



Development of an Assessment System to Evaluate
the Ecological Status of Rivers in the Hindu Kush-Himalayan Region

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River Water Quality Policies, and Pressures and Impacts in the Hindu Kush- Himalayan Region

Volume I: Synthesis Report
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Abbreviations and Acronyms

ADB	Asian Development Bank
AHEC	Alternate Hydro Energy Centre (IIT, Roorkee)
AIBP	Accelerated Irrigation Benefits Programme
ARWSP	Accelerated Rural Water Supply Programme
ASSESS-HKH	Assessment System to Evaluate the Ecological Status of Rivers in the Hindu Kush Himalayan Region
BCM	Billion Cubic Meters
BECA	Bangladesh Environment Conservation Act
BOD	Bio-chemical Oxygen Demand
BWDB	Bangladesh Water Development Board
CaCO ₃	Calcium Carbonate
CADP	Command Area Development Programme
CBO	Community Based Organisation
CEMAT	CEMAT Consultants (Pvt.) Ltd.
CGWB	Central Ground Water Board
CMO	Central Monitoring Organization
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CWC	Central Water Commission (India)
DDC	District Development Committee
DHM	Department of Hydrology and Meteorology
Disvi	Italian NGO
DNPWC	Department of National Parks and Wildlife Conservation
DO	Dissolved Oxygen
DoE	Department of Environment
DoED	Department of Electricity Development
DoF	Department of Forest
DoI	Department of Irrigation
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads.
DPAP	Drought Prone Areas Programme
DSCWM-	Department of Soil Conservation and Watershed Management
DWIDP	Department of Water Induced Disaster Prevention
DWQ	Drinking Water Quality
DWQM	Drinking Water Quality Monitoring
DWRC	District Water Resources Committee
DWSS	Department of Water Supply and Sewerage
E Coli	Eserisha Coli
EAA	Environment Assessment Act
ECA	Environmental Conservation Act
ECoP	Environmental Code of Practice
ECR	Environmental Conservation Rules
EIA	Environment Impact Assessment
ENPHO	Environment and Public Health Organisation
EPC	Environment Protection Council
EQS	Environmental Quality Standards
ETFC	Electricity Tariff Fixation Commission
FAP	Flood Action Plan

FFC	Federal Flood Commission
FINNIDA	Finnish International Development Agency
GLOF	Glacier Lake Outburst Flood
GNH	Gross National Happiness
GOP	Government of Pakistan
HDI	Human Development Index
HKH	Hindu Kush Himalayan Region
HMGN	His Majesty's Government of Nepal
Hrs./day	Hours per day
ICAR	Indian Council for Agricultural Research
ICIMOD	International Centre for Integrated Mountain Development
IEE	Initial Environmental Examination
INGO	International Non-governmental Organisation
IPNS	Integrated Plant Nutrient System
IUCN	International Union for Conservation of Nature (World Conservation Union)
IWM	Institute of Water Modeling
IWRM	Integrated Water Resources Management
KVWA	Kathmandu Valley Water Authority (now Kathmandu Valley Water Management Board)
KWSB	Karachi Water and Sewerage Board
LBOD	Left Bank Outfall Drain
lpcd	Litres per capita per day
LSGA	Local Self Governance Act
mg/l	Milligram per litre
MINFAL	Ministry of Food, Agriculture and Livestock
ml	Millilitre
MLD	Million litres per day
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoEST	Ministry of Environment, Science and Technology
MoFSC	Ministry of Forest and Soil Conservation
MoH	Ministry of Health (now Ministry of Population and Health)
MoI	Ministry of Industry
MoLD	Ministry of Local Development
MOPE	Ministry of Population and Environment (Now part of MOEST)
MoWR	Ministry of Water Resources
MPN	Most Probable Number
MPPW	Ministry of Physical Planning and Works
MTEF	Mid Term Expenditure Framework
MWSDB	Melamchi Water Supply Development Board
N	Nitrogen
NCS	National Conservation Strategy
NDC	National Development Council
NDWQS	National Drinking Water Quality Standards
NEA	Nepal Electricity Authority
NEAP	National Environment Action Plan
NEC	National Environment Commission
NEPA	National Environmental Protection Act
NEPP	National Environment Policy of Pakistan 1999
NEQS	National Environment Quality Standard

NES	National Environment Strategy
NESS	Nepal Environmental scientific Services
NGO	Non-governmental Organisation
NH ₃	Ammonia
NLCP	National Lake Conservation Plan
NO ₃	Nitrate
NO ₃ -N	Nitrate-Nitrogen
NORAD	Norwegian Agency for Development Co-operation
NPC	National Planning Commission
NRCD	National River Conservation Directorate
NTU	Nephelometric Turbidity Unit
NWDA	National Water Development Agency
NWFP	North-West Frontier Province
NWP	National Water Plan 2005 (to be published)
NWQMP	National Water Quality Monitoring Program
NWRDC	National Water Resources Development Council
NWRS	Nepal Water Resources Strategy 2002
NWSC	Nepal Water Supply Corporation
O&M	Operation and Maintenance
OECD	Organisation for Economic Co-operation and Development
PCRWR	Pakistan Council of Research in Water resources
pH	Hydrogen ion Concentration
PIHS	Pakistan Integrated Household Survey (2001/02)
PLAN	PLAN International (INGO)
PNCS	Pakistan National Conservation Strategy
PSQCA	Pakistan Standards and Quality Control Authority
PWSC	Pakistan Water Sector Strategy
RBOD	Right Bank Outfall Drain
RGoB	Royal Government of Bhutan
RONAST	Royal Nepal Academy of Science and Technology
RWSSFDB	Rural Water Supply and Sanitation Fund Development Board
SAECP	South Asia Co-operative Environment Programme
SAF	Sindh Agriculture Form
SCARPs	Salinity Control and Reclamation Projects
SMO	Salinity Control and Reclamation Project Monitoring Organization
SoE	State of Environment Report
SPCB	State Pollution Central Board
SWMRMC	Solid Waste Management & Resource Mobilisation Centre
TCU	True Colour Unit
TDS	Total Dissolved Solids
TERI	Tata Energy Research Institute (now The Energy Resources Institute)
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TSS	Total Suspended Solids
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children Fund
UNIDO	United Nations Industrial Development Organisation
VDC	Village Development Committee

WAPDA	Water and Power Development authority
WARPO	Water Resource Planning Organisation
WASAs	Water and Sanitation Agencies
WB	World Bank
WEC	Water and Energy Commission
WECS	Water and Energy Commission Secretariat
WHEM	Water, Hazards and Environment Management
WHO	World Health Organisation
WQS	Water Quality Standards
WRA	Water Resources Act 1992
WSS	Water Supply and Sanitation/Sewage
WSSP	Water Supply and Sanitation Project
WSTFC	Water Supply Tariff Fixation Commission
WUA	Water User's Association
µS/cm	Micro Siemens (mhos) per centimeters

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I. BACKGROUND

1.1 Project Aims, Methodology and Contents of this Report

The project “Development of an Assessment System to Evaluate the Ecological Status of Rivers in the Hindu Kush-Himalayan Region (ASSESS-HKH)” aims at developing tools for river assessment and river basin management in the HKH region jointly by Asian and European partners. The project activities are divided into eight work packages. The objective of the Work Package 3 “Pressures and Impacts” is to establish an overview of driving forces, pressures and impacts on the rivers in the region. The present study has been conducted as part of Work Package 3.2 and focuses on the identification of the most significant problems experienced in the respective countries- i.e. Bangladesh, Bhutan, India, Nepal and Pakistan. It aims to establish an overview of the policies and legal regimes pertaining to the driving forces, pressures and impacts on the three major river systems in the HKH region - the Indus, the Ganges and the Brahmaputra. A description of the water availability and uses in the Hindu Kush-Himalayan (HKH) region is provided in the next section.

The existing policies and legal instruments pertaining to the sustainable management of water resources, in particular to river water quality in the region, have been reviewed. The analytical process involved the following steps:

- Collection of reports, data and information from the five countries
- Review of the collected material
- Synthesis of the collected material
- Preparation of the Draft Report
- Circulation of the Draft Report to the partners and presentation
- Collection of reviews and comments from the partners
- Preparation of the Final Report and submission

It has to be noted that the analytical review mentioned above is based entirely on secondary data. The two main sources of information were the country papers presented at the Integrated Workshop on Water Quality in South Asia: Issues and Status, June 29 – July 2, 2004, Kathmandu, Nepal (organized by ICIMOD/CMC) and the State of the Environment Reports prepared by the respective countries with the assistance of UNEP (2001/2005). Partner Organizations in the respective countries have also provided informative documents, which have been duly acknowledged in the respective country background reports (Vol. II).

This report describes the socio-economic aspects and related pressures and impacts related to the river systems. The policy and legal provisions that have a direct bearing on river water quality have also been highlighted. The report is broken down in two volumes. Volume I: the main “Synthesis Report”, is a consolidated synthesis of the status in the five countries and presents some of the more important issues in comparative tabular form. The following topics have been covered:

- Background to the Study
- Socio-Economic Status and Indicators
- Most Relevant Socio-Economic Pressures and Impacts
- Review of Existing Policies and Legal Instruments
- Institutional Arrangements and Regulatory Framework
- Identification of Gaps
- Conclusions and Recommendations

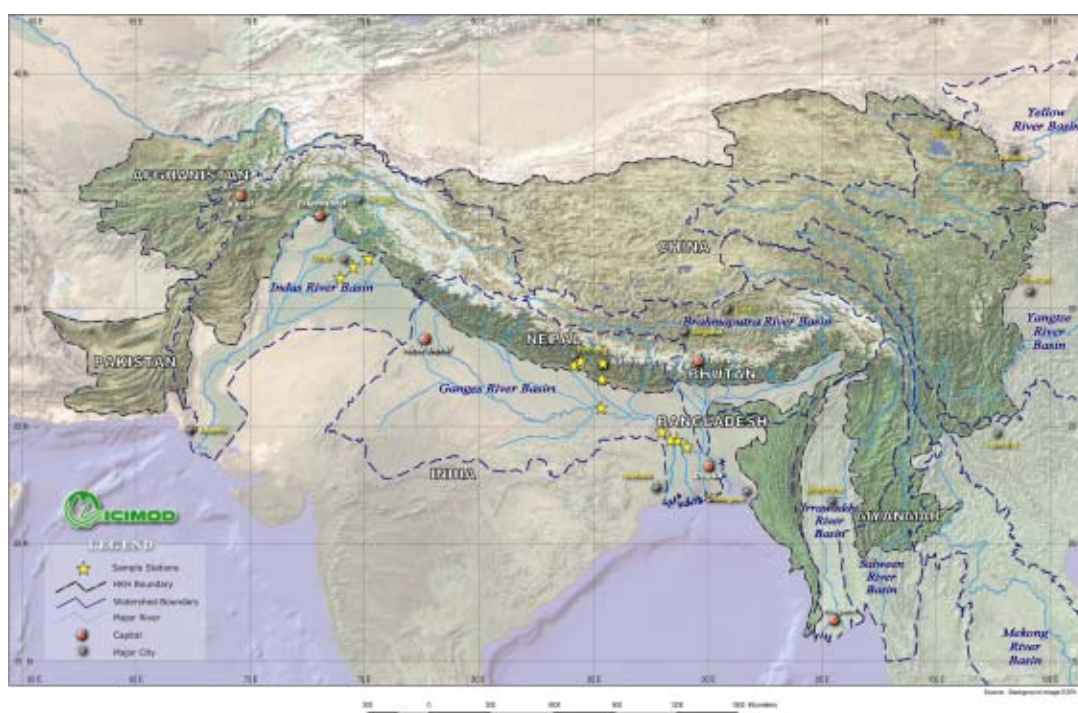
Volume II, the “Country Background Reports”, consists of country reports of individual countries and discusses in some detail the following:

- Background to the study including methodology and the KHH Region river systems
- Socio-economic status/implications
- Identification of the most relevant socio-economic pressures and impacts in the HKH region
- Review of existing policy and legal instruments in the participating countries that have a direct bearing on river water quality
- Regulatory framework and mechanism
- Identification of gaps in the policy and legal provisions
- Conclusions and recommendations.

1.2 Water Availability and Uses in the HKH region

The three major river systems in the HKH region in South Asia are the Indus, the Ganges and the Brahmaputra. The five countries located in the catchments of these river systems are Bangladesh, Bhutan, India, Nepal and Pakistan. Besides the Indo-Gangetic Plain, this region also comprises of the head reaches of the Irrawaddy and the Mekong basins. Figure 1.1 shows a panoramic view of the river systems emanating in the Hindu Kush-Himalayan (HKH) region.

Figure 1.1: Major River Basins in the Hindu Kush-Himalayan (HKH) Region



This region is one of the largest storehouses of fresh water in the world supplying the needs of about 500 million people living in South Asia. It is important to note that these rivers are not only sources meeting their water needs but are also major foci for both religious and cultural activities. Surface water in the region is imperilled by untreated industrial and municipal discharges, runoff pollution from agrochemical wastes, and oil spillages. As a result, deteriorating water quality poses a great threat to both the environment and the health of the people. Areas that need to be urgently addressed in order to tackle these problems are population growth, rapid urbanization, unplanned development, land degradation and lack of the requisite infrastructure for waste treatment and disposal.

The HKH region is the largest area under ice and snow at the highest elevations on earth, with the permanent snow line at about 5,000 m. Many glaciers are found there including some of the longest outside the polar regions (for example, Batura glacier in Karakoram, Pakistan). They provide a unique situation in which vast, perennial sources of water are available at elevations higher than elsewhere on earth. The hydropower potential of the rivers and streams is enormous and one of the greatest in the world. High variation in altitude within short horizontal distances

is a key feature that provides advantages as well as poses problems for water resource management in the HKH region.

Water supplies in the HKH mountains are seasonal, mostly coming under the influence of the south-west monsoon in summer and the western disturbances in winter. The influence of the summer monsoon is strong in the East and diminishes gradually to the West, being almost insignificant in the Karakoram region. Similarly, the influence of the western disturbances is predominant in the West and becomes insignificant in the East. In the areas affected by the monsoon, the central and eastern Hindu Kush-Himalayas, precipitation is mostly confined to the four months between June to September (about 80%) and the remaining months are comparatively dry. In the western HKH, the precipitation caused by the western disturbances occurs mostly during four months in winter and early spring (late November to early March). Such a marked seasonal precipitation pattern greatly influences water supplies from season to season and, even in areas where precipitation is intense, scarcity of water is common during the dry periods. Thus, people in the HKH mountains have to cope with either 'too much' or 'too little' water at different times of the year. This seasonal characteristic of precipitation across the HKH also influences natural hazards in the region.

In the HKH countries, considerable scope for hydro power generation and irrigation as well as for the control of floods by constructing multipurpose storage dams on mega and small scales exist. As a rough approximation, a total power potential of nearly 4,29,000 MW is available in HKH countries. Although mega power, irrigation, and flood control projects are preferred, there is a growing interest in the development of small hydropower in China, India, Nepal, etc. This is due to the environmental consequences of 'mega' projects, the fragile geology and active seismicity of the region, and their high costs. In addition, the extreme variability of climatic and precipitation patterns, the lack of sufficient knowledge of the hydrology of the HKH rivers and streams, and the complex interrelationships between ecology and hydrology in the region pose serious scientific and technical limitations on the development of water resources. The access to hydrological data is restricted and is not freely available for research except Nepal where access to such data is not restricted. The uncertainty about the possible impacts of global warming and climate change further complicates these problems. An understanding of the climate-ecology-hydrology relationship in the HKH will pave the way for finding solutions to the above problems (AHEC, 2005).

In Table 1.1 the water availability and uses in the five countries of the HKH Region are given.

Table 1.1: Water Availability and Uses

Water Availability						
Feature	Unit	Bangladesh	Bhutan	India	Nepal	Pakistan
Rivers	No.	Major -3 Others 53	Major-4 Medium- 12	Major- 14, Medium-48	>3,000 (all sizