre-feasibility studies starting from available reconnaissance studies	0.01 million (per site)
3.	Feasibility and design studies starting from available pre-feasibility studies	0.15 million (per site; based on costs for Aweto, Bonora and Hoha)
4.	Construction cost	3,000 (per kilowatt, for a 500 kW site; based on costs for Aweto, Bonora, and Hoha; small-hydropower study in Gojam in 1989 by a Chinese team)
B.	**Medium and large hydro schemes**	
1.	Reconnaissance studies	0.05 million (per site)
2.	Pre-feasibility studies starting from available reconnaissance studies	0.8 million (per site)
3.	Feasibility studies starting from available pre- feasibility studies	2.0 million (per site)
4.	Construction costs	2,200 (per kilowatt; average for Chemoga, Yeda, Halele, Werabesa, and Aleltu)
C.	**Other activities**	
1.	Study of HPBED sub-strategy	1.0 million (total)
2.	Study of local manufacture of hydro plant machinery components, steel towers, and insulators	0.6 million (total)

carried out are defined, including the institutional responsibility.

(a) Feasibility studies of 15 medium hydro sites by MoWR.

(b) Feasibility studies of 2 hydro sites by EEPCo.

(c) Feasibility studies of 35 small hydro sites:

- 05 sites (currently at reconnaissance stage) in Tigray Region
- 10 sites (currently at reconnaissance stage) in Amhara Region
- 10 sites (currently at pre-feasibility stage) in Oromiya Region
- 10 sites (currently at pre-feasibility stage) in the SNNP Region.

(d) Pre-feasibility studies of 18 medium hy dro sites, by MoWR.

(e) Pre-feasibility studies of 30 small hydro sites:

- 15 sites (currently at reconnaissance stage) in Oromiya Region
- 15 sites (currently at reconnaissance stage) in the SNNP Region.

(f) Reconnaissance studies of 30 medium hydro sites, by MoWR:

- 15 sites identified in WAPCOS studies for new reconnaissance studies
- 15 sites identified in various master plan studies to be upgraded or updated to re connaissance stage.

Miscellaneous outcomes: In addition to realization of very specific outputs mentioned above, the HDP will undertake many other activities. For example, the national water strategy dictates that the study of any hydropower scheme should consider the multipurpose use of regulated water. As a result, additional irrigation projects are expected to emerge. At the onset of the HDP, it is not possible to forecast the extent of additional irrigation that will result from the HDP because the studies have yet to be undertaken. Major outputs of this component will include the following.

(a) Review of feasibility studies for the Ethio pia-Sudan and Ethiopia-Djibouti transmis sion lines.

(b) Construction of Ethiopia-Sudan and Ethio pia-Djibouti 230-kV lines.

(c) Initiation of construction of 1 power plant for the NBISAP.

(d) Study of Koka dam and reservoir support schemes (raising of dam height and di version to an alternative reservoir).

(e) Database development and management at the Federal level, by the MoWR.

(f) Development of the hydropower regulatory framework, by the MoWR.

(g) Study and implementation of a national strategy for hydropower-based economic development.

(h) Establishment of demand management schemes in electric power utilization, by EEPCo.

7.5 Investment requirements

7.5.1 Investment plan: general characteristics

The HDP investment plan sets out the investment needs for Federal and Regional hydropower development projects for the program years 2002-2016. Investment needs have been framed within three planning horizons. The foreign exchange and local currency portions of the planned investment are estimated for each project in each planning horizon. For the short- and medium-terms, the investment requirements for each project are expressed on an annual basis. For the long term, on the other hand, only the total investment for each project is indicated.

The selected projects themselves have been categorized into ongoing and planned projects. Ongoing hydropower development projects exist at the Federal level and they are well known. Consequently, all details including the investment amount, the project duration, and foreign and local currency requirements are better known for this category of projects. Also, some of the planned projects have been included in the short-term development programs of implementing agencies because details for those projects are fairly well known. The investment figures shown for less known projects are estimated based mostly on experience with comparable projects.

At the Regional level, data on costs of hydroelectricity production for studied sites are not available. The choice of sites for further study has been left to the Regional Governments themselves. The current HDP investment plan is thus limited to an indication of sites to be studied in various regions during the program period. This limitation has been further restricted to those regions that have provided the names of sites that have already been studied to some extent.

Table 7-7. Summary of investment in HPD for years 2002-2016 (US$ millions)

No.	Project Category	Short term		Medium term		Long term		Total		
		F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	Total
1.	**Federal Projects**	475.00	172.34	387.30	128.90	518.00	246.50	1380.30	547.74	1928.04
1.1	On-going Projects:									
	- Construction	61.3	31.3	-	-	-	-	61.3	31.3	92.60
1.2	Planned Projects:									
	- Construction	397.3	136.2	374.7	125	507	243	1279	504.2	1783.20
	- HPD studies	11.4	3.7	11	3.5	11	3.5	33.4	10.7	44.10
	- Other activities	5	1.14	1.6	0.4	0	0	6.6	1.54	8.14
2.	**Regional Projects**	1.36	0.34	5.36	4.34	6.76	5.44	13.48	10.12	23.60
1.1	On- going Projects									
1.2	Planned Projects:									
	-Small hydro construction	-	-	4.0	4.0	5.0	5.0	9.0	9.0	18.00
	- Small hydro studies	1.36	0.34	1.36	0.34	1.76	0.44	4.48	1.12	5.60
	Total	476.36	172.68	392.66	133.24	524.76	251.94	1393.78	557.86	1951.64

7.5.2 Summary of investment plan

The summary of investment for hydropower development during the program period is presented in table 7-7. Of the total investment requirement of US$ 1,951.6 million during the entire HDP period (2002-2016), US$ 1,928.0 million or 99 per cent is allocated for Federal projects while regional projects account for only 1 per cent.

The main reason for the steep difference in share of investment between Federal and Regional projects is the cost of construction of Gilgel Gibe, Tekeze, Gojeb, Finchaa IV, and hydropower projects that are included under Federal projects. They are ongoing and committed projects. The construction cost of those projects accounts for about 96 per cent of the total investment requirement for Federal and Regional projects for the 15-year period.

In comparison, the costs of small hydro plant construction in various regions amount to only US$ 18 million. The level of investment on small hydro construction is limited by the fact that feasibility studies of small hydro schemes have yet to be undertaken. Thereafter, construction can commence at a realistic rate of a maximum of 1 site every 3 years.

Studies at Federal and Regional levels account for a total of US$ 49.7 million (or 2.5 per cent of the total investment requirement) for the 15-year program period. Tables 7-8 and 7-9 present further details on investment plans at the Federal and Regional levels, respectively. Yearly investment schedules are presented both for short- and medium-terms, but only indicative lump sum figures are shown for the long-term planning horizon.

7.5.3 Investment priorities

Financing for HDP construction projects at the Federal level is expected to come from EEPCo and private investors. EEPCo is likely to welcome long-term external loans. The total investment requirement for Federal-level hydropower construction, apart from ongoing and NBISAP projects, is about US$ 1,405 million. Of that sum, the short-term requirement is about US$ 533.5 million. Projects requiring external financing take the following priority order:

The first priority goes to the study projects because these studies would provide essential basis for sustainable hydropower generation. External assistance would be required for study projects in the HDP at both Federal and Regional Government level. They would amount to US$ 59.7 million over the 15-year program; US$ 7.8 million alone during the short term planning horizon.

The second priority goes to the implementation of projects identified under the NBISAP. These projects are part of an international commitment. The financing requirement for NBISAP project construction is about US$ 378 million, all in the long term.

Construction of regional hydropower projects is classified as third in order of investment priority. The financing requirement for regional construction is about US$ 18 million, all in the medium- and long-terms. Regions would not probably have the financial capacity to undertake small hydro plant construction at their own, and would strongly depend upon external assistance.

Table 7-8. Annual Investment schedule for Federal hydropower plan (US$ millions)

Description of Projects	Short- term						Medium -term						LT Tot-al	Grand Total
	Year 1	Year 2	Year 3	Year 4	Year 5	ST Total	Year 6	Year 7	Year 8	Year 9	Year 10	MT Total		
Construction of 6 medium hydro plants														1495.8
Gilgel Gibe (180 MW)	55.1	23.9	12.9	-	-	91.9	-	-	-	-	-	-	-	91.9
Finchaa IV unit (34 MW)	0.7	-	-	-	-	0.7	-	-	-	-	-	-	-	0.7
Tekeze (225 MW)	51.6	41.4	112.3	40.0	65.0	310.3	70.7	-	-	-	-	70.7	-	381
Gojeb (105 MW)	13.0	54.4	52.0	59.2	40	218.6	51	-	-	-	-	51	-	269.6
Construction of 1st medium hydro (200 MW) after Tekeze/Gojeb	-	-	-	-	-	-	-	-	50	100	150	300	150	450
Construction of 2st medium hydro (200 MW) after Tekeze/Gojeb	-	-	-	-	-	-	-	-	-	-	-	-	300	300
Construction of 3 small hydro plants														4.6
Hoha (2.5 MW)	0.3	0.7	1.6	-	-	2.6	-	-	-	-	-	-	-	2.6
Const of Aweto & Bonora (Federal)	0.5	0.3	1.2	-	-	2.0	-	-	-	-	-	-	-	2.0
Feasibility study of 11 medium hydro sites														32
Geba	1.0	1.5	-	-	-	2.5	-	-	-	-	-	-	-	2.5
Baro	1.0	1.5	-	-	-	2.5	-	-	-	-	-	-	-	2.5
Genale	-	-	1.0	1.0	-	2.0	-	-	-	-	-	-	-	2.0
Feasibility studies of 1 site (medium & large hydro) per year (including Birbir and Karadobi)	-	-	-	2.0	2.0	4.0	2.0	2.0	2.0	2.0	2.0	10.0	10.0	24
Raising Koka dam height (feasibility review)	-	-	1.0	-	-	1.0	-	-	-	-	-	-	-	1.0
Pre-feasibility study of 15 medium & large hydro sites														10.4
Pre-Feasibility studies, including OM21, Derba (DSS), Fofa (DS8A), Daka, Birbir and Dedessa of 1 site (medium and large hydro) per year	-	-	0.8	0.8	0.8	2.4	0.8	0.8	0.8	0.8	8.0	4.0	4.0	10.4

Table 7-8. Annual Investment schedule for Federal hydropower plan (US$ millions) *...continued*

Description of Projects	Short- term						Medium -term						LT Total	Grand Total
	Year1	Year2	Year3	Year4	Year5	ST Total	Year6	Year7	Year8	Year9	Year10	MT Total		
Reconnaissance study of 30 medium & large hydro sites														**1.70**
Reconnaissance studies from various sites identified so far medium hydro development (1 site per year; candidate sites include GD6, GD7, GD16,GD24, WS2, WS13, WS14, Amarti/Neshe)	0.05	0.05	0.05	0.05	0.05	0.25	0.05	0.05	0.05	0.05	0.05	0.25	0.25	0.75
Updating reconnaissance studies undertaken in various master plan studies (1 site per year; (sites include OM3 (Abelti), OM5 (Alati), OM6, Bibir A, Kashu and Daka)	0.05	0.05	0.05	0.05	0.05	0.25	0.05	0.05	0.05	0.05	0.05	0.25	0.25	0.75
Koka reservoir and Zwai lake interconnection		0.05	0.05	-	-	0.1	-	-	-	-	-	-	-	0.1
High dam between Koka and Awash II stations		0.05	0.05	-	-	0.1	-	-	-	-	-	-	-	0.1
Other projects														**386.20**
3. HP export Projects Transmission line studies and design TRL construction (Ethio -Djibouti / Ethio - Sudan) Nile Basin Initiative HEPP construction	- - -	1.0 - -	1.0 - -	1.25 - -	1.25 - -	4.5 - -	1.0 - -	1.0 - -	- 18 -	- 30 -	- 30 -	2.0 78 -	- - 300	6.5 78 300
Data base development at MOWR	-	-	0.02	0.02	-	0.04	-	-	-	-	-	-	-	0.04
Study of HPBED sub-strategy	-	-	0.5	0.5	-	1.0	-	-	-	-	-	-	-	1.0
Study of Local manufacture of hydropower plant parts, steel towers and insulators	-	-	0.3	0.3	-	0.6	-	-	-	-	-	-	-	0.6

Chapter 8 Water Resources Development Program

The term Water Resources Development Program (WRDP) is used here to describe a subsector like the 3 other subsectors of the WSDP that have subsectoral development programs—water supply and sewerage, irrigation and hydropower. The WRDP, however, is unlike the other 3, which conceptualize their subsectors as single commodities. In contrast, the WRDP as a subsector covers actions that are multi-sectoral in nature and not covered in the other subsectors. It deals with hydrology, meteorology, surface water and groundwater resources and preparation of integrated water-resources master plans for river basins. Activities such as flood protection and watershed management are also embedded in this subsector. The WRDP provides a basis for the implementation of other subsectoral programs, in terms of data and information resources, execution of multipurpose projects, and technical services such as quality standards. In summary, it is an integrated discipline dedicated to optimizing the varied uses of country's water resources.

8.1 Goals

The principal goal of the WRDP is to promote conditions for sustainable development and management of a country's water resources so as to maximize economic and social benefits from available water resources, while ensuring that basic human needs are met and the environment is protected. Towards this goal, the WRDP attempts to target the following specific objectives.

(a) Assess and develop the country's surface water and groundwater resources and promote optimal utilization for diverse uses.

(b) Optimize use of water resources by focusing on multipurpose water-resources development.

(c) Ensure appropriate watershed management practices to promote water conservation, maximize water yields, improve water quality and reduce reservoir silt ation.

(d) Protect water resources from pollution through development and enforcement of appropriate mechanisms and standards.

8.2 Program description

The WRDP consists of the following six major components. A number of interventions are proposed under each component discussed in the succeeding sections.

- Water Resources Assessment
- Flood Protection
- Master Plans for Integrated Basin Development
- Water Quality Monitoring
- Regional Projects
- Eastern Nile Cooperation Projects

8.2.1 Water resources assessment

This component includes installation of hydrological stations, meteorological stations and assessment of groundwater resources. Relevant related aspects are also discussed.

(a) Hydrology

The program calls for upgrading of some river-gauging stations with such equipment as remote

Panel 8-1. Ethiopian cooperation with Nile neighbors

Ethiopia liaises closely with the downstream riparian countries of the Nile River Basin to initiate joint programs and projects for water-resources development in Ethiopia. This cooperative program is known as the Eastern Nile Cooperation Program (ENCP). Organized within the Nile Basin Initiative (NBI), ENCP enjoys the active support of the multilateral donors such as the World Bank and the United Nations Development Programme.

Ethiopia has submitted single-purpose and multipurpose projects in irrigation and hydroelectric power to ENCP. The irrigation projects will cover a total of 174,000 ha. The hydropower projects have a combined installed capacity of 2,473 MW. At a recent meeting of the International Consortium for Cooperation on the Nile (ICCON–CG), the World Bank announced that it is ready to allocate US$ 140 million to start with for common projects. The projects submitted by the Ethiopian Government are described in greater detail in later sections.

sensing (telemetric) stations to enable acquisition of timely data. Such stations may serve as a source of vital information for early warning in the event of floods. Information such as this could be useful, both for internal purposes and also for neighboring countries, especially Sudan which recently experienced high floods from the Blue Nile River during the Ethiopian rainy season. With Sudan and Ethiopia cooperating in economic and social projects, early warning on flood risks could form a vital element amongst the joint activities. In order to be able to supply timely hydrological information, researchers need up-to-date technology for analysis, storage and retrieval of hydrological data. Computerization of hydrological data analysis and storage will be conducted early in the short-term of the WSDP. During the plan period, river-flow measuring stations will be expanded and old stations upgraded in order to improve capacity to collect reliable hydrological data. Two basic types of measuring stations will be installed: automatic recording (primary stations) and non-recording (secondary stations). This program will include:

- Installation of 150 new automatic record ing stations at various rivers and lakes during the short, medium, and long terms of WSDP; i.e., 50 during each term or 10 per year.
- Installation of 124 new non-recording sta tions at various rivers and lakes: 50 sta tions in short and medium terms and 24 in the long term.
- Complete computerization of hydrological data storage and processing in the short term of the program period.
- Providing access to hydrological data through production of yearbooks and net working facility with the Ministry's data

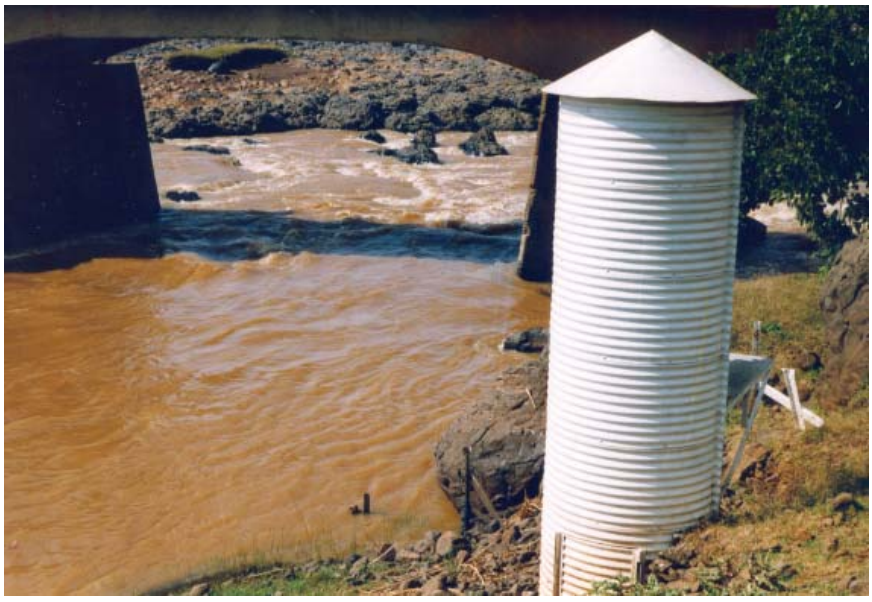
base.

- Operation of secondary stations (installed on minor tributaries) will be transferred to regional water bureaus. Sediment monitoring will continue during the program period.

(b) Meteorology

According to the recommendations of the World Meteorological Organization (WMO) for geographical distribution of meteorological stations, 5,500 weather stations of different classes would be needed for adequate countrywide coverage of Ethiopia. Only 795 weather stations are currently operating, including non-NMSA units. The resource requirements to close the gap and meet WMO recommendations are too high for the Government to afford at present. Therefore, a smaller number is proposed in the WRDP. Older stations will also be rehabilitated to improve the reliability of data they collect. Site selection for new stations will center around activities associated with food-security issues, such as early warning of flood occurrence and agrometeorological information on weather affecting crop production. Priority will also be given to weather stations for new airports that will provide aeronautical weather information for enhanced aviation safety. Key elements of this component are:

- Installation of 745 stations of different classes: 210 in the short term, 235 in the medium term, and 300 in the long term.
- Establishment and strengthening of 8 regional branch offices to improve the efficiency and quality of data collection and analysis.
- In each of the 5-year terms of the WSDP, many of the staff will be trained to help cope with the expanded activities (costs of this component are reflected under chapter on institutions and capacity building).



(c) Groundwater resources study

Exploitation of groundwater resources for domestic water supply is necessary in most parts of the country to supplement surface-water resources, especially in regions of recurring drought. In the dry lowlands, groundwater may be the only resource for all other uses as well. However, the extent of Ethiopian groundwater resources is not well known. An assessment of groundwater resource is critically needed to help mitigate the effects of drought and reduce the risks of overexploitation. Detailed information on groundwater resources in all parts of the country is an essential element of the Water Management Policy and an objective of the WSDP. The

Ethiopian Geological Survey (EGS) is responsible for studying and mapping groundwater resources countrywide. EGS has investigated groundwater resources and prepared maps for an area of 445,700 square kilometers at scales of 1:250,000 and 1:1,000,000. EGS plans to continue its survey work and mapping with data and information from its own drilling program and other sources. Key features of this study are proposed to be as follows:

- Assessment of groundwater resources available for sustainable exploitation both in time and space.
- Monitoring of groundwater quality by de veloping a network of monitoring bore holes.
- Hydrogeological mapping covers only about 40 per cent of the country with maps scaled at 1:1,000,000 and 1:250,000. Un der this program, covering the remaining area is proposed.
- The EGS has only 9 hydrogeologists. This program plans to train 30 more hydrogeologists and 11 geophysicists at the MSc level and in specialized courses, including five chemists. Much of this train ing will take place during the short term (costs are reflected under chapter on in stitutions and capacity building).

It may be noted that the EGS groundwater assessment program consists of 3 phases+. Phase I will last for 5 years. Phases II and III will last 4 and 3 years respectively, thus concluding the assessment in 12 years. Financing has been committed only for the first 5 years. Six “type areas” have been selected for detailed hydrogeological study based on hydrogeological setting, data availability, and socio-economic requirements. The EGS will perform its own drilling.

8.2.2 Flood protection

This component covers completion of two flood protection studies (Awash River and Lake Tana) and implementation of four flood control projects (Awash River, Lake Awassa, Besseca Lake, and heightening of Koka Dam).

(a) Flood protection studies

Flood risks exist among some Ethiopian water bodies. The following studies are proposed under the present program to help in developing flood-protection solutions:

- Studies on flood protection and river train ing programs for the Awash River.
- Detailed study to identify the causes of flooding along the shores of Lake Tana and recommendations to prevent recurrence.

(b) Flood control projects

Implementation of the following works has been proposed as part of the flood control component.

Awash River. Annual floods in the valley cause considerable damage to economic infrastructure, especially in the Middle and Lower Awash areas. As a stopgap measure, flood-protection activities in those areas will be reactivated and strengthened primarily to protect economic infrastructure. The operations and maintenance units that used to exist at two locations (Amibara and Dubti) will be re-established. The strengthening program includes procurement of equipment for maintaining protective dikes and for river training and stabilizing watercourses. The 2 units also need additional manpower, at least 2 engineers and 3 aide engineers with support personnel, at each location.

Lake Awassa. The level of Lake Awassa has gradually risen, causing damage to infrastructure in Awassa town. Construction of a dike between

the lake and the town has not contained the floods. Proposals for remedial measures, to be based on detailed study of the causes of the rising water level, are considered essential. Detailed technical and environmental studies to elucidate the nature of the rising lake levels have been conducted. Tentative flood protection proposals include using lake water for irrigation and recharging aquifers connected to nearby water bodies at lower levels than Lake Awassa. This proposal together with other pilot activities proposed by these studies will be undertaken under this program.

Lake Besseca. Lake Besseka, located near Metahara town, has been growing in size and

causing problems on the railroad and the Assab highway. It has also inundated some sugarcane plantation and grazing areas in the vicinity. The lake water is highly saline. The Government has designed a scheme for controlling the rising level of the lake and partially reclaiming the inundated farmland and grazing area. According to the plan, enough lake water will be pumped into the Awash River to keep the lake at a level that will not affect the railway track and the highway. If the rate of pumping is controlled, the addition of the lake water will not raise the salinity of river water to a level unsafe for irrigation downstream. Implementation of this proposal constitutes an important element of the present program.

Koka Dam heightening. Koka Dam provides the only control of the Awash River for supplying water for irrigation and hydroelectric power generation at the three power stations on the river and to prevent flooding of farmlands in the upper and middle valleys. The reservoir has silted up, resulting in loss of 40 per cent of its original capacity. The amount of water available for downstream use is severely reduced and Koka reservoir no longer has a flood-control capacity. In the previous Awash Valley master-plan study, it was proposed to raise the Koka Dam height to increase its capacity to provide water for downstream irrigation, hydropower development, and flood control. The planned Awash study within the master-plan study will further investigate heightening of the Koka Dam from E.C. 1998 to 2000.

8.2.3 Master plans for integrated basin development

The MoWR has in the last 8 years prepared master plans for integrated basin development of Ethiopia's 5 major basins. The Government remains firmly committed to support the preparation of such plans for all the remaining basins; namely, the Wabi-Shebelle, Genale-Dawa, and Awash rivers, the Rift Valley lakes, the Ogaden basin, and the Danakil and Aysha dry basins. The Wabi-Shebelle study has already begun and those for the rest of the basins will be carried out during the plan period. Status of each basin in terms of how much is known about its natural conditions is briefly reviewed below.

Wabe-Shebelle River Basin. A reconnaissance study was conducted between 1968 and 1973 with French assistance, followed by an in-house reconnaissance survey in 1998 by the MoWR. The integrated river-basin development master

plan study has begun with the Water Works Design & Supervision Enterprise (WWDSE) in association with national and foreign consulting firms. The study is to be completed within the coming 3 years.

Genale-Dawa River Basin. A reconnaissance survey by the MoWR was conducted for this river basin in 1998. It will provide the basis for development of an integrated river-basin development master plan under the present program.

Awash River Basin. A master plan based on surface-water resources was completed in 1981 E.C. Under the present program, a master plan for integrated water-resources development including groundwater will be prepared. It is important for the Government to give high priority to this study since the basin has reached a high level of development. The master plan will allow consideration for improving water supply for irrigation and hydropower development in the river basin, as well as to examine the possibility of restoration of capacity of Koka reservoir with heightening of the Koka Dam.

Rift Valley Lakes Basin. A reconnaissance survey has been completed with the UNDP assistance. An integrated river-basin development master plan will be prepared between 2003 and 2005.

Ogaden Basin. The MoWR has prepared a reconnaissance survey. Preparation of river-basin development master plan is planned for the short term of the WSDP.

Danakil and Aysha Basins. These two dry basins lie in the northeastern part of Ethiopia and have no perennial streams. The study will focus on groundwater resources and livestock development. The MoWR has conducted a reconnaissance survey that will enable master plans to be prepared during the short term of the WSDP.

Countrywide integrated water-resources master plan. After the completion of individual master plans, a countrywide integrated river-basin master plan will be prepared that incorporates all the individual basin master plans. That comprehensive master plan will provide full and complete information on all development options in the country's river, lake, and dry basins.

Combined basin master plans. In a measure to take advantage of existing master plans, master plans of adjacent river basins can be combined for specific purposes. If adjacent river basins form part of an international river basin, e.g., tributaries to the Nile River system, existing master plans can be combined into one document showing the full plans of the country's basins of Nile tributaries. If water can be transferred from one basin to another, for example, a revised water-availability study and comparative study on the advantages of water transfer could help to optimize water utilization in the country.

8.2.4 Water quality monitoring

Industrial effluents are being directly emptied into the Awash River system and its tributaries in an uncontrolled manner. Old industries have abandoned their treatment plants and the new ones are starting with no permit for water extraction and no obligation to treat their effluents before discharging them into watercourses. Other river basins are experiencing similar abuses, especially the Blue Nile, with factories at Bahr Dar.

The Ethiopian Water Resources Management Policy has clearly stated that the water sector has the responsibility to "Develop water quality criteria, guidelines and standards ... and to formulate water quality standards ... for effluents to be discharged into natural watercourses ... and to ensure their implementation ..." To fulfill those requirements, the MoWR is preparing a set of national water-quality guidelines that will specify the quality of drinking water and effluent water-quality standards from industrial and irrigation drainage. To be able to monitor fulfillment of those standards,

the present program will support the establishment of: (a) one central water quality laboratory, (b) eight regional water quality laboratories, and (c) strengthening of the pollution control unit with relevant equipment and staff for Addis Ababa City Administration.

8.2.5 Regional projects

Watershed management projects for the 3 regions of Harari, Somali, and SNNPR, and the Dire Dawa City Council, are included in the WRDP. Environmental impact studies for coffee-washing plants for SNNPR and flood studies and control for Gambella are the other region-initiated projects.

8.2.6 Eastern Nile Cooperation Projects

The Ministers of Water Affairs of the Nile riparian countries have agreed to collaborate in developing Nile water resources to achieve sustainable socio-economic development of their people through the equitable utilization of their common resources of the Nile waters. In the case of Ethiopia, the World Bank, CIDA and UNDP are working in partnership with the Government at this beginning stage. The Nile Basin Initiative Strategic Action Program (NBISAP) consists of two subprograms: the Shared Vision Program and the Subsidiary Action Program.

The Shared Vision Program comprises a range of activities to set up coordination and create an environment of mutual trust to enhance implementation of projects of common interest. Projects selected by individual riparian countries will be implemented through subsidiary action programs. The projects selected by the Ethiopian Government and accepted by the NBI Council of Ministers consist of 4 hydropower and 4 irrigation projects. (See table 8-1.)

The main consumer of future hydroelectric output is expected to be the Sudan. However, that country's power needs are not yet known or established, so it is problematic to set a realistic

Table 8-1. Ethiopian Projects with ENCP

Irrigation and Drainage Projects		**Hydropower Development Projects**	
			Installed
1. Lake Tana Area	50,000 ha	1. Baro	669 MW
2. Anger-Nekemt Area	26,000 ha	2. Geba	254 MW
3. Diddessa Area	55,000 ha	3. Birabir A&R	508 MW
4. Humera Area	45,000 ha	4. Karadobi	1,050 MW

implementation plan. In this case, WSDP implementation schedule can be considered indicative at best. The schedules may serve to indicate the magnitude of investment, if not the actual time frame.

A brief description of the above projects, together with some watershed management projects, is provided below.

(a) Irrigation and drainage projects

Lake Tana Shores and Regulation Works. The Chara Chara weir, already completed, regulates the outflow of the Blue Nile through the Lake Tana outlet. The regulated flow is to be used for hydroelectric generation at the Tis Issat power plant. Regulation of the outflow of the lake will also permit irrigation development along the shores of Lake Tana with water from the Lake. The total area to be irrigated is 50,000 ha. The Ethiopian Government gives high priority to irrigation development mainly for food production in this densely populated and drought-prone area.

Anger-Nekemt Irrigation Project. Located in the Angar River Basin, the project will construct 2 impounding dams on the upper reaches of the river. The total area to be developed for irrigation is 26,000 ha. A hydropower plant may also be developed there with an installed capacity of 15 to 20 MW for the Nekemte area.

Diddessa Irrigation Project. Located in the Diddessa Basin in Western Wollega Zone, this project will construct 3 regulation dams: 1 on Diddessa River and 1 each on its tributaries, the Dabana and Negeso Rivers. Irrigation canals and drainage systems will need to be constructed to irrigate a total area of 55,000 ha. A small hydropower plant can be developed with an installed capacity of 22 MW at the dam planned for the Diddessa River.

Humera Irrigation Project. The Humera Irrigation Project is situated in Tekeze Basin, near the town of Humera on the left bank of the river. With the construction of the Tekeze dam for hydropower, the regulated flow of the river will ensure adequate flow for irrigation development in the Humera area. The construction of a diversion weir upstream of the area will make irrigation water available by gravity. The total gross estimated area available for irrigation is 45,000 ha.

(b) Hydropower Projects

Baro 1 and Baro 2 Hydropower Projects. Located in the northeastern part of the Baro-Akobo basin, the 2 hydropower projects are based on the same reservoir. A dam built on the upper reaches of Baro River will regulate the river flow. The 2 hydropower plants will be developed in series with Baro 1 at the dam site and Baro 2 downstream as a cascade scheme with a total head of 690 meters, depending on the regulation provided by the dam. The Baro Dam will also provide flood protection for the Gambella plain and reduce water losses.

Geba Hydropower Plants. Located in the Baro-Akobo Basin on a tributary of the Baro River, the 2 power plants are cascade schemes drawing water from the same regulating dam. The two power plants will each have a diversion weir and power plant in series on the Geba River. Geba 1 and Geba 2 power plants will have a total combined gross head of 702 m. The two plants will have a

combined capacity of 254 MW. Both plants are designed as underground schemes.

Birbir A & Birbir B Hydropower Projects. Also located in the Baro-Akobo Basin, on the Birbir River which is a tributary of the Baro River, the 2 dams will be in series, each with a hydropower plant. Their combined capacity will be 508 MW.

Karadobi Hydropower Project. One of the 4 major hydropower plants planned for the main stem of the Blue Nile River, the Karadobi plant will be located at the toe of the dam. The dam will be a high concrete arch dam with a reservoir capacity of 41 billion cubic meters. The installed capacity will be about 1,050 MW with an annual average energy production capacity of 6,920 GWh. The estimated unit cost of energy of 5.7 US¢/kWh is attractive for project development. Regulation of the Blue Nile (Abbay) River with the dam will benefit the downstream countries of the Sudan and Egypt. The Sudan will benefit most from flood control and from irrigation and power generation at Roseires Dam.

(c) Watershed Management

The ENCP participating countries consider watershed management for erosion control to be extremely important. A vital multisectoral activity, erosion control helps in reducing reservoir siltation and sedimentation, thereby extending the life of impounding dams built, or to be built, in their countries. Interventions in the Ethiopian section of the sub-basin should deal with the causes of land degradation, soil erosion, deforestation, and soil fertility. The watershed management program could also address long-term problems of desertification and rainfall reduction in the Nile tributary basins. The ENCP members have agreed to conduct programs in Ethiopia as outlined below.

- Support to institutional and legislative re form component of the irrigation and drain age development subproject.
- Capacity-building and institutional strengthening in agriculture and forestry at national and regional levels, research and development, soil and water conser vation measures, population policies, health, and nutrition.
- Undertaking of an erosion and sediment study that will investigate and determine the impacts of control measures against soil erosion in the project areas.
- Assistance in undertaking studies and ra tionalizing polices dealing with population, education and literacy, alternative liveli hoods and out-migration, and carrying capacity and population density.

8.3 Cost assumptions

Assumptions made in estimating the funding requirements for different program components are outlined below.

- Following unit prices of equipment and sta tions are used in local currency (Birr): staff gauge water-level recorder (4,000), float type (30,000), digital (50,000), bank-oper ated cable-way (7,000) and installation cost per station (4,000).
- Based on the above unit prices, estimated cost of each type of station is: 15,000 Birr for non-recording stations, 45,000 Birr for float type automatic recording stations,

and 65,000 Birr for digital automatic recording stations. All new primary stations will be equipped with the digital type of stage recorders.

- EGS has developed financing needs for the first phase of groundwater assessment study. These estimates are used, and pro rate estimates have been made to obtain investment needs for the other phases. Equipment procured in the first phase is assumed to be available for the other phases.

- For Besseca Lake works, the least-cost alternative designed and estimated by WWDSE was used. Its cost is Birr 15,410,000. Construction is assumed to begin in 1994 E.C. and would be completed within 2 years.

- Cost estimates for laboratories were estimated based on record of costs actu ally involved or estimated for similar ac tivities in various studies.

- For the Nile Basin projects, funds will be committed to advance these projects to feasibility and design stage, and to imple mentation of watershed management projects. Once the studies and designs are completed, funding for implementation might become available, pending agree ment among member countries. However, funding of US$ 400 million has been ear marked for the subprograms listed under watershed management.

8.4 Investment requirements

The Investment requirements for different program components are presented in accordance with the level of implementation responsibility (table 8-2). It was considered necessary because some of the proposed projects were to be implemented by the Federal Government and there are others that would be executed by the Regional Governments. Total investment requirements over the entire plan period amounts to $US 655.58 million.

Table 8-2. Investment requirements for WRDP (US $ Millions)

Project Description & Category	Short-Term 2002-2006	Medium-Term 2007-2011	Long-Term 2012-2016	Total
Federal Projects				
· *On-going Projects*				
Hydrology (stream gauging stations)	0.39	0.39	0.32	1.10
Meteorological stations	1.29	1.42	2.10	4.80
· *Planned Projects*				
Integrated WR Master Plans	17.13	6.94		24.07
Lake Tana Flood Study	1.13			1.13
Awash Valley Flood Study	1.51			1.51
Besseka Lake Control Works	1.81			1.81
Watershed Management	100.00	150.00	150.00	400.00
Ground Water Resources Assessment	4.56	1.36	1.36	7.29
Awash Valley Emergency Flood Control	4.31	0.00	0.00	4.31
Central Water Quality Laboratory	1.34	0.00	0.00	1.34
Federal Total	133.63	160.11	153.78	446.83
Regional Projects				
Gambella	0.18	0.29		0.47
Dire Dawa	7.94	12.25	5.65	25.84
Harar	8.59	19.10	11.47	39.16
Somali	13.02	15.29	22.94	51.25
SNNP	0.05			0.05
8 Regional Water Quality Laboratories	1.65			1.65
Addis Ababa City Administration	18.78	24.85	46.78	90.41
Regional total	50.21	71.78	86.84	208.74
Total: Federal and Regional	183.83	231.90	240.62	655.59

The share of the Federal and Regional projects is estimated to be 68 and 32 per cent respectively. As far as the share over the three planning periods is concerned, it is around 30 per cent in the short-term, while almost evenly distributed in the remaining two planning periods. Local currency portion represents over 90 per cent of the total investment requirements. Tables 8-3 and 8-4 present annual investment schedules for various program components on, respectively, the Federal and Regional basis.

Table 8-3. Annual investment schedule of Federal projects (US$ millions)

Description of Federal Projects	Short- Term						Medium-Term						Long Term	Grand Total
	Yr1	Yr2	Yr3	Yr4	Yr5	Total	Yr6	Yr7	Yr8	Yr9	Yr10	Total	Total	
River Gauging Stations	.079	.079	.079	.079	.079	0.395	.079	.079	.079	.079	.079	.395	.314	1.105
Establishment & Rehabilitation of Meteorology Stations	.047	.316	.317	.302	.303	1.285	.280	.280	.280	.288	.288	1.416	2.101	4.802
Integrated WR Master Plans	1.647	3.101	4.047	2.800	5.694	17.289	4.400	1.694	.165	0	0	6.941	0	23.548
Lake Tana Flood Study	.452	.679	0	0	0	1.131	0	0	0	0	0	0	0	1.131
Awash Valley Flood Study	.602	.904	0	0	0	1.506	0	0	0	0	0	0	0	1.506
Besseka Lake Control Works	.727	.906	.181	0	0	1.814	0	0	0	0	0	0	0	1.814
Ground Water Resources Assessment	2.984	.542	.477	.280	.280	4.563	.272	.272	.272	.272	.273	1.361	1.361	7.285
Watershed Management			30	35	35	100	30	30	30	30	30	150	150	400
Awash Valley Emergency Flood Control Strengthening		1.07	1.62	1.62		4.31								4.31
Central Water Quality Laboratory		.25	.44	.445	.192	1.337								1.337
Total Federal Projects	6.538	7.847	37.161	40.526	41.548	133.63	35.031	32.325	30.796	30.639	30.64	159.43	153.77	446.83

Table 8-4. Annual investment schedule of Regional projects (US$ millions)

Description of Federal Projects		Short- Term						Medium-Term						Long Term	Grand Total
		Yr1	Yr2	Yr3	Yr4	Yr5	Total	Yr6	Yr7	Yr8	Yr9	Yr10	Total	Total	
1.Gambella															
	Gambella Flood Study & Control					.176	.176	.294					.294		.47
2. Harar															
A.	Implementation of Watershed Management		1.53	2.29	2.29	2.29	8.40	2.29	2.29	2.29	2.29	2.29	11.45	3.82	23.67
B.	Study Inter-Regional WR Management			.18			.18								.18
C	Implementation of Inter-Regional WR Management							1.53	1.53	1.53	1.53	1.53	7.65	7.65	15.3
Sub-Total - Harar			1.53	2.47	2.29	2.29	8.58	3.82	3.82	3.82	3.82	3.82	19.10	11.47	39.15
3. Dire Dawa															
3.1 Watershed Management															
A.	Implementation of WR Management in Region	2.82	1.12	1.12	1.12	1.12	7.30	2.27	2.27	2.27	2.27	2.27	11.35	5.65	24.3
B.	Study Inter-regional WR Management				.294		.294								.294
C.	Implementation of Inter-Regional WR management.							.18	.18	.18	.18	.18	.9		.9
3.2 Flood Protection studies of Dire Dawa City						.06	.06								.06
3.3 D/Dawa Master Plan Study		.118	.176				.294								.294
Sub-Total - Dire Dawa		2.94	1.30	1.12	1.41	1.18	7.94	2.45	2.45	2.45	2.45	2.45	12.25	5.65	25.84

Table 8-4. Annual investment schedule of Regional projects (US$ millions)...*continued*

	Description of Federal Projects	Short- Term						Medium-Term						Long Term	Grand Total
		Yr1	Yr2	Yr3	Yr4	Yr5	Total	Yr6	Yr7	Yr8	Yr9	Yr10	Total	Total	
4. Somali															
A	Implementation of Regional Watershed Management.		3.82	1.47	3.82	3.82	12.93								12.93
B	Study Inter-Regional WR Management		.088				.088								.088
C	Implementation of Inter-Regional WR Management							3.06	3.06	3.06	3.06	3.05	15.29	22.94	38.23
Sub-Total - Somali			**3.91**	**1.47**	**3.82**	**3.82**	**13.02**	**3.06**	**3.06**	**3.06**	**3.06**	**3.05**	**15.29**	**22.94**	**51.25**
5 SNNPR															
A	Environmental Impact Study of Coffee Processing Plants		.02				.02						-	-	.02
B	Flood Management studies		.03				.03								.03
Sub-Total - SNNPR			**.05**				**.05**								**.05**
6	8 Regional Water Quality Labs.(Tigrai, Amhara, Afar, Oromia, SNNPR, Somali Gambella. & Ben.-G.)		.411	.411	.411	.414	1.647								1.647
7	Addis Ababa City Admin.														
A	Flood Control		4.55	4.55	4.55	4.54	18.19	4.97	4.97	4.97	4.97	4.97	24.85	46.78	89.78
B	Pollution Cont. Equip			.196	.196	.196	.59								.59
Sub-Total Addis Ababa Admin.			4.55	4.75	4.75	4.74	18.78	4.97	4.97	4.97	4.97	4.97	24.85	46.78	90.37
	Total Regional	**2.94**	**11.75**	**10.22**	**12.68**	**12.63**	**50.19**	**14.59**	**14.30**	**14.30**	**14.30**	**14.29**	**71.78**	**86.81**	**208.74**

Chapter 9 Institution and Capacity Building Program

9.1 Existing policy and regulatory framework

The basic water policy document in Ethio pia is: Comprehensive and Inte-grated Wa ter Resources Management: Ethiopian Water Resources Management Policy issued by the Ministry of Water Resources in July 2000. This document sets out management policy on water resources in general and those that relate to water supply and sewerage, irrigation and hydropower. It also describes policy on various cross-cutting issues, among others, those dealing with groundwater resources, watershed management, water-rights allocation, trans-boundary concerns and technology.

Proclamation No. 197/2000, the Ethiopian Water Resources Management Proclamation, was issued in March 2000. It assigned certain key functions - regulatory duties, responsibilities, and authority - among the various agencies concerned with the water sector. It superseded Proclamation No. 92/1994 that provided provisions for utilization of water resources. In any case, that latter proclamation is inapplicable, as the relevant agency, the Ministry of Natural Resources Development and Environmental Protection, no longer exists.

Proclamation No. 197/2000 declares that "All water resources of the country are the common property of the Ethiopian people and the State." It gives MoWR the authority to allocate and apportion water to all regions regardless of the origin and location of the resource. The proclamation lists a wide range of the following regulatory tasks among the powers and duties of the MoWR (see Panel 9-1).

There still appears to be some overlap between the water-sector regulatory tasks stipulated for the

Panel 9-1. Powers and duties of the supervising body (MoWR)

1. The supervising body shall be responsible for the planning, management, utilization and protection of water resources. It shall also have the necessary power for the execution of its duties under the provisions of this proclamation. Without limiting the generality of the above statements, the supervising body shall have the following powers and duties:

(a) Issue permits and certificates of professional competence.

(b) Ensure that studies relating to water resources development, protection, utilization and control have been carried out.

(c) Determine the allocation and manner of use of water resources among various uses and users.

(d) Require submission of plans and proposals from any persons who apply for a permit to undertake any kind of waterworks and approve, reject, or amend such plans and proposals.

(e) Establish quality standards for surveys, design and specification of waterworks as well as standards for the construction of waterworks, necessary for the development of water resources; it shall also supervise compliance of waterworks with the established standards.

(f) Prepare directives, in consultation with public bodies concerned, in order to en sure that water resources are not polluted and hazardous to health and environ ment.

(g) Issue directives pertaining to the safety of hydraulic structures for the prevention of damages caused by dam water to dams, persons, property and crops.

(h) Cause, in consultation with the public bodies concerned, the issuance of quality or health standards that enable it to entertain an application for a permit to dis charge or release polluted water into water resources.

(i) Give an order of rectification or suspension of waterworks that are incompatible or inconsistent with the Ethiopian water resources policy, relevant Basin Master Plan Studies and water resources legislative framework; and ensure its implementation.

(j) Issues directives, regarding water use restrictions in a situation of water shortage mergency, and supervise the implementation of same.

2. The Supervising body may, where necessary, delegate its powers and duties to the appropriate body for efficient execution of its duties.

MoWR and those stipulated for the Environmental Protection Authority (EPA). By Article 6 of Proclamation No. 9/1995, for example, the EPA became responsible for protecting the water resources of the country. A review of the current institutional responsibilities strongly suggests that distinction between the tasks assigned to different institutions must be clarified or the incompatible articles repealed.

Proclamation No. 41/1993 grants Regional Governments regulatory powers that include small-scale hydropower. In addition, the following provision of that proclamation empowers the Regions to:

(a) Supervise the implementation within the regions, of purity and sanitation standards prescribed in relation to the water used for various services and sewerage purposes.

(b) Supervise the balanced distribution and uti lization of region's water resources to vari ous types of services.

(c) Ensure the implementation of law, regula tions and directives issued in relation to the protection, conservation and utilization of water in the region.

9.2 Institutional overview

9.2.1 General conditions

Historically the first water-sector institution was established in Ethiopia in 1956 as a "Water Resources Department under the then Ministry of Public Works." The sector has since experienced considerable institutional changes and developments. Many water-sector institutions were created at Federal and Regional levels following the new decentralization and regionalization policy.

Existing Federal institutions directly or indirectly involved in the management of water resources are: MoWR, EPA, Ethiopian Electric Power Corporation (EEPCo), Ethiopian Electric Light and Power Authority, Ministry of Works and Urban Development, Ministry of Health, the Water Supply and Sewerage Authority (WSSA) of Addis Ababa, and the Addis Ababa Municipality. In addition, there are some subsidiary organizations of the MoWR that are engaged in different aspects of water resources planning, development and management, namely: the Ethiopian Water Works Construction Enterprise (EWWCE); the Water Well Drilling Enterprise (WWDE); the Water Works Design & Supervision Enterprise (WWDSE); and the Awash Basin Authority.

Most Regional Governments have established bureaus of water, mines and energy or bureaus of water resources development. All bureaus have branch offices or departments. Some Regions have established such specialized institutions as waterworks construction enterprises, commissions for sustainable agriculture and environmental rehabilitation, and/or irrigation authorities.

The Ethiopian water-resources management policy specifies that urban water-supply services be recognized as autonomous entities. Currently, however, some are autonomous and others are organized under bureaus or branch offices.

9.2.2 Issues and constraints

In analyzing institutional issues within the water sector, a wide array of documents were reviewed, discussions were held with a number of professionals and officials, and responses were obtained from regional water bureaus through a questionnaire survey. Main findings are summarized below.

(a) Institutional instability. Water-sector insti tutions frequently undergo restructuring and reorganization, creating uncertainty and complicating the task of institutional capacity building.

(b) Management problems. Such problems are typically caused by inefficient organi

zational structure, understaffing, and un der equipping; lack of organizational units at the lowest levels like woreda and zones that could cater to local needs; absence of career paths for staff; low salaries and lack of staff motivation; and inability of the Government to retain trained and experi enced staff.

(c) Lack of institutional coordination. Major stakeholders in water-sector activities in clude the MoWR, regional water bureaus, non-governmental organizations (NGOs), local communities, and the private sec tor. However, no structural and coordi nated linkages exist among them, even between the two key institutions: the MoWR and the water bureaus. Poor insti tutional coordination often defeats the ef forts to achieve sectoral goals.

(d) Problems of capacity. Shortage of skilled manpower is the critical issue facing all institutions. Every regional government has identified this constraint as the most limit ing in the fulfillment of its 5-year plan. More over, inadequate office and equipment fa cilities, including insufficient vehicles, fur ther compound the nature of the problem.

(e) Limited funds/budget. Water-sector devel opment projects require a high level of in vestment. Lack of sufficient funding has imposed limits on the quantity and quality of outputs and services of the sector. More over, lack of effective cost-recovery mechanisms often inhibits institutions from sustaining themselves and fulfilling their mandates.

(f) Lack of an integrated management infor mation system (MIS). Water-sector insti tutions generate and utilize a wide range of data. Nevertheless, the sector lacks a centralized and integrated MIS. There are no standard procedures for the gathering and storing of data and information, as well as deficiencies in regional institutions at all levels in regards to maintaining proper data and information records.

(g) Weaknesses in O&M systems. Consid erable drawbacks exist in managing, op erating, and maintaining facilities, espe cially in rural areas. Several water supply and sanitation services are not function ing in almost every region. Operations and maintenance usually have a “low profile” and are under funded and under equipped, in comparison with design and construc tion functions.

(h) Absence of equipment standardization. Several NGOs help rural communities in constructing and developing water supply and irrigation schemes, installing various types of pumps and generators. When equipment items begin to fail, the commu nities often face difficulty in finding replace ments or spare parts. Standardizing equip ment specifications should therefore be on the development agenda of the water sec tor.

(i) Low community participation. Sectoral as sessments indicate a low level of com munity participation in project identification, construction, and O&M of schemes. Par ticipatory and consultative approaches with stakeholders are key to effective and responsive development activities.

(j) Policy and legislative issues. Enabling leg islation appears to be missing from such issues as formation of water users’ asso ciations (WUAs); cost recovery; O&M, and administration of schemes; and water-use rights of downstream and upstream con sumers. Mandates and responsibilities are not clearly delineated between Fed eral Government agencies and Regional bureaus regarding water-quality manage ment, the collection and analysis of hydro logical data and other similar functions.

Regarding sewerage, lines of responsibility are unclear between the MoWR and Federal and Regional health and sanitation agencies, and—at Regional level—between bureaus of water resources, urban water supply services, municipalities and health bureaus. Similarly, land tenure is another area requiring legislative action. The 1975 land reform proclamation conferred land ownership on the State, which may in turn grant land-use rights to individuals and associations. Land may be reallocated by the State as it deems necessary. This means security of land tenure is not guaranteed, even in areas under small-scale irrigation. In the absence of legal guarantees against reallocation or outright eviction, farmers might be discouraged from investing in permanent structures on the land during their tenure.

9.2.3 Sub-sector specific constraints

The above issues and constraints characterize the general institutional conditions in the water sector. Nevertheless, there are many other issues and constraints that have specific implications for a particular water using subsector. Though these might have been discussed in the preceding section within a broader context, they will be briefly summarized here.

In water supply and sewerage, the most prevalent constraints in all regions are: (a) shortage of skilled manpower at all administrative levels; (b) community participation is low in the formulation and implementation of development programs; (c) insufficient capacities in terms of equipment and other material resources. Moreover, sanitation issues are not properly addressed. The most recurrent sanitation problems involve solid wastes, industrial wastes, and urban sewerage. Institutions with a mandate to address these problems are the WSSA of Addis Ababa, regional urban water-supply services, the MoWR, and municipalities (for solid waste). They are, however, not fully capable of tackling the existing problems.

The irrigation subsector has been frequently subject to restructuring and reorganization. The result is institutional instability and uncertainty that deter capacity building. Institutional ineffectiveness, high investment requirements, manpower shortages, and insufficient equipment and machinery also plague the subsector. No governmental unit exists to coordinate, monitor, supervise, or regulate subsectoral activities and to foster sound policy related to agriculture. Similarly, at the woreda level, there is no effective administrative unit to provide guidance in operating and maintaining irrigation systems for farming communities. NGO involvement in the subsector has not effectively shifted from a relief orientation to a development basis. Capacity for coordinating, monitoring, and supervising multipurpose projects is lacking. Further constraints to irrigation development stem from low levels of private-sector involvement, owing to a poor environment for private ownership and due to a lack of economic incentives in the form of agricultural credit.

Major constraints in the hydropower subsector are shortage of skilled manpower, lack of funds for investment, inadequate private-sector involvement as a result of lack of incentives.

9.3 Institutional requirements

The WSDP is a long-term plan that would guide the development and management of the country's water resources towards achieving the goals of poverty reduction and sustainable development. So long as the institutional structure remains as fragmented as described in the preceding sections, Ethiopia will not be able to achieve these goals. The national water policy has set broad principles for institutional reforms that were further elaborated in the national water strategy. This section aims to translate these policy principles and strategy directions into an "Institutional Reform Package" that is not only essential for successful implementation of the WSDP, but also in order that Ethiopia have the continued growth in economic productivity that is needed for sustainable development. The Institutional Reform Package has four components: (a) reorganizing the Federal institutional structure, especially the

MoWR; (b) establishing new institutions; (c) strengthening of the regional institutions; and (d) building partnerships. Main features of each of these components are discussed below.

9.3.1 Reorganizing the Federal institutional structure

The existing organization of the MoWR is incomplete in some aspects. Sectoral management policy has bestowed additional mandates on the MoWR, and in its present form the Ministry is not capable of meeting those mandates. It is therefore essential to restructure the MoWR in line with the policy provisions and in response to the institutional requirements stipulated in this report. This entails reorganizing and strengthening of the MoWR, as well as establishing some new institutions. Regarding the first point, it is proposed that the MoWR be reorganized into following units or departments, in addition to administrative/financial support units.

- Irrigation development
- Hydropower study, design, and development
- Groundwater study and development
- Research and development
- Flood control
- Transboundary affairs
- Legal and regulatory affairs.

The other water-sector institutions requiring strengthening at Federal level is the WSSA of Addis Ababa. Institutional structure dealing with sanitation issues needs particular attention. At the Federal level, only water-dependant sewerage is covered by the WSSA. They are not responsible for solid waste, industrial waste and all other non-water-dependent sanitation that affect the quality of ground and surface waters. The following institutions need to work together at the Federal level to perform sanitation-related responsibilities. An important step forward would be bringing harmony in the functions and responsibilities of these organizations through a legal decree.

- The Environmental Protection Authority should enforce waste-disposal laws by taking action against solid waste disposal that causes environmental pollution in cit ies and contaminates rivers. Linkages with other institutions and programs should be studied to ensure effective outcomes from shared sanitation responsibilities.
- The Ministry of Health, together with the Ministry of Education and mass media, should raise awareness regarding hy giene and sanitation from the health per spective.
- The Ministry of Housing and Urban Devel opment should incorporate waste-disposal mechanisms in construction design and implementation, enforce national policy and follow-up related action.
- The Ministry of Water Resources should monitor and supervise quality, and other standards, in partnership with other stake holders.
- Municipalities should play a leading role in waste collection and monitoring in collabo ration with the urban dwellers' associa tions. The municipalities should also en courage private-sector involvement and should facilitate waste-collection opera tions by the private sector.

9.3.2 Establishing new institutions

In order to implement the WSDP, and to secure long-term basis for sustainable development and management of water resources, 4 types of new institutions should form the foundation for action

and become integral parts of the MoWR. They are:

- Basin Development Authorities
- Water Resources Information Center
- Water Resources Research Center
- Water Resources Training Institute

(a) Basin Development Authorities

The national water management policy rightly states that the basin should be considered as the basic planning unit for development and management of water resources. It is so because the basin approach promotes comprehensive development of a large area, rather than fragmented development interventions. Decentralized management requires basin level organizations. It would be unrealistic to assume that the MoWR will be able to perform the functions of decentralized water resources management. It neither has the capacities, nor will it be appropriate for the Ministry as a policy and regulatory institution to involve itself in the implementation of water resources development and management activities. Accordingly, the present program proposes the establishment of the following 7 basin development authorities:

- Blue Nile Basin Authority
- Baro Akobo Basin Authority
- Omo-Gibe Basin Authority
- Awash Basin Authority
- Northern Basin Authority
- Eastern Basin Authority
- Southern Basin Authority.

The rationale for such a distribution of authorities is the scale of resources involved. The Blue Nile, Baro Akobo, and Omo Give rivers hold immense water resources; together they command from 80 to 90 per cent of all water resources country-wide. The Awash basin merits an independent authority because of the relatively advanced level of the existing organization and its operations. The remaining authorities would be composed of basin groupings that are geographically contiguous or close to each other. They would be responsible for flood control, irrigation, hydropower development, water supply, and allocation of water to various end users.

It is proposed that each basin authority have 4 technical departments: 2 planning and programming departments and 2 support units. Directing each authority would be a Water Resources Management Council (WRMC) for decision-making in all policy and legal matters. In addition, the council would give general guidance and evaluate the performance of the basin authority and ensure participation of the stakeholders. Composition of the WRMC is proposed as follows:

- MoWR Chairman
- Chamber of Commerce Member
- Community representatives Members
- EEPCo Member
- EPA Member
- Ministry of Agriculture Member
- Ministry of Economic Development and Cooperation Member
- Ministry of Mines and Energy Member
- Regional councils within each basin Members
- Women's representatives (to be deter mined) Members.

(b) Water Resources Information Center

For successful WSDP implementation, a sound and comprehensive information system is needed at Federal and local levels: the Ethiopian Water Resources Information Center (EWRIC). This

set-up should be established according to the national management policy document that has established clear guidelines for this purpose. It unambiguously states that a management information system, monitoring, assessment, and auditing are a prerequisite for proper water resources management. National policy also envisages a "practical, coherent, well-designed and smoothly functioning Ethiopian water resources information system (EWRIS)" that would deal with computerized and networked database on all aspects of water resources. Main functions of the EWRIC would be to:

- Collect or acquire, process, analyze, report, store, retrieve and disseminate water-related data and metadata.
- Provide integrated and coordinated information management for water-resources development at national and regional levels.
- Contain all information—technical, scientific, financial, managerial and administrative—needed for implementation of the WSDP and decision-making.
- Support and provide services for MoWR technical departments, regional bureaus, water resources subsectors, and other related institutions as well as communities. It would also provide services for the managerial, regulatory, and supervisory bodies of stakeholders.
- Contribute towards improving the quality of decision making in the water sector.

(c) Water Resources Research Center

Currently there is no national institution in Ethiopia able to undertake research on different aspects of water resources development and management. Many concerned professionals and others see the establishment of such a center as the best means of addressing the problems that impede development of the water sector and providing technical solutions that can facilitate water access and use by the general public. The proposal of an Ethiopian Water Resources Research Center (EWRRC) under MoWR supervision would focus on the applied research needs that such a center could fulfill and how it could develop technologies for improved resource management from source to end-user. The Center should aim to adapt or improve technologies to suit local conditions or develop new technologies. Its work program should include planning, installation, operation and maintenance of technologies in various water subsectors and field research activities. It would also investigate technical problems in irrigation, hydropower, flood control, drainage, water supply, hydrology, meteorology and management aspects, including those dealing with demand management.

(d) Water Resources Training Institute

As discussed above (section 9.2.2), one of the major problems of the water sector is insufficient numbers of qualified technical manpower. The water sector lacks specialized training institutes to foster professional skills and attitudes through short-term and on-the-job training and workshops.

While enough water-related training institutions exist to do the job, they need strengthening in terms of manpower, facilities, and curricular materials and their objectives. Following are the leading national institutions that provide general training in various aspects of water resources.

- Addis Ababa University (civil engineering)
- Alemmaya Agricultural University (irriga tion)
- Arba Minch Water Technology Institutes (specialized fields)
- Kotebe Electricity Training Center
- Mekele University (dryland agriculture)
- MoWR Kaliti Groundwater Investigation and Water Supply Training Center
- MoWR Outreach Training Unit

These academic organizations could play a key role in training the human resources needed for successful implementation of WSDP in the coming 15 years steps. A solid networking among these institutions is proposed under some kind of umbrella arrangement to draw upon their expertise towards bridging the capacity gaps. Towards this aim, the Kaliti Groundwater Investigation and Water Supply Training Center could play an important role as it is, with the help of the Japanese Government, planned to be upgraded into a specialized water-sector training institute.

9.3.3 Strengthening of the regional institutions

The institutional framework at Regional level is decentralized, with the objective of promoting self-sufficiency and sustainability in both technical and financial terms. Since each institution operates independently, outside of any unifying standard or policy, regulatory framework, or coordinating mechanism, it is important that monitoring and supervisory functions are built into each decentralized organization. There is no point in shifting responsibility to the lowest level of management, if it cannot ensure delivery of on-site, fast, and high-quality services to the community.

At the Regional level, a number of Government institutions that would be involved in the implementation of WSDP are: the Water, Mines, and Energy Bureau (WMEB), the Bureau of Agriculture (BoA), Commission for Sustainable Agriculture and Environmental Rehabilitation (CoSAER), the Bureau of Planning and Economic Development, the Bureau of Health, Bureau of Works and Urban Development, Urban Water Supply Services, Irrigation Authority, and Small-Scale Hydropower Development Units. The private sector, NGOs and local communities would be the other important partners. Regional WMEBs are a combination of offices for the water, mines, and energy sectors, indicating that the water sector is represented at a departmental level in those regions. Such a status tends to lower the level of authority accorded to the water sector. To make the implementation of the WSDP more effective, the existing set-up should be reorganized so that the water sector is represented as an independent bureau. A detailed study should be conducted to examine this proposal.

Linkages between Federal and Regional water-sector institutions need further clarification and institutionalization, because regional development is an integral part of the management of the whole sector. Also, individual communities and private sector elements have vital contributions to make together with the public partners to sustain the impact of water supply schemes at the regional level. The Government and regional bureaus thus need to work together as how to promote the privatization of water services, and what sorts of incentives need to be instituted.

Sustainability of water-supply schemes, inter-alia, depends on a committed and motivated work force and a sufficient supply of spare parts. The

later issue further supports the need for privatization of services. Motivation of staff with improved pay and other benefits is key to retaining the required caliber of professionals. Some of the regions need a better payment structure as compared to others, as suggested by the level of their socioeconomic development. This might apply for Gambella, Benishangul-Gumuz, Somali, Afar, among others.

There is no justification whatsoever for the existence of 2 separate agricultural institutions at the Regional level: BoA and CoSAER. Any governmental agency for agriculture should work for both sustainability and rehabilitation of the system. It is therefore proposed that these two offices be integrated and share resources for the same objectives, focusing on the structure for implementing agricultural development and not on content. Most of the activities of the CoSAER could be privatized and regional government could focus on policy, standards, and regulatory aspects of development efforts.

9.3.4 Building Partnerships

In addition to the public institutions mentioned above, many other stakeholders would be part of the WSDP implementation. Notable ones are: women, NGOs, private sector, local communities and water user associations. Each of them, in their own capacity, is expected to play different roles. The organizational challenge here is to tap their joint capacities and direct their efforts towards achieving the objectives of the WSDP. The role of many of these stakeholders is discussed in section 12.2.

Implementation of the WSDP at a local level will benefit greatly from the participation of women, since they are generally responsible for domestic water provision and management countrywide. Similarly, NGOs have an important role in water resources management and development. To date their technical and financial assistance has been limited to provision of manpower, equipment, and other resources to Regional WMEBs, mainly for emergency and relief works. Implementation of the WSDP requires a more proactive role from the NGOs. Private investment has played no significant role in addressing the sectoral concerns, mainly because of the central command economy that dominated the country for many years until 1990. New partnerships with the private sector could help boost the economic performance of the water sector in several ways, by building capacity in planning, design, construction, and operation and maintenance activities and in mobilizing new resources for development.

Community participation in the implementation of WSDP will be critical for the sustainability of investments made in the sector. After all, they are the primary beneficiaries. They will have to lead and monitor water governance at local levels. One of the most useful actions to take in optimizing the outcomes and results of the WSDP is the establishment of WUAs. This practice is currently common in irrigation subsector, where the WUAs are composed of representatives of the immediate beneficiaries of the resource. Useful lessons have been learned, especially regarding effective decision-making, enforcement of the rules, and setting of guidelines for common benefit, coordination of activities, conflict resolution, equitable resource-sharing, and optimal utilization of the resources with reduced water losses.

9.4 Capacity-building

Limited technical capacities in the water sector inhibit sustainable development and management of country water resources. The Outcomes and sustainability of investments in the WSDP will thus very much depend upon how quickly the country is able to bridge capacity gaps. Capacity constraints are so serious that only a very big leap in this direction will help to set the priorities and directions right. Within the context of the WSDP, capacity building concerns development of skilled manpower and other technical capacities that are required for achievement of planned objectives and targets in each subsector. Accordingly, it involves:

- Creation of an enabling environment that includes a legal and regulatory framework, together with those required for enforce ment of policy and strategy.

- Establishment of the necessary institu tions to implement various components of the WSDP.

- Manpower development, including train ing, career development, and use of moti vational measures.

- Provision of inputs in the form of machin ery and equipment, infrastructure (con struction) and finance.

Historically, the water sector like other sectors has mostly relied on external sources of funding, technical expertise, and material inputs. However, long-term sustainability and continuity of the activities depend very much on local funding of essential components. In general, capacity building should not be limited to governmental efforts but to private business as well, and the communities that benefit from such a program. Hence, the following capacity-building interventions are proposed as part of the WSDP. It may be noted that to initiate the implementation of WSDP does not have to wait for capacity building to take place first. On the contrary, capacity building is viewed as a parallel activity to the other WSDP interventions. In the short-term, however, this component will receive much more focused attention to strengthen the following capacities.

Human resource development: Training programs to develop the human resources for the water sector will be implemented throughout the 15-year WSDP period abroad as well as in the country. Trained manpower will help to improve the quality of decision-making, technical performance, and efficiency in planning and operations at Federal, Regional, and local levels. Local training centers could play an important role in fulfilling the planned target for the most common types of training required. Overseas training will cover subject areas that are not offered in the local training institutions.

Financial capacity: Water-sector projects by nature require large investments. Lack of adequate funding and budget constraints have posed barriers to sectoral development. To improve the financial capacity of the sector, mechanisms will have to be established to generate funds for small-scale development. Establishment of a revolving fund and levying water use charges are some of the options. See chapter 13 for more discussion on this issue. Capacity to generate funds for program use will enhance the overall sustainability of WSDP investments.

Operations and maintenance: Under centralized governmental management, operations and maintenance activities are usually inadequately performed. As recommended earlier in this chapter, communities and private-sector firms can assume greater responsibilities regarding operations and maintenance functions, with support from Regional Government in the form of incentives and measures to facilitate the necessary conditions and enabling environment.

Standardization of equipment: Many NGOs launch rural water-supply schemes and furnish the pumps and other equipment. When breakdowns occur, spare parts are usually difficult to obtain. To avoid that and other problems associated with the range of equipment used in different projects, standards for the types and accessories of pumps to be used countrywide will be promoted. The regions should provide advice about local conditions to the central bodies responsible for setting the standards and putting the established standards into practice.

Equipment and facilities: Most regional water bureaus must upgrade their equipment and facilities in order to discharge their responsibilities. The program elements in greatest need of upgrading are labs for water-quality testing, vehicles, gen-

erators, pumps, and tools for operations and maintenance.

9.5 Investment requirements

Investment requirements for the institutional and capacity building plan presented above are shown in table 9.1. The total plan will cost about $US 218 million over a 15 years period. Regional share constitutes about 89 per cent of the total investment plan. About 43 per cent of the plan requirements need to be met in the short-term planning horizon. The remaining amount will be distributed almost equally during the medium- and long-term plan periods.

These figures however should be interpreted with caution. Unlike other sectors, where either the unit costs were available or there were bases to update the project costs or comparable cost estimates were available from other similar studies, cost parameters used here reflect quite a bit of subjectivity. Regional investment plans were primarily developed by the regions themselves using a common format of components, based on their needs assessment, and have been reflected as such into the total investment plan.

Institutional and capacity building financial needs constitute only 3 per cent of the total investment requirements for the WSDP. Looking from another perspective, average annual requirements are estimated to be $US 14.5 million. Given the massive needs for capacity building, and the fact that 10 regions and the Federal Government will have to share this amount among themselves, investment figures presented here do not appear to be overly estimated.

Table 9-1. Investment plan for institution and capacity building under WSDP (US$ 000)

No.	Description	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5	ST	MT	LT	TOTAL
1	**Federal Requirements**									
1.1	Institutional Strengthening	400	498	52	50	82	1,082			1,082
1.2	Establishment of New Institutions	259	1,264	842	821	1,204	4,390	1,237	624	6,252
1.3	Equipment & Machinery	400	498	52	50	82	1,082			1,082
1.4	Training	213	296	819	2,159	1,938	5,426	4,067	4,337	13,829
	Sub-Total	1,272	2,556	1,765	3,080	3,307	11,980	5,304	4,961	22,245
2	**Regional Requirements**									
2.1	**Tigrai Region**									
2.1.1	Institutional Strengthening		47	12	12		71			71
2.1.2	Construction Needs		59	53	41	35	188	65		253
2.1.3	Procurement of Machinery & Equipment		1,283	837	549	481	3,151	1,256	667	5,074
2.1.4	MIS set up		32	12	6		49			49
2.1.5	Private Sector Support		30	25	18		73	18	18	109
2.1.6	Community Support		20	18	18		56	18	18	92
2.1.7	Training (HRD)		837	1,463	1,859	889	5,048	6,064	7,233	18,345
2.1.8	Community Training		59	35			94	48	35	177
	Sub-Total	0	2,367	2,455	2,503	1,406	8,730	7,469	7,971	24,170
2.2	**Amharai Region**									
2.1	Institutional Strengthening		51	20	20		91			91
2.1.1	Construction Needs		147	71	53	35	306	65	59	429
2.1.2	Procurement of Machinery & Equipment		1,403	1,852	1,081	938	5,275	1,979	729	7,983
2.1.3	MIS set up		36	12	12		60			60
2.1.4	Private Sector Support		35	20	20		75	20	20	115
2.1.5	Community Support		35	20	20		75	20	20	115
2.1.6	Training (HRD)		452	1,421	1,925	1,212	5,010	6,621	6,795	18,426
2.1.7	Community Training		212	45	1		258	52	40	349
	Sub-Total	0	2,370	3,461	3,132	2,185	11,149	8,758	7,662	27,568
2.3	**SNNPRS**									
2.3.1	Institutional Strengthening		51	20	20		91			91
2.3.2	Construction Needs		147	188	82	65	482	241	235	958
2.3.3	Procurement of Machinery & Equipment		1,350	1,777	833	547	4,507	1,395	733	6,634
2.3.4	MIS set up		32	12	12		56			56
2.3.5	Private Sector Support		30	20	18		68	17	17	102
2.3.6	Community Support		25	20	15		60	18	15	93
2.3.7	Training (HRD)		318	1,498	1,975	2,871	6,662	6,246	6,908	19,816
2.3.8	Community Training		212	53	1		266	52	40	358
	Sub-Total	0	2,164	3,589	2,956	3,482	12,191	7,970	7,947	28,108
2.4	**Gambella**									
2.4.1	Institutional Strengthening		42	10	5		57			57
2.4.2	Construction Needs		32	29	24	6	91	12	12	115
2.4.3	Procurement of Machinery & Equipment		633	387	213	135	1,367	239	269	1,875
2.4.4	MIS set up		32	12	6		50			50
2.4.5	Private Sector Support		21	23	15		59	10	10	79
2.4.6	Community Support		20	20	15		55	5	5	65
2.4.7	Training (HRD)	175	537	1,282	1,909	1,043	4,946	4,222	3,949	13,117
2.4.8	Community Training		9	7			16	7	5	28
	Sub-Total	175	1,326	1,769	2,186	1,185	6,640	4,495	4,250	15,385

Table 9-1. Investment plan for institution and capacity building under WSDP (US$ 000)...*continued*

No.	Description	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5	ST	MT	LT	TOTAL
2.5	**Benishangul Gumuz**									
2.5.1	Institutional Strengthening		42	10	5		57			57
2.5.2	Construction Needs		41	32	18	12	103	29		133
2.5.3	Procurement of Machinery & Equipment		665	321	265	162	1,412	374	248	2,034
2.5.4	MIS set up		32	12	6		50			50
2.5.5	Private Sector Support		21	23	15		59	10	10	79
2.5.6	Community Support		20	20	15		55	5	5	65
2.5.7	Training (HRD)		592	1,337	1,747	439	4,114	5,373	4,219	13,706
2.5.8	Community Training		14	19			33	19	19	70
	Sub-Total	0	1,427	1,773	2,070	612	5,882	5,810	4,500	16,192
2.6	**Affar Region**									
2.6.1	Institutional Strengthening		38	10	110		158			158
2.6.2	Construction Needs		24	12	35	29	100	12	12	124
2.6.3	Procurement of Machinery & Equipment		527	455	286	150	1,418	337	229	1,983
2.6.4	MIS set up		32	12	6		50			50
2.6.5	Private Sector Support		15	13	8		36	8	8	52
2.6.6	Community Support		15	13	7		35	8	8	51
2.6.7	Training (HRD)	175	322	924	1,335	857	3,613	2,804	3,816	10,233
2.6.8	Community Training		9	7			16	7	5	28
	Sub-Total	175	982	1,445	1,787	1,036	5,425	3,175	4,078	12,678
2.7	**Somali**									
2.7.1	Institutional Strengthening		42	11	10		63			63
2.7.2	Construction Needs		141	94	71	59	364	12	12	388
2.7.3	Procurement of Machinery & Equipment		1,257	1,457	470	95	3,279	882	704	4,866
2.7.4	MIS set up		32	12	6		50			50
2.7.5	Private Sector Support		22	18	15	10	65	10	5	80
2.7.6	Community Support	175	20	13	15	10	58	10	5	73
2.7.7	Training (HRD)		286	1,204	1,707	831	4,202	3,860	3,956	12,018
2.7.8	Community Training		9	7			16	7	5	28
	Sub-Total	175	1,808	2,815	2,294	1,005	8,097	4,781	4,687	17,565
2.8	**Oromia Region**									
2.8.1	Institutional Strengthening		60	25	25		110			110
2.8.2	Construction Needs		270	276	112	112	770	253	241	1,264
2.8.3	Procurement of Machinery & Equipment		1,406	2,886	819	1,016	6,127	2,260	1,459	9,845
2.8.4	MIS set up		38	12	6		56			56
2.8.5	Private Sector Support		40	18	15	10	83	10	10	103
2.8.6	Community Support		40	20	12	12	84	10	10	104
2.8.7	Training (HRD)	531	1,362	877	3,012	2,517	8,298	9,811	11,542	29,651
2.8.8	Community Training		215	53	1		269	52	39	360
	Sub-Total	531	3,431	4,167	4,002	3,666	15,796	12,396	13,301	41,493
2.9	**Dire Dawa Adm. Council**									
2.9.1	Institutional Strengthening		20	8	7		35			35
2.9.2	Construction Needs		24	12	6		41			41
2.9.3	Procurement of Machinery & Equipment		366	206	82	9	663	234	64	960
2.9.4	MIS set up		32	12	6		50			50
2.9.5	Private Sector Support		20	10	5	5	40	10	8	58
2.9.6	Community Support		10	10	8	7	35	7	7	49
2.9.7	Training (HRD)	175	278	750	1,009	467	2,678	1,440	1,140	5,258
2.9.8	Community Training		7	5			11	5	4	20
	Sub-Total	175	756	1,012	1,122	488	3,553	1,695	1,223	6,471

Table 9-1. Investment plan for institution and capacity building under WSDP (US$ 000)...*continued*

No.	Description	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5	ST	MT	LT	TOTAL
2.10	**Harar Region**									
2.10.1	Institutional Strengthening		20	8	7		35			35
2.10.2	Construction Needs		41	29	29	29	129			129
2.10.3	Procurement of Machinery & Equipment		417	254	73	70	814	139	128	1,081
2.10.4	MIS set up		32	12	6		50			50
2.10.5	Private Sector Support		8	8	5		21	5	5	31
2.10.6	Community Support		8	8	8		24	3	3	30
2.10.7	Training (HRD)	175	250	614	1,114	363	2,516	1,280	970	4,766
2.10.8	Community Training		4	4			8	4	3	15
	Sub-Total	175	780	938	1,242	462	3,597	1,430	1,109	6,137
	Regional Total	1,406	17,411	23,423	23,294	15,527	81,060	57,978	56,729	195,767
	Grand Total	2,678	19,967	25,188	26,374	18,834	93,040	63,283	61,690	218,012

Chapter 10 Physical and Investment Plans: An Overview

Chapters 5 through 9 presented in detail various subsectoral plans. Each chapter started with the targets to be achieved over the planning horizon, methodology used to develop the plan, critical assumptions employed in the analysis, how subsectoral specific issues were treated in the analysis, leading finally to the description of physical program and assessment of investment requirements. This chapter brings together main outputs together with their funding requirements to sum up the overall investment picture.

10.1 Main program outputs

10.1.1 Water supply and sewerage development

Urban water supply: The coverage will grow from 74 to 98 per cent of the urban population by 2016. In this context, the following works will be undertaken.

- Completion of study and design of 391 towns.
- Implementation of construction works for 402 towns.
- Rehabilitation for 112 towns.

Rural water supply: The coverage will grow from 23 to 71 per cent of the rural population by the end of the WSDP planning horizon in 2016. This would entail the execution of the following works.

- 4,255 deep wells
- 9,329 shallow wells
- 27,338 hand-dug wells
- 18,908 springs [developed]
- 222 subsurface dams, surface-water harvesting, river intakes, and like projects
- 2,857 rehabilitation works.

Livestock watering. The WSDP will provide for 10,761 ponds, cisterns, ground catchments and livestock watering facilities.

Sewerage. The WSDP will undertake studies and design work for 109 cities and towns, while construction work will be carried out for 110 sewerage projects.

10.1.2 Irrigation development

New irrigation works will be undertaken to develop a total of 274,612 ha of farmland under the Irrigation Development Plan (IDP). Of that total, the Federal Government under the Large- and Medium-Scale Irrigation Development Plan will develop 147,474 ha, while the Regional Governments under the Small-Scale Irrigation Development Plan will develop 127,138 ha. By the end of the WSDP in 2016, the total area under irrigation will be 471,862 ha.

10.1.3 Hydropower development

A total of 6 medium-scale hydroelectric power plants with an aggregate installed capacity of 950 MW will be constructed under the WSDP. The total installed capacity of hydropower plants in the Interconnected System of the EEPCo will be about 1,300 MW by the end of WSDP in 2016. A total of 15 medium-scale and 37 small-scale hydropower sites will be developed to the level of feasibility study during the program period.

10.1.4 Water resources development

Studies for integrated water-resources master plans will be conducted on the following basins: Wabi Shebelle, Genale-Dawa, Ougaden, Awash, Danakil-Aysha, and Rift Valley lakes. Therefore, by the end of the WSDP, master-plan studies will be completed for all major basins in Ethiopia.

A total of 274 river-flow measuring stations and 745 meteorological stations will be installed under the WSDP. The additional meteorological stations will bring the number of stations at national level to half the standards prescribed by the World Meteorological Organization. Assessment of groundwater resources will be completed.

10.1.5 Institution- and capacity-building development

Institutional and technical capacity-building activities will continue throughout the program period. In this context, human resources development plans in the form of long-term and short-term training for the staff of Federal institutions and Regional bureaus will be implemented. Other features of institution and capacity building program are:

- Federal institutional structure will be strengthened, especially with the reorganization of the MoWR.
- In addition to seven Basin Authorities, three new centers/institutes will be established: Water Resources Information Center; Water Resources Research Center; and a Water Resources Training Institute.
- Capacities of Regional institutions will be strengthened through training of their staff, and by the provision of required equipment and facilities.
- The WSDP will promote the involvement of important stakeholders such as women, NGOs, private sector, local communities and water user associations in implementing various components of the WSDP.

10.2 Indicative financial requirements

Total financial requirements for the WSDP over the entire planning period of 2002-2016 is estimated to be $US 7,444.8 million. Water supply and sewerage program constitute about 39 per cent of the total investment needs followed by 26 per cent for hydropower, 23 per cent for irrigation, 9 per cent for water resources, and 3 per cent for institutional development and capacity building. Financial requirements estimated for three planning horizons amounts to: $US 2,110 million (28 per cent) in the short-term, $US 2,336 (31 per cent) in the medium term, and $US 2,999 million (41 per cent) in the long-term. These shares are exhibited in figures 10-1 through 10-3.

The recommended strategy for the short-term, which is aligned with the national development goals and priorities, is to fund programs and projects that can help in building national and regional capacities, securing food production, and meeting immediate infrastructural needs.

For the medium-term, investment is recommended in programs and projects that can maximize growth in the financial and economic base for future investment, that will help develop sustainable social and physical infrastructure and capacities for future growth.

In the long-term, investment should strengthen programs and projects that reduce regional disparities and enhance the contribution of sector to the socio-economic development of the country.

Table 10-1. Summary of WSDP financial requirements, by Federal and Regional Governments (in US$ millions)

Subsector / investment area	Financial requirements by planning horizon				
	Short Term	Medium Term	Long Term	Total	F/C
1. Irrigation	307.6	456.9	918.3	1,683.1	877.6
Federal	114.7	268.1	700.9	1,083.7	645.7
Regional	193.2	188.8	217.4	599.4	231.9
2. Hydroelectric power	649.1	525.9	776.7	1,951.6	1,393.8
Federal	647.4	516.2	764.5	1,928.0	1,380.3
Regional	1.7	9.7	12.2	23.6	13.5
3. Water supply & sewerage	876.2	1,057.9	1,001.7	2,935.8	2,113.7
Federal					
Regional	876.2	1,057.9	1,001.7	2,935.8	2,113.7
4. Water resources	183.9	231.9	240.5	656.3	57.1
Federal	133.7	160.1	153.7	447.5	19.6
Regional	50.2	71.8	86.8	208.8	37.5
5. Inst/capacity-building	92.9	63.3	61.7	217.9	190.7
Federal	13.2	5.3	5.0	23.5	18.4
Regional	79.7	58.0	56.7	194.4	209.1
Total	2,110.0	2,335.9	2,998.9	7,444.8	4,453.2

Figure 10-1. Share of various programs in WSDP

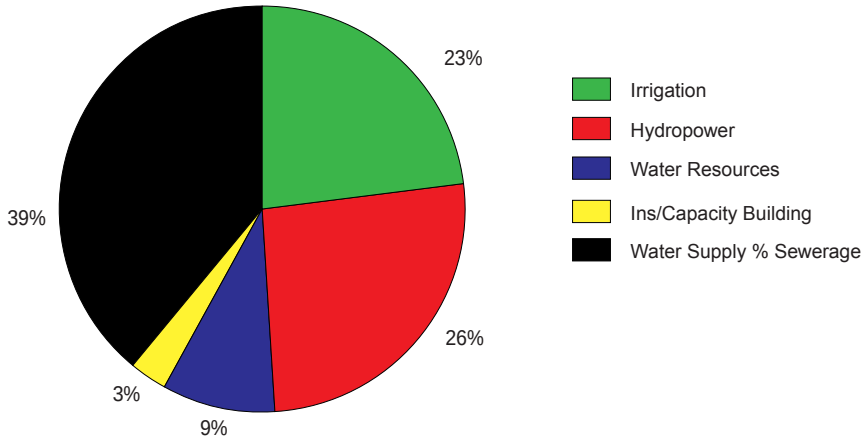


Figure 10-2. WSDP Over Different Planning Horizons

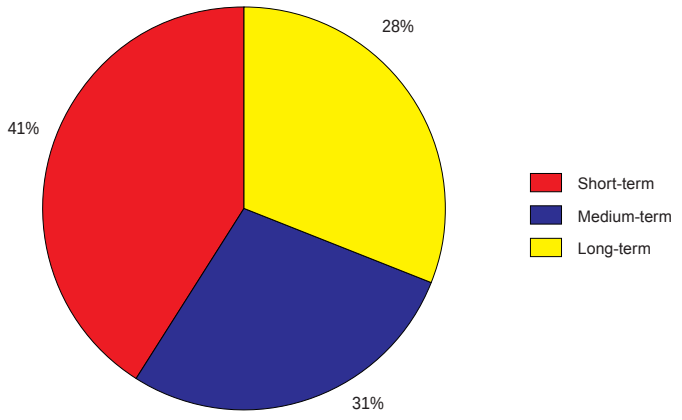
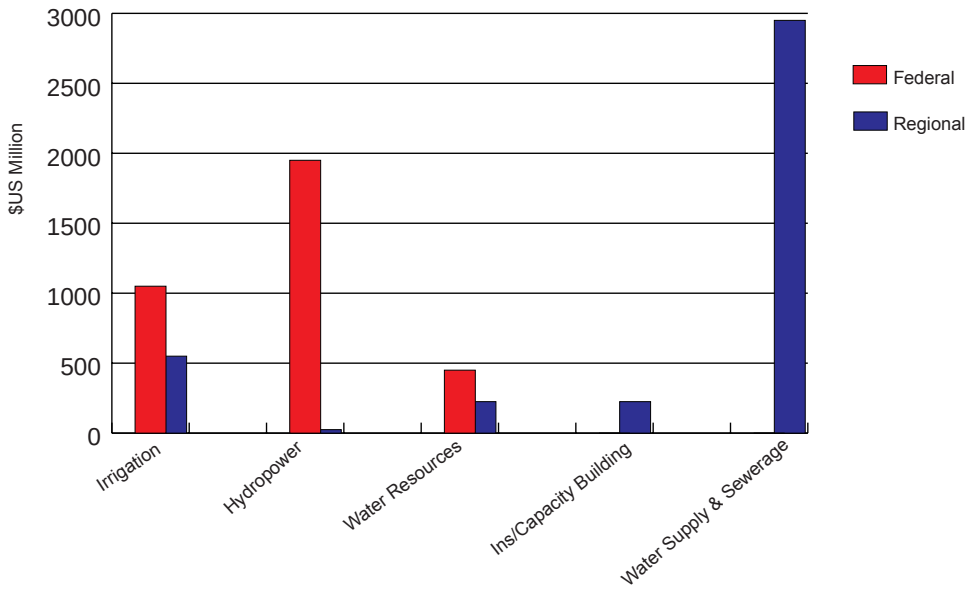


Figure 10-3. Federal Regional Composition of WSDP



10.3 Resource gap in the short-term

The immediate priority of the Government of Ethiopia is to mobilize resources for the implementation of short-term plan that require an investment of $US 2,110. Towards this aim, the Government plans to utilize all possible sources of domestic and external financing. The Government strategy is not to fully rely on the external funding, but to generate as much funding locally as possible. However, in view of the limited capacities of the Government in meeting all the required investments from its domestic sources, funding from external agencies will constitute an important contribution towards achieving the program objectives. The Government so far has mobilized (or will definitely be able to do so) about 59 per cent of the short-term funding requirements that amounts to $US 1,241 as per the following details.

• From NBI for hydropower construction investment	=	742	$USM
• Government allocation from treasury	=	325	$USM
• Contributions from beneficiaries of SSIDP	=	19	$USM
• Contributions from beneficiaries of RWSDP	=	55	$USM
• Funding already available under bilateral and multilateral	=	100	$USM
Total available:	=	1241	$USM
Net requirements:	=	869	$USM

Section III

Impact Analysis and Implementation arrangements

Chapter 11 Potential Social and Enviornmental Impacts

11.1 Government commitment

The Government of Ethiopia recognizes that the WSDP has positive and negative en vironmental impacts. While hydropower development, for instance, can improve energy availability for domestic and industrial development and help diminish the consumption of fuel wood and hence the rate of deforestation, it can also cause damage to aquatic and terrestrial ecosystems, change the riparian communities to tree-dominated vegetation, and change a free-flowing riverine habitat into a lacustrine one.

In order to maximize positive impacts and minimize or avoid negative impacts, the Government, in line with its environmental and water sectors policies and legislation, commits itself to undertaking an Environmental and Social Impact Assessment of the WSDP components. The analysis will identify, predict, and evaluate both positive and negative impacts, and propose strategies to mitigate the negative impacts. Such an action would provide an "effective means of harmonizing and integrating environmental, economic, cultural, and social considerations into a decision-making process in a manner that promotes sustainable development."

This analysis will be undertaken for all major projects identified in the WSDP. Some of these projects, especially those selected from the master plan studies, had already been subject to this kind of analysis. In many cases, however, this analysis will require updating because conditions have changed quite a bit since the master plan studies were completed. At some stage during the planned period, each of the interventions proposed for various components of the WSDP will be transformed into a specific project document—this is the time when detailed impact assessment will have to be undertaken. Recognizing the need for, and importance of, such an analysis, this chapter highlights some potential impacts of the WSDP and its components in much broader terms, draws attention to some of the critical issues that should be considered in the analysis, and provides a framework for undertaking environmental and social impact analysis.

11.2 Environmental impacts

Given the magnitude of the investments and activities planned in the WSDP and the location of those activities in a number of different regions, often with large land-use consequences that affect various physical media, and due to the pervasive nature of the water resources, for each of the WSDP subsectoral programs, consideration will be given to 2 sets of environmental impacts: (a) those on the water resources itself and (b) the derived impacts on the other components of the environment and human health.

11.2.1 Impacts on water resources

The WSDP interventions could have four types of impacts on water resources, namely (a) impacts on the water cycle, (b) impacts on the water availability, (c) impacts on water quality, and (d) impacts on the aquatic ecosystems.

(a) Impacts on the water cycle. Project outcomes that involve water diversion (dams and reservoirs) or major water use (irrigation schemes, water-supply facilities) may influence the water cycle itself either through modification of the water regulation mechanisms (e.g., drainage of wetlands), stream flow (water withdrawal or storage, water diversion) or climatic patterns (creation of new large water bodies) which can give rise to extreme natural hazards such as floods. The creation of new, large water surfaces may increase evaporation and have impacts on the microclimate.

(b) Impacts on water availability. The withdrawals on water bodies, especially groundwater reserves (overpumping or overirrigation), may severely affect the water availability, in the short or the long term, at the national or local level, over and beyond the planning horizon. If not prevented, they may lead to irreversible and cumulative consequences (e.g., depletion of non-renewable aquifers). Water abstraction may also affect the activities of downstream users who use the same water flow, including other countries in the case of transboundary rivers. This could lead to severe user conflicts that could exacerbate the seasonal variations in water supply. Such problems can be adequately addressed through water allocation rights or permits.

(c) Impacts on water quality. Depending on existing standards for water quality and quantity flows and the way they are implemented, some of the WSDP activities (such as wastewater discharge and industrial effluents) might result in emissions in water bodies of substances from either diffuse (agriculture) or point (human settlements) sources that may, if discharged emissions rise above certain thresholds, pollute the water and affect downstream activities. A key issue is the quality of water used for human consumption. Pressure from heavy use can be exerted by human or animal settlements around water points, as a result, for instance, of displacement imposed by large water projects. Dam operations or other works could be severely affected if there is no legal framework to control settlements and prevent adverse effects. Therefore, the WSDP, and each of its subsectoral programs, will have to comply with national environmental legislation on water emissions and drinking-water quality standards. Pollution of the rivers or other water bodies such as lakes might also have cumulative effects such as sedimentary pollution by heavy metals or toxic wastes. High rates of water withdrawal from aquifers may also affect their quality.

(d) Impacts on aquatic ecosystems. Changes in quantitative and qualitative water characteristics may in turn reduce water allowance to ecological functions and environmental flows, especially under low flow or drought. Major adverse transformations might be induced in the aquatic ecosystems. In turn, modified aquatic ecosystems may interact with neighboring ecosystems in adverse ways. These issues will be examined in detail at the time of project preparation.

11.2.2 Other environmental impacts

Table 10-1 presents a summary of the environmental impacts, by subsectoral programs, that can be expected as a result of WSDP implementation.

Major changes in water quantity or quality, or water regulation, may affect the flora and fauna living or dependent on aquatic ecosystems and create disturbance in the natural environment that threaten the existence of indigenous species. For instance, dams can obstruct fish migration pathways and bar the movement of wildlife. Irrigation often leads to loss in natural habitats (wetlands) and biodiversity. The introduction of alien species in dams can also severely affect the population of endemic species. Generally speaking, changed conditions may favor certain endemic species at the peril of others, in a new balance of life.

Water development programs can also impact on human health—they can provide a favorable environment for increase in the number of organisms that depend on water, or they can increase the contact between human communities and those organisms, resulting in increased incidence in disease. The transformation of both quantitative and qualitative characteristics of the water resources can create or expand health risks due to the spread of water-borne diseases or the emission into the water of toxic substances or bacteriological pollution, if water abstraction points

Table 11-1. Main Potential long-term environmental impacts of the WSDP

Sector	Impacts on the water resource	Derived impacts
Hydropower	- Change in water regime - Decrease in downstream -water availability and water transfers- - Risks inherent to stagnant water - - Loss of water through increased evaporation-Transboundary impacts	- Disturbance of the natural environment - Encroachment of ydropower on the natural environment - Obstruction of fish migration pathways and barrier to the movement of wildlife - Loss in natural habitats (wetlands) and biodiversity - Siltation and sedimentation - Induced development around barrage and related effects - Creation of conditions favorable to water-borne diseases - Risks associated with collapse of barrages - Introduction of alien species and plants - Water-borne diseases
Irrigation	- Change in water regime - Overexploitation of water resource, including groundwater - Pollution by nutrients and pesticides - Eutrophication of water bodies - Flood risks - Saline intrusion - Transboundary impacts	- Loss in natural habitats (wetlands) and biodiversity - Induce development around irrigation schemes and related effects - Water-borne diseases
Water supply and sewerage	- Overexploitation of resource - Emission of non-treated waste water and pollution of water resources	- Induced development around water supply and sanitation facilities - Water-borne diseases

are not protected.

11.3 Social Impacts

Proposed development programs such as the WSDP can generate both positive and negative consequences to human populations in the ways that people live, work, play, relate to one another, organize to meet their needs and generally cope as members of a society. For example, ready availability of affordable electricity for domestic and other uses, especially in the rural population, can impact positively on sustainable use of biomass with a decline in erosion and siltation of water reservoirs and reduced drudgery of women and children who are usually responsible for collecting water and fuelwood supplies. Similarly, well-managed irrigation schemes can positively impact on food security. In the same vein, equitable and ready access to clean water has a direct positive impact on human health and an indirect one on labor productivity. However, poorly planned and managed hydropower, irrigation, and water-supply schemes can also generate negative social impacts.

11.3.1 Essence of social impact assessment

Social impact assessment therefore is an effort to estimate, in advance, the likely positive and negative social consequences of the proposed

WSDP activities so that action can be taken to enhance benefits from the positive impacts and to mitigate the negative consequences. Ethiopia's Constitution, its environmental and water policies, and the recent draft Environmental Impact Assessment Proclamation (of February 6, 2002) provide the legal and policy basis for this assessment. The Environmental Impact Assessment Proclamation, for instance, deems the impact assessment as providing "an effective means of harmonizing and integrating environmental, economic, cultural and social considerations into a decision-making process in a manner that promotes sustainable development". The country's final draft Environment Impact Assessment Guidelines, when approved by the Cabinet, will indeed be the operational tool for effecting the assessment.

11.3.2 Building on past experience

Various components of the WSDP are certainly not new forms of development activities in Ethiopia or within the Eastern Africa region. Lessons learned and experiences gained from past sectoral programs in Ethiopia and elsewhere will guide the determination of probable social impacts of the WSDP on the behavior and livelihoods of individuals and communities in designated program areas. The available evidence from Ethiopia for instance, indicates, "the most important policy and regulatory interventions in terms of their negative impacts on the environment were those impositions which increasingly and cumulatively eroded the rights of individuals and communities to use and manage their own resources." Some of the principles of the water resources management policy protect stakeholders and beneficiaries from being marginalized in the wake of the WSDP.

11.3.3 Issues to consider

At the subsectoral and project level, the nature, scale, duration, intensity, or severity of the social impacts of WSDP will be estimated. The likelihood of the social impacts interacting with the environmental ones and impacts from 1 subsectoral program with those from other components, over time, to generate an overall cumulative impact, will also be assessed. It is in this context that the Environmental Impact Assessment Proclamation requires that the "impact of a project be assessed on the basis of the size, location, nature, cumulative effect with other concurrent impacts or phenomena, transregional effect, duration, reversibility or irreversibility or other related effects of the project."

Ethiopia is also ecologically and socially diverse. It is therefore necessary that social equity or distributional impacts of the program also be assessed in line with the country's desire to promote peace and harmony. Concretely, just as an environmental impact assessment measures the program impact on threatened and endangered plant and wildlife species, the social impact assessment does likewise with program impacts on vulnerable segments of the human population such as the poor, the elderly, adolescents, the unemployed, women, and ethnic minorities. In doing so, however, consideration is given to the different viewpoints and interests in the Ethiopian society, because they shape people's reactions either in favor of or against the WSDP.

At the subsectoral and project level, the following issues and variables will be considered in the social impact analysis.

- How will interventions by the WSDP af fect the population structure? Hydropower generation and irrigation components of the WSDP will be assessed against popu lation displacement, induced growth of population at project site, potential conflict between new population groups and the original inhabitants, changes in traditional lifestyle, and increased pressure on natu ral resources. The disruption of produc tion and livelihood systems of the dis placed population and the potential con flicts between them and their host com munities will also be assessed.

- How will the proposed WSDP activities affect the community and institutional structures? Not only are new institutions are expected to emerge, but implementa tion of the WSDP will also modify the ex isting ones. Interrelationships among these institutions and their interface with local governments and the larger political systems to, either enhance, or impair the achievement of the WSDP objectives will be examined. Concretely, any proposed modification of the water users' associa tions and farmers' co-operatives, for in stance, to provide the social organization for the management of irrigation water, will affect their efficiency and effectiveness of the management system. The WSDP ini tiatives are likely to impact on occupational structure and employment in the program areas. The nature of that impact will also be determined at the subsectoral program and project level.

- How will the WSDP affect the distribution of power and authority? Impacts on lead ership capability and capacity within the communities will be assessed. In the spe cific case of the Irrigation Development Program, lessons learned over the years in the shift from water users' associations (in the 1980s) to the water committees (of the 1990s) would be useful in shaping social organizations so that they would have adequate legitimacy and capacity for the management of irrigation water. How that evolving power and authority struc ture interfaces with the one that the de centralization policy has put in place will be assessed and acted upon appropri ately.

- How will the proposed interventions en hance or impair the livelihoods of vulner able and marginalized social groups? At the subsectoral program and project level, attention will be given to how the WSDP's proposed mechanisms for cost recovery in providing clean water and irrigation, for instance, will affect the accessibility of the poor to those services. The viability of the social tariff, provided for in the drinking-water supply policy as a means of en abling poor communities to cover opera tion and maintenance cost, deserves careful consideration. In the same vein, the WSDP must consider women's needs, especially regarding water for household purposes. The special case of pastoral and agro-pastoral communities in the lowlands, which constitute 56 per cent of the country's land mass and sup port the livelihoods of 10 per cent of the population, deserves careful consider ation.

Chapter 12 Program Implementation and Monitoring

The Water Sector Development Program (WSDP) is a call for action addressed to the Federal and Regional Governments, private sector, non-governmental organizations (NGOs), local communities and individuals and international development partners of Ethiopia. Implementation of the WSDP is a huge endeavor. Where to begin? And how to proceed? Those two questions of the implementation strategy are interrelated, and answers to these questions are provided in this chapter. These answers grow out of the various subsectoral recommendations that are presented in earlier chapters of Section II. The implementation strategy also takes into account the roadmap provided by the national water-sector strategy.

12.1 Main elements of the implementation strategy

The WSDP recommends an array of investments and measures that emerged through an extensive consultative process for each subsector and supporting program. These measures are outlined below as main elements of the implementation strategy. If these elements are not made explicit, implementation of the WSDP will not get concerted action; nor can its progress be monitored for mid-course correction and periodic revision.

- Capitalize and build upon the existing institutional structure. New institutions should be established only if extremely necessary and justifiable.
- Ensure integrated implementation and strong coordination among all program components, realizing that each of the program areas has its own specific, extension, communication, and research components.
- Tailor the program implementation to cope with funding constraints, if and when they emerge.
- Assign priority for completion of the on-going programs/projects.
- View and implement resource mobilization efforts as part of the implementation strategy.
- Transform attitudes and practices to influence investments in favor of water resources development and management.
- Promote decentralized management and governance, and involve communities in localized water governance.
- Assign high priority to bridge technical capacity gaps in the short-term.
- Create conditions to build new and innovative partnerships at all levels.
- Rely on national expertise to deliver program outputs to the maximum possible extent, but secure external technical assistance whenever it is necessary.
- Make continuous adjustments in the implementation strategy based on program's performance using monitoring indicators (financial, technical, institutional).
- Set priorities and begin implementation from undisputed resource development and management domains.

12.2 Roles of different partners

Implementation of the WSDP activities and projects will involve a large number of partners—each with different roles and functions. These include: (a) Government institutions; (b) private sector; (c) local communities and individuals; (d) NGOs; and (e) external support agencies. This section provides an overview of the roles and functions of these groups with the objective to develop a management model to cater the needs for implementation of the WSDP.

12.2.1 Government institutions

Implementation of activities of the WSDP at Federal and Regional levels will not only involve water-related institutions, but other institutions as well. Nevertheless, MoWR at the Federal level and WMEB at the Regional level will assume the lead responsibility. Their principal role will be to make high-profile decisions, designed for maximum impact within limited means. Reviewing sectoral policies and large investment projects is also an important function at this level. Increasing the resource allocation for priority components will send strong signals to civil society and international donors of the changes in investment patterns required for sustainable development and management of water resources. Another leadership role will be to improve the systems for inter-institution collaboration, and enhancing departmental capacities for implementation of program components. Within the framework of improved inter-institution collaboration for planning and programming, departments should focus on outreach and facilitation. Within the regions, concerned departments at the zonal/woreda level are seen as important players in implementing the WSDP activities. This level of administration will have to serve as an important link between the perceptions of the communities at the local level and the leadership role Government has to assume at Federal and Regional levels. These departments will collaborate on the spatial coordination of departmental plans and projects.

12.2.2 Private sector

The private sector so far has played very little part in the development of the water sector. However, as the Government moves towards the implementation of activities of the WSDP, it sees private sector as an important partner in achieving the WSDP objectives. The Government will examine the possibility of introducing different kinds of incentives to create conditions conducive to private sector participation. This would include, but not be limited to: provision of access to land and water resources, fiscal incentives - such as longer income tax holidays - and concessional lending from commercial sources. At the same time, the private sector is expected to improve their production of key inputs, establish more efficient markets, and bring new investments into the sector. During the course of forging public-private partnerships, it will be ensured that role of the private sector is viewed as of a service provider, and not of a resource owner.

12.2.3 Local communities and individuals

Individuals and communities have very important roles to play in the implementation of activities of the WSDP. Individuals are expected to invest capital and labor and to improve their resource management practices. Communities will be responsible for managing common resources, improving their own organizational set up, undertaking and maintaining projects, and increasing the involvement of women. They will be able to participate as project or program initiators, implementers, or owners as well as operators of community schemes. Their involvement as prime stakeholders in large-scale schemes needs to be ensured. The possibility of expanding the scope and functions of Water Users' Associations (WUAs) beyond the irrigation subsector to improve governance of the whole implementation of the WSDP is an important avenue that needs to be explored.

12.2.4 Non-governmental organizations

Presently, more than 100 NGOs are involved in the water sector of Ethiopia. Their activities range from project identification to implementation and financing. Organized to promote integrated rural development, they are involved in rural water supply, small-scale irrigation development, and catchment management. The effectiveness of the NGO contribution to the WSDP can be improved if their activities are coordinated and linked to the development programs of the regions. Some Regional authorities stress the need for integrating NGO activities with central program efforts. In summary, the NGOs can perform four important functions within the context of the WSDP implementation: (a) bringing additional financial resources; (b) strengthening technical capacities of regional bureaus; (c) organizing local communities; and (d) undertaking rehabilitation works.

12.2.5 External support agencies

Given the financial size of the WSDP, the role of international lending and donor institutions in providing financial resources and technical assistance to implement the program can hardly be over-emphasized. Efforts to date to mobilize resources and invest in the sector have remained below the mark. This can best be evidenced by the fact that the country has been able to exploit only a fraction of its land and water resources. Ethiopia has had to rely on food-aid year after year because there is no irrigation infrastructure to support large-scale irrigated agriculture. The WSDP provides a comprehensive framework to donor agencies not only to select projects and programs for financing in accordance with their country assistance strategies, but also to coordinate water sector activities to improve the efficiency and management of external assistance. The Government's resource mobilization strategy is presented in the next chapter.

12.3 Program Management

Program management entails four major functions: planning, implementation, coordination and monitoring. During the course of implementation of the WSDP, all of these functions are to be performed at three levels: national, regional, and local. At each level, different partners (identified above) are expected to make specific contributions in the execution of these functions. The WSDP management framework proposed below responds to the challenges posed by the sector specific constraints and issues, as well as being based on lessons learned from the implementation of similar programs.

12.3.1 Some important considerations

Three broad approaches could be considered for program management: the public sector-led approach, the representative approach, and the participatory approach.

Under the public sector-led approach, activities are usually carried out without the involvement of the people for whom services and facilities are being provided or constructed. This unfortunately means that the people least concerned address the sustainability of the provided services. The other serious problem with this approach is that it does not allow communities to adjust the blueprints developed by the public sector institutions to reflect their needs.

The representative approach, driven by political considerations of the elected representatives, also has some demerits. Representatives cannot plan and implement day-to-day economic activities of communities. At the same time, this approach is more often political rather than consensual, whereas consensus is a pre-requisite of development at the community level.

Both these approaches are not successful in reaching people and solving their problems. This

may not be due to them working inefficiently, but rather due to their implementation structure and mandates. The participatory approach, on the other hand, encourages making optimal use of grassroots opportunities. The systems of local governments, development administration and resource mobilization remain incomplete without the involvement of community organizations. None of this, however, will happen without Government support. The Government will ensure stable and reliable economic incentives for individuals, enforce consistent and equitable regulations for corporations, and provide enabling legislation allowing communities to reap the rewards of their collective efforts. Therefore, the program management arrangements proposed here aims at bringing all stakeholders together for increased upstream level support and improved downstream level coordination.

12.3.2 Management arrangements

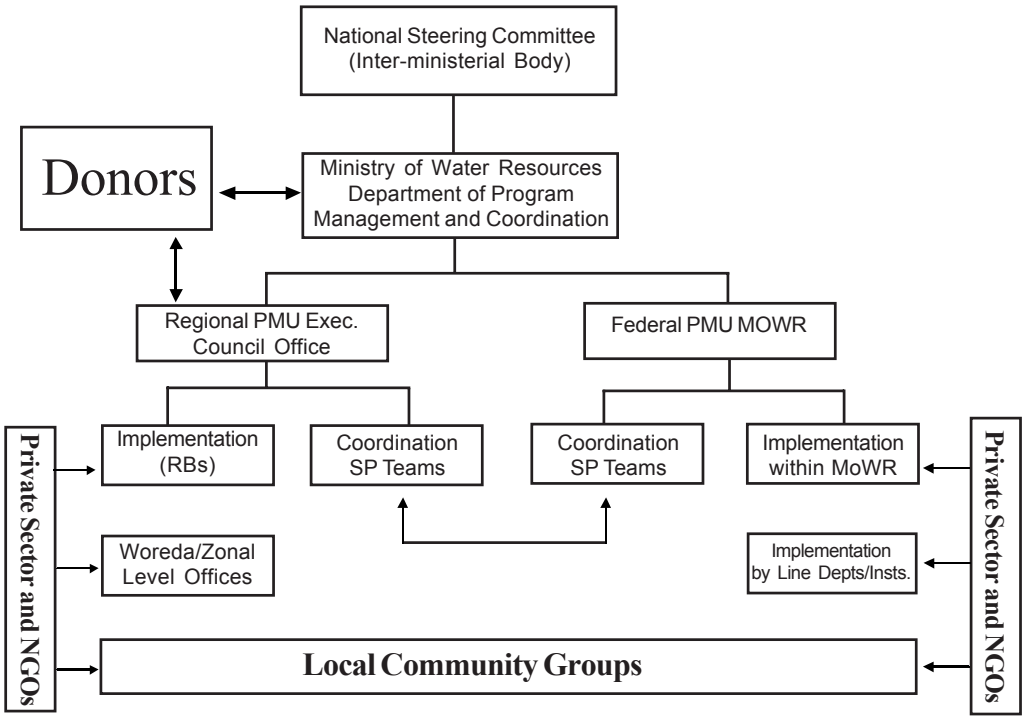
The general management model for implementation of the WSDP is derived from the above consideration of typical decisions, stakes and key instruments. It is a closed loop that begins with Government leadership and ends with Government support to private and community implementation. Specific management arrangements proposed for the implementation of WSDP are exhibited in schematic form in figure 12-1. These arrangements ensure strong linkages between the Federal and Regional components of WSDP. In line with the broad implementation strategy guidelines, these arrangements would contribute further towards strengthening the existing institutional framework. Towards this aim, establishment of the following organs is proposed.

- National Steering Committee (NSC)
- Federal Program Management Unit (FPMU) at the Ministry of Water Re sources
- Regional Program Management Units (RPMUs) at the Executive Council Office
- Sub-program Level Teams at the FPMU and RPMUs

National Steering Committee (NSC): The WSDP consists of interventions proposed for many subsectors. Therefore, program implementation and management can best achieve its objectives in a multi-sectoral development framework. This requires participation of leading institutional stakeholders. Accordingly, at the highest level, a National steering Committee (NSC) will be established. This will be an inter-ministerial body consisting of representatives of relevant Federal ministries and institutions, regional states, donors and private sector. Selected community representatives from different regions will also be represented on the committee. This committee will: (a) provide vision for poverty alleviation and sustainable water resources development and management; (b) improve the quality of decision making, sector efficiency and managerial performance in the implementation of the WSDP; (c) ensure inter-ministerial coordination for long-term sustainability of WSDP investments; and (d) mobilize financial assistance. This Committee will not be involved in the routine day-to-day program management operations; instead its role will be to monitor program progress and provide policy advice and guidance to the implementing organs.

Federal Program Management Unit (PMIU): The FPMU will be established within the MoWR to provide technical, logistical and administrative support to, as described earlier, all aspects of program management: planning, implementation, coordination and monitoring. To begin with, it can start functioning as part of the Planning Department of the MoWR. However, there is a growing perception that once all the building blocks of program management are in place (probably in the second year of program implementation), it should be transformed into a full-fledged Department of Program Management and Coordination. The FPMU will ensure a continuous flow of information between the MoWR and RPMUs. Other re-

Figure 12-1. Program Management Arrangements



sponsibilities of the FPMU will include: (a) reporting on program progress and impact; (b) identifying gaps and bottlenecks; (c) brokering donors support; (d) monitoring and evaluating program performance and impact; and (e) reviewing and validating the continued relevance of the program components and approach etc. On top of its functions, it will serve as the Technical Secretariat to NSC.

Regional Program Management Unit (RPMU): On the pattern of FPMU, a separate RPMU will be established in each region within the Executive Council Office. This is essential because much of the program components are to be implemented at the regional level. Socio-political considerations also warrant so. Its functions and responsibilities will almost be similar to those of the FPMU. It will ensure a continuous flow of information from the region to the FPMU at the MoWR.

Sub-program Level Teams: Both under the FPMU and RPMUs, 3-4 sub-program level teams will be established because the WSDP projects are grouped in accordance with major sub-sectors dealing with irrigation, hydropower, water supply and sewerage and general water resources. Number of teams in each region will be determined by the extent of sub-sectoral projects to be implemented in that region. These specialised teams will be responsible for co-ordination of sub-program level activities. Each regional sub-program level team will also co-ordinate with its Federal counterpart team for exchange of information and data on various aspects of program implementation. In many cases, since actual works will be executed through contracts with private companies, consulting firms, NGOs and local communities, these teams will also be responsible for the technical monitoring functions.

12.3.3 Program execution

Implementation of the WSDP works can be broadly grouped into two categories: (a) studies and designs works; and (b) construction works. In the case of small projects, most of the studies and design works will be undertaken using local capacities, which can be found within the private sector, and to some extent within the MoWR and EEPCo. Much of the small-scale construction work will be contracted out to local companies, NGOs and local communities. In the case of large projects, works will be awarded to local or international companies through a competitive bidding procedure. One of the key features of the WSDP implementation strategy is to promote new and innovative partnerships among various stakeholders. The Government will take necessary steps to promote conditions that foster partnership building, especially with the private sector so so as to bring much needed investment to the water sector. At the beginning of the program implementation, a Program Implementation Manuel (PIM) will be prepared to define, inter-alia, rules and procedures for engaging local and international consultants in the execution of WSDP works.

12.3.4 Program monitoring

The ultimate responsibility for monitoring of the proposed program lies with the Government of Ethiopia as part of its fundamental responsibility to execute its own program. At the initiation of the program implementation, a detailed monitoring process will be defined, including operational plan, performance indicators, monitoring tools, and boundary conditions. These procedures will be elaborated in the Program Implementation Manuel, together with the concrete steps to be followed in the process with definition of responsibilities. In this context, a detailed electronic monitoring system will be put in place that will ensure timely flow of information among various implementing organs in the required format.

The monitoring system will include baseline data and information that will serve as a benchmark for future comparisons and evaluations. The monitoring system will respond to the specificity of each sub-program, its components and the outputs to be produced and will also encompass a reporting mechanism that will ensure a smooth flow of information regarding the implementation of various activities to managers at different levels of the hierarchy on a quarterly basis. This report will describe the achievement of benchmarks on the set time scale, specify the actions required by the concerned parties in order to achieve the next set of targets and, if necessary, will make substantive recommendations about the orientation of the program.

In order to be consistent with the level of responsibility, implementation of the WSDP will be reviewed and evaluated at a minimum of three different levels.

The *first level* of review and evaluation process calls for continuous monitoring of the performance indicators for various projects planned under different program components at the local/project level. Quarterly meetings between the project implementing agencies (private sector, communities, NGOs etc.) and sub-program level teams will provide the necessary forum for this review. The sub-program level teams will then consolidate and report their findings to the respective RPMUs.

The *second level* of review calls for more intensive review and evaluation of program performance on a bi-annual basis. The Program Managers of FPMU and all RPMUs will jointly undertake this review. Reports emerging from the first level of review will serve as the basis for discussion at this stage. Exchanges of inter-regional information and experience will help to fine-tune the implementation process and agenda. The FPMU and RPMU will assume the responsibility for preparing their respective progress reports for discussion at the meeting while the FPMU will prepare a summary of this review for submission to

the Minister of Water Resources. Critical issues impeding program progress, if any, will be highlighted so as to seek high-level guidance in overcoming the implementation constraints. If warranted, the Minister should call a meeting of the National Steering Committee to discuss and resolve these issues.

The *third level* of review calls for an annual review of program performance by the National Steering Committee. Towards this aim, the FPMU will prepare the Annual Progress Report with the involvement of all stakeholders (especially the RPMUs). This report will reflect the results achieved so far, as well as the problems encountered in program execution. In addition, the effectiveness of the management and coordination mechanisms will be reviewed. This meeting in addition to reviewing the past progress will approve the operational plan for the next year. The situation with respect to resource mobilization will be reviewed and a strategy devised for mobilizing additional funding to meet the next year's targets. This meeting will take place at the end of each year so as to allow time for the revision of work plans, and the incorporation of agreed changes into the budget for the coming financial year.

In sub-sectoral chapters (chapter 5 through 9) growth targets are set for different planning horizons: short-term (2002-2006), medium-term (2007-2011) and long-term (2012-2016). A physical program is developed to meet these targets, and corresponding annual investment schedules are drawn up. Achievement of these targets or implementation of proposed annual program would serve as broad benchmarks for monitoring program progress. Since achievement of these benchmarks would depend upon availability of required funding, monitoring benchmarks would be adjusted accordingly to reflect realistic goals. In addition, at the beginning of each year specific benchmarks and performance indicators will be developed as part of the annual operational plan, especially those relating to institutional and technical capacity building.

12.4 Institutional and organizational reorientation

Successful implementation of the WSDP depends on fulfilling a number of preconditions. The most critical of these preconditions are availability of (a) adequate institutional and organizational capacity and (b) the required funds. This section deals with the first issue, while the second is discussed in chapter 13. Within the context of capacity building, many institutions will have to reorient their functions and mandates so as to be able to secure the basis for successful implementation of the WSDP activities. In this regard, the short-term capacity building plan will be specifically geared to focus on achievement of the following objectives. Parallel to this effort, meanwhile, implementation of a general capacity building program, as outlined in chapter 10, will be ongoing.

- Improved capacities of Federal and Re gional governments to integrate the pro posed WSDP interventions into their re spective economic development plans, capable among other things for providing clear and stable decisions on resource al location, resource sharing, and pricing of critical resources.

- Improved capacities of the zonal/woreda level organs of the Regional administra tion in coordinating local level development and implementation of the WSDP, and enabling the communities to organize and participate in the implementation of activi ties of the WSDP. This will help to achieve improved spatial and sectoral coordination of subsectoral plans at the district/woreda level. Where such organs do not exist, the Regional governments will be encouraged to establish these.

- The capacity for increased interagency co operation in plan making and program-

ming, and, where needed, in extension, implementation and operation at all levels will be streamlined and strengthened. This will also include creation of the capability in line ministries and institutions (at the federal, regional, and district/woreda levels) to provide technical assistance and support for implementation and monitoring of activities of the WSDP.

- The corporate sector will be encouraged to take the lead in modernizing the water sector of Ethiopia. Horizontal equity in regulations and incentives will be pro moted for competitive firms to invest in providing water supply services.

- Given the policy for lean government and budgetary constraints, most of the capac ity building work will be done by reorient ing, training and upgrading existing profes sionals. Indigenous expertise will be taped from government, NGOs, community groups, and the private industrial and com mercial sectors.

12.5 Hopeful factors

In spite of the stagnant character of the water sector, there are many hopeful factors in the present situation. First, the Ethiopian government remains very much committed to the goal of poverty alleviation and realizes that sustainable development and management of water resources is crucial to achievement of this goal. As such, water has been reflected as one of the priority areas in the country's poverty alleviation strategy. Second, Ethiopia has come a long way in creating mutual trust and better understanding with its riparian neighbors about equitable sharing of transboundary waters. The NBI has made considerable progress and a common vision has been developed, together with investment plans for mutually agreed projects. Third, Ethiopia has already committed to mobilizing a considerable amount of financial resources from domestic sources to meet the short-term investment needs of the WSDP. Fourth, provision of water supply to those having no access to safe drinking water supply remains on the top of internal development agenda, as was agreed in the Millenium DevelopmentGoals and recently reaffirmed in the Johannesburg Summit. Accordingly, the multilateral and bilateral development agencies are expected to extend more support to the water sector in Ethiopia. Finally, building partnerships with the private sector is increasingly seen as an important means of bringing additional financial resources to the development and management of the water sector. Ethiopia is ready to discuss such partnerships and create the necessary incentive structure and regulations to promote the participation of the private sector.

12.6 Moving ahead in the initial years

Implementing the WSDP activities will take considerable multi-sectoral and sectoral planning and programming over the next 1-2 years, along with capacity building and institutional strengthening. Yet the focus solely on planning and institutional development in the initial years risks losing momentum on substantive action—that is, implementation of projects. Feedback from the implementation of projects at ground level is also important for proper planning and strengthening of institutions. Chapters 5-10 have indicated the priority projects in each subsector; some are ongoing while others have to be implemented. One might argue that some of the short-listed projects are not ideal for the given conditions—they might need to be made more cost effective, or need to be reconceived as inputs to facilitate community development rather than as managerially delivered products. Revamping these projects is seen to be a continuous exercise, yet there are many short-listed projects that are believed to be good candidates to get action underway. In addition, the Government will take following actions in the initial years to ensure smooth implementation of WSDP activities and secure sustainability for the WSDP investments over the entire planning horizon.

- To initiate and facilitate program implementation, the following institutional arrangements will be made: (a) creation of a National Steering Committee representing all stakeholders; (b) establishment of a Federal Program Management Unit (FPMU) within the Ministry of Water Resources; and (c) establishment of Regional Program Management Units (RPMUs) in the Executive Council Offices of all regions.

- The FPMU and RPMUs will be made fully functional by assigning necessary staff and making available the required equipment. These units will develop an operational plan (work plan) for the short-term, especially with more details for the initial years, for approval of the National Steering Committee.

- A Program Implementation Manuel (PIM) will be prepared that would serve as a step-by-step guide to deal with different aspects of program implementation. Such aspects may include, but not be limited to: procurement of goods and services, engagement of consultants/firms, accessing program funds, disbursement procedures and regulations, roles and functions of implementing agencies vis-à-vis other agencies participating in the program etc.

- A monitoring system that will include baseline data and information and encompasses a reporting mechanism will be put into place. This system will also include detailed procedures for the monitoring and evaluation of program impacts.

- The WSDP has identified a series of projects with tentative cost estimates. Proposed interventions will be transformed into detailed project documents in line with the formats and requirements of funding agencies. In some cases, these project documents might already exist but will need some updating. These documents (whether new or revised) will give due attention to environmental and social impact assessments in line with the guidelines proposed in chapter 11.

- A detailed resource mobilization strategy will be worked out consistent with the strategic guidelines proposed in chapter 13. A series of resource mobilization meetings will be arranged with all partners, whether domestic or international, particularly with the private sector. The WSDP will be introduced at all international water related conferences in order to sensitize the international community. These efforts will also continue in the medium-and long-term.

- Necessary measures will be taken to speed-up the pace of implementation of on-going projects, and linking their progress or constraints to the overall monitoring system for the WSDP.

- A short-term capacity building plan will be prepared and implemented to enable the existing institutions to cope with the extensive program management requirements in the first part of the planning horizon. The plan will include detailed assessment of capacities in the FPMU and all RPMUs, and an action plan to meet the capacity gaps. Capacity building priorities as defined in section 12.4 above will be specifically targeted.

Chapter 13 Financing the WSDP

The WSDP is not just an investment plan. Rather, it is concerned with the way all social and economic development will be undertaken. Indicating the size and phasing of core subsectoral programs in chapter 5 through 10 highlights the physical thrust of the WSDP, as well as the investment Ethiopia needs to, literally, make for its future.

13.1 Investment requirements: an overview

Total estimated cost of the WSDP is $US 7,444.8 million over a 15 year period (2002-2017), covering all aspects of water resources development and management, and extending to all possible uses (see table 13-1). This turns out to be a little less than $US 500 million per year. Immediate requirements for the short-term planning horizon (2002-2006) are $US 2,110 million -28 per cent - of the total investment plan (see chapter 10 for more details).

The proposed investments are likely to generate thousands of jobs, as most of the WSDP investment areas are heavily biased in favor of labor-intensive processes. The WSDP would thus make a useful contribution to the critical problem of employment generation in a surplus labor economy. This would also enhance the prospects for sustainability of investments, since people will be able to pay for the services.

13.2 Sources of funding

Projections of investment requirements to support the WSDP activities over the next 15 years are based on three major sources of financing: (a) external sources; (b) domestic resources; and (c) private capital-both domestic and international.

13.2.1 External sources

(a) Multilateral and bilateral aid: A number of major multilateral and bilateral agencies are already assisting the water sector and have committed resources to numerous water projects. So far, the donors have reacted positively to the WSDP in the meetings held during the formulation of the WSDP. Due to its critical role in poverty alleviation and achieving the goals of sustainable development, water is perceived as an important priority in many donors' development assistance agendas. However, because a substantial aid pipeline already exists, especially for the projects to be implemented under the Nile Basin Initiative the question of additional aid resources at this stage may be premature. It is important that Ethiopia should carefully determine that on what projects, and in what form, it would

Table 13-1. Summary of investment plan ($US millions)

Subsector	Short-term	Medium-term	Long-term	Total
1. Water supply & sewerage	876.2	1,057.9	1,001.7	2,935.8
2. Irrigation	307.9	456.9	918.3	1,683.1
3. Hydropower	649.1	525.9	776.7	1,951.7
4. General water resources	183.9	231.9	240.5	656.3
5. Institution/capacity building	92.9	63.3	61.7	217.9
Total	2,110.0	2,335.9	2,998.9	7,444.8

like to seek donors' assistance and maintain ongoing dialogue with the donors. Here it is sufficient to note that the aid pipeline, as well as current inflows, matched by donors' interest, provides grounds for optimism.

(b) Debt-swap arrangements: A second source of aid-related funding for the WSDP is somewhat less conventional. Ethiopia faces quite a bit of debt burden. A slow down in macroeconomic growth performance, failure to diversify the export base, and a looming world recession leading to reduction in trade collectively constitute a troubling matrix for Ethiopia's debt servicing capacity. Present debt servicing capacity is estimated to be around 3.5 per cent of the GDP, and projected to stay at the same level in the next 3-4 years. In monetary terms, debt servicing in 2001-2002 amounted to about $248 million. Ethiopia has reached a decision point for enhanced HIPC (Heavily Indebted Poor Countries) facility in October 2001. The Government plans to utilize this debt relief to supplement its efforts to boost investments in social sectors. In other words, relief given on debt servicing and on the principal amount would be used to finance the WSDP activities. This approach has proven to be very successful in improving the capacity and performance of social sectors in many developing countries. There is no reason why Ethiopia can't make best use of this facility to support one of the most vital social programs in the country.

(c) Government Sources: Ethiopia will have to increase its allocations to the water sector if the goal of poverty alleviation is to be achieved. Besides showing its commitment to the development of water sector, it will help to stimulate the interest of other funding partners such as international agencies, NGOs and private sector in the WSDP and would provide evidence of matching words by actions. However, this would require extra revenue generation efforts. There are two ways in which the Ethiopian Government could raise funds directly for activities of the WSDP. The first, and most obvious, category is new taxation measures, such as a polluter pay principle. For example, industrial units damaging water quality with untreated wastewater could be taxed. In addition to direct pollution taxes, resources could be supplemented by lotteries and other fund raising schemes that have already demonstrated their potential in raising private capital in many parts of the world. A second source for mobilizing domestic resources would be to rationalize water charges within the context of efficiency, equity and cost recovery considerations.

(d) Non-government sources: Community contributions in the form of cash and in-kind inputs would be another instrument for domestic resource mobilization. The WSDP activities will benefit the local communities in terms of growth of economic activities in local economies resulting in increased employment opportunities and household incomes. If communities become convinced about these impacts, the experience of many countries shows that they will contribute. This is especially true for small-scale irrigation and rural water supply schemes. The role of community participation in reducing recurrent project costs and enhancing sustainability of water supply schemes can hardly be over-emphasized. Attaching a price tag to these two contributions will reduce the investment requirements.

13.2.3 Private sector

Given the dire constraints on and competing demands for existing public revenues and specificity of aid commitments, the private sector will have to assume a lead role in providing the required capital and management expertise to the WSDP. In many countries of the world, private sector response has been laudable. In Ethiopia, private sector contributions have been almost negligible. The Government will need to encourage and stimulate private investment towards activities of the WSDP by establishing special credit lines, identifying market opportunities and assisting with technical information. This applies both to the commercial banking sector and private companies. In addition to the domestic private sector, large multinational companies can bring special-

ized management experience and large scale financing. The Government, drawing on similar experiences elsewhere, will develop a strategy to attract such investments. It is important that the domestic private sector in Ethiopia also views the WSDP as a source of opportunity, not merely of taxation.

13.3 Financial plan

At this stage it would be premature to indicate who would contribute what resources towards implementation of the WSDP . Part of the Government's resource mobilization strategy is to present this WSDP to various partners and to seek their participation in its implementation. However, based on past experience of financing to the water sector, as well as the response of different partners to other sector development plans (health, education and road), the Government has made tentative estimates of funding from different sources. These estimates were arrived at on the basis of expected contributions of different partners to various components of the WSDP (table. 13-2), and will be subject to further refinement as the discussions on resource mobilization proceed.

Translating above subsectoral figures over the entire WSDP will set the following financial targets from different sources over the next 15 years: $1,827 from Government sources (24.5%), $1,895 from international private sector (25.4%), $759 from domestic private sector (10.2%), $377 from communities/beneficiaries (5.1%) and $2,585 million from multilateral and bilateral donors (34.8%).

Table 13-2. Contribution of various financing sources to WSDP (Per cent)

Subsectoral Description	Government (Federal and Regional)	Private Sector (Int'l)	Private Sector (Domestic)	Communities/Beneficiaries	Multilateral/Bilateral	Total
Water Supply and Sewerage						
Urban water supply	10	40	10	-	40	100
Rural water supply	40	-	-	10	50	100
Sanitation	10	40	10	-	40	100
Hydropower						
Federal projects	-	80	20	-	-	100
Regional projects	50	-	50	-	-	100
Irrigation						
Small scale projects	80	-	10	10	-	100
Medium and large scale projects	10	-	20	10	60	100
General water resources						
Monitoring networks	25	-	-		75	100
Flood protection works	25	-	-	-	75	
Master plan studies	75	-	-		75	100
Institution and capacity building						
Human reources development	40	20	-		40	100
Institution building	70	-	-		30	100

At this stage, the financial picture for short-term (2002-2006) is relatively clear. Total investment requirements for all subsectors are $2,110 million. The Government has already mobilized a total of $1,241 from different sources, including $742 million available under the NBI. The remaining balance turns out to be $174 million per year over the next five years. In other words, the Government has raised enough resources to begin program implementation. As program implementation progresses, and resource mobilization efforts are intensified, it is expected that the remaining resources will become available. The Government fully realizes that the future of this program and of resource mobilization greatly depends upon its implementation performance in the initial years of the program. At the same time, the Government remains hopeful that different partners will use the opportunity provided by the WSDP to invest in sustainable development of Ethiopia.

There should be no doubt about Government's commitment to allocate higher resources for investing in the water sector. A recent paper presented by the Government of Ethiopia in the Third United Nations Conference on the Least Developed Countries (May 2001) provided Ethiopia's development vision over the next years (2001-2010). It was estimated that Ethiopia would need to invest an amount of $39 billion to achieve the targets set under this vision. Out of this, about $25 billion would be invested in major development programs which have a strong impact on poverty alleviation. Water was not only identified as one of the important pillar of the development vision, it also received a significant share of resource allocations marked for the development of social sectors. The paper went on to state that water sector investments would be targeted to realize the objectives of the water resources policy issued in 1999.

13.4 Steps towards resource mobilization

Bringing people out of the poverty trap is the main development goal of the present government. The Government is fully aware of the fact that not many options are available to pursue this goal. Out of the limited options available, development of water sector stands out prominently as a way to achieve the objectives of sustainable development. This is because water occupies a central role in the national development process—both as a natural resource and as a service provider to other sectors of the economy. The country has already suffered too much because of the number and scale of water related disasters—either too little water (drought) or too much uncontrolled water (floods). As such, the Government views investment in the water sector as both a necessary effort, and as an opportunity to invest in the future of Ethiopia.

Therefore, the Government is planning to exert concerted effort towards raising the required resources for implementation of activities of the WSDP. Though resource mobilization efforts will continue over the entire planning horizon, the Government plans to take the following steps to meet the short-term resource gap of $869 million over the next five years.

- A donor's meeting will be organized in Addis Ababa to launch the implementation of the WSDP and to secure donors' inter est in various WSDP activities. As men tioned earlier, the Government has already raised some resources from its own sources that will be utilized to initiate implementation of the program.

- The Government has already constituted a Resource Mobilization Committee. This committee has started its work and is hold ing discussions with the representatives of resident donor agencies. The commit tee however will intensify its work once this report is officially released and distributed to all potential partners.

- The committee will hold meetings with various donor agencies (not present in Addis Ababa) at their headquarters and

introduce them to the various aspects of the WSDP. Similar efforts will be made to secure the interest of large international private sector companies. Experience elsewhere shows that multinational com panies usually remain interested in invest ing in urban water supply projects.

- The Government will soon announce a policy on tax rebates and extending credit lines to private sector companies that would be willing to invest in water sector.

- The year 2003 has been declared as an International Year of Freshwater. During that year a number of international water meetings are planned. All efforts will be made to introduce the WSDP in those meetings.

Chapter 14 Summary of Conclusions

The WSDP report is carefully structured in terms of investments planned for the de velopment of water sector over the next 15 years. The objective is to present a comprehensive inventory of projects that should be implemented in the different subsectors that form the water sector. These projects were identified to meet the specific growth targets set for each of the subsectors, while the national development agenda formed the basis for setting the growth targets. Subsector specific recommendations are dispersed throughout the report, and so is the case in regards to Government commitments to development of water sector are concerned. This chapter brings these recommendations and commitments together in the form of an agenda for action.

14.1 Agenda for action in the short-term

The Government of Ethiopia will undertake the following actions to provide basis for successful implementation of the WSDP.

- Program implementation will begin as soon as possible. For this purpose, the Government will not wait for resource mobilization to take place. The Government views resource mobilization as a continuous activity parallel to those defined in the WSDP. Moreover, sufficient resources have already been raised (or for sure will become available) to initiate the program activities—at least to begin the implementation of short-term program.

- Necessary steps will be taken to mobilize the resources required to meet the financial gap in the short-term. This specifically will include organizing a donor's conference, meetings with individual donors, visiting headquarters of various donor agencies and multinational companies, and introducing the WSDP in all major international water meetings.

- Following institutional structure will be established to provide solid start to program implementation: a National Steering Committee, a Federal Program Management Unit (FPMU) within the Ministry of Water Resources and Regional Program Management Units (RPMUs) in all regions. These units will be staffed with qualified personnel and equipped with required facilities. If competent staff is not available from the relevant Government institutions to make these units functional, their services will be secured from the private sector. Existing rules and regulations regarding staff salaries and benefits will be made flexible, at least in the short-term, realizing that required staff otherwise may not be available.

- A Program Implementation Manual will be prepared describing the rules and procedures for financial management and reporting, procurement of goods and services, contract management, and monitoring and evaluation of program activities etc. This Manual will be prepared at the very beginning of program implementation, as FPMU and RPMUs will need it for their day-to-day functioning.

- All future water sector projects and donors activities will be coordinated within the framework provided by the WSDP. This applies equally to all those projects that are not included in this WSDP.

- As a matter of priority, the implementation capacity of Federal and Regional institutions at the lowest administrative levels and the community will be strengthened. That will entail employing additional skilled manpower, upgrading the skills of existing manpower, and purchas

ing construction machinery, vehicles, and equipment. Capacity-building and institu tional development will be focused in all major program activities.

- The monitoring and evaluation system for following up the progress of program and project implementation will be strength ened in terms of both manpower and in stitutional capacities. Improvements will be made at all levels of implementation: Fed eral Government, Regional Government, zonal administration, woreda administra tion, and project management levels.

- The WSDP beneficiaries and stakehold ers will be encouraged to become actively involved in program activities. Towards this aim, a legal framework for establishing voluntary beneficiary associations, simi lar in nature to the water users' associa tions and farmers' cooperatives, will be provided.

- The Government will take necessary steps to create conditions conducive to the par ticipation of private sector in program implementation activities.

- Environmental protection standards, with respect to protection of water quality, will be strictly enforced.

- If funding becomes a constraint, Federal projects will be given priority over those of the regional projects, followed by the Addis Ababa priority projects.

- The program's performance will be con tinuously monitored and evaluated at dif ferent levels—ranging from project level progress to subprogram level perfor mance to national level evaluation and as sessment.

14.2 Summary

The WSDP consists of, and depends on, an interweaving of the physical means of land and water resources with the necessary economic, social, environmental and political factors. Implementation of such a plan will require heroic efforts by both the Government and people of Ethiopia. The impact of concerted efforts to increase food production, providing safe drinking water to those who presently do not have an access, generate additional hydropower to stimulate economic growth will be felt in almost every department of the Federal and Regional Governments. These institutions will need to start reorienting themselves to cope with these impacts.

The WSDP will intimately affect the life of every family in each project area. Each year thousands of farmers and their families will be involved in technologic, economic and social revolution. The local communities must become aware of a new frontier, after years of decreasing hopes and resources. The Government should play a lead role in raising this awareness among the rural population, though it will be a daunting task because of problems of village isolation, illiteracy, shortage or lack of qualified personnel, and lack of mass communication media. Success will not occur unless the communities can be motivated and mobilized to extend their efforts to cooperate.

Staffing of the implementing institutions will be a difficult problem. Domestic personnel will clearly not be available in adequate numbers during the early years of the program, but every effort should be made to build up the domestically recruited staff as quickly as possible. During the early years, technical assistance from private sector and external support agencies will probably be essential. It is evident that, based on the present salary structure, competent professionals will not be willing to work. The Government therefore must adjust itself to this reality and be ready to attract national professionals by offering them competitive packages.

References

1. Acres. (1996) Ethiopia: Power System Planning Study 1995 Update (for EELPA). Addis Ababa.
2. Acres. (2000) Ethiopian Power System Expansion Master Plan (for EEPCO). Addis Ababa.
3. Applied Energy Group (AEG). 1997. Forecast of EELPA Electric Energy and Peak Demand f or1998-2016. Preliminary Report. Addis Ababa.
4. BCEOM-BRGM-ISL. (1997) Abbay River Basin Integrated Development Master Plan Study, Phase 2 Final Report.
5. BCEOM-BRGM-ISL. (1998) Abbay River Basin Integrated Development Master Plan Study, Phase 3 Final Report.
6. Brian Grover, World Bank Technical Paper Number 12, Vol. 1: Guidelines, 1983.
7. Cesen, Ansaldo. 1986. Co-operation Agreement in the Energy Sector. Ministry of Mines and Energy. Addis Ababa.
8. CSA. The 1994 Population and Housing Census of Ethiopia, Vol. I, Statistical Report, June 1998.
9. CSA. (1998) The 1994 Population and Housing Census of Ethiopia. Addis Ababa.
10. EELPA. 1996. System Load Forecast and Supply - Demand Balance. Addis Ababa.
11. EELPA. 1997. EELPA Restructuring and Institutional Development Study: Executive Sum mary. Addis Ababa.
12. ERA. (1996) Proceedings of the Donors' Conference on the Road Sector Development Pro gram. Addis Ababa.
13. FDRE. (1995) A Proclamation to Provide for the Definition of Powers and Duties of the Execu tive Organs of FDRE. Addis Ababa.
14. FDRE. (1995) A Proclamation to Provide for the Establishment of the Environmental Protec tion Authority. Addis Ababa.
15. FDRE. (1996) Proclamation No. 37/1996: Investment Proclamation of the Federal Demo cratic Republic of Ethiopia. Addis Ababa.
16. FDRE. (1997) Council of Ministers Regulation No. 18/1997: Regulation to Provide for the Es tablishment of the Ethiopian Electric Power Corporation. Addis Ababa.
17. FDRE. (1997) Proclamation No. 86/1997: A Proclamation Relating to Electricity. Addis Ababa.
18. FDRE. (1999) Council of Ministers Regulations No. 49/1999: Council of Ministers Regulations to provide for the regulation of electricity supply. Addis Ababa.
19. FDRE. (2001) Ministry of Economic Development and Cooperation. Development Frame work and Plan of Action 2001-2010: Country Report to the United Nations Conference on the Least Developed Countries.
20. FDRE.(1998) Proclamation no. 116/1998: A Proclamation to Amend the Investment Procla mation. Addis Ababa.
21. Gessesse, Habtamu. Problems and Constraints in the Study, Construction and Management of Small-scale Irrigation Projects, Oct. 1991.
22. HALCROW. (1989) Master Plan for the Development of Surface Water Resources in the Awash Basin, Final Report.

23. Hill, L. (1992) Pricing Initiatives and Development of the Korean Power Sector - Policy lessons for developing countries. In: Energy Policy. Butterworth - Heinemann Ltd.
24. HRC JV (1997) Tekeze Hydropower Project Feasibility Study, Final Report.
25. HRC JV/MoWR. (1997) Gojeb Hydropower Project Feasibility Study, Final Report.
26. LEK JV. (1999) Feasibility Study of Chemoga - Yeda Stage I Hydropower Project, Draft Report.
27. LEK JV. (2000) Feasibility Study of Beles Hydropower Project, Draft Report.
28. LEK JV. (2000). Feasibility Study of Beles, Chemoga - Yeda and Halele Werabesa Hydro power Project: Comparison with Aleltu Hydropower Project, Final Report. Addis Ababa.
29. LEK JV. (2000). Feasibility Study of Halele Werabesa Stage 1 Hydropower Project, Main Re port. Addis Ababa.
30. Martin, J. et al. (no date). Preparation of the Education Sector Development Program in Ethio pia. Addis Ababa.
31. Medium-scale Hydropower Studies Project Office, MoWR. (1997) Genale Hydropower Project Reconnaissance Study Report.
32. Ministry of Health. (2001) Ethiopian Health Sector Development Program Report of the Mid-term Review Mission. Addis Ababa.
33. Ministry of Mines and Energy. (1994) Energy policy of Ethiopia (Amharic version). Addis Ababa.
34. Ministry of Mines and Energy. 1994. Small-hydro Development Program for the Period 1995-2005. Addis Ababa.
35. Ministry of Water Resources, Ethiopian Water Resources Management Policy, June 2000.
36. MOWR. (2000) Ethiopian Water Resources Management Policy. Addis Ababa.
37. NEDECO-DHV. (1998) Tekeze River Basin Integrated Development Master Plan Study Final Report.
38. Nile Basin Initiative Strategic Action Program, 2000.
39. Norplan-Norconsult/MoWR. (1999) Baro Hydropower Projects Prefeasibility Study Report.
40. Norplan-Norconsult/MoWR. (1999) Geba Hydropower Projects Prefeasibility Study Report.
41. Norplan-Norconsult/MoWR. (1999) Genale Hydropower Projects Prefeasibility Study Report.
42. Norplan-Norconsult/MoWR. (1999) Guder Hydropower Project Prefeasibility Study Report.
43. Richard Woodroofe and Associates. (1993) OMO-Gibe Basin Development Master Plan Study, Reconnaissance phase 1 Report. Vol. III, Annex XI. Ministry of Water Resources . Addis Ababa.
44. Richard Woodroofe and Associates. (1995) OMO-Gibe Basin Development Master Plan Study, Vol. X . Ministry of Water Resources. Addis Ababa.
45. Richard Woodroofe & Associates. (1996) Omo-Gibe River Basin Integrated Development Mas ter Plan Study Final Report.
46. SADELEC. (2000) Electricity Prices in Southern and East Africa. Johannesburg.
47. TAMS-ULG. (1997) Baro-Akobo River Basin Integrated Development Master Plan Study. Final Report.
48. Tessema Woubneh, Current Status and Issues in Irrigation Development, Water Sector De velopment Program, Sector Review Report, Water Works Design and Supervision Enter prise, Feb. 2000.
49. TGE. (1994) Water Resources Utilization Proclamation. Addis Ababa.
50. TGE. (1992) Proclamation No. 25/1992: Public Enterprise Proclamation. Addis Ababa.

51. TGE. (1993) Economic Development Strategy for Ethiopia (in Amharic). Addis Ababa.
52. Tropics Consultancy Engineers. (1997) Feasibility Study and Final Design of Seven Mini/ Micro Hydropower Sites in Oromia: Executive Summary. Addis Ababa.
53. WAPCOS. (1990) Preliminary Water Resources Development Master Plan for Ethiopia. Vol. VII. Annex J: Hydropower. Ethiopia. Valleys Development studies Authority. Addis Ababa.
54. WEC. (1994) New Renewable Energy Resources. Kogan Page Ltd. London.
55. WWDSE/MoWR. (2000) Dawa Hydropower Project Reconnaissance Study Draft Report.
56. WWDSE/MoWR. (2000) Jema Hydropower Project Reconnaissance Study Draft Report.
57. WWDSE: Methodological Framework for the Preparation of Water Sector Development Program (WSDP), April 2001.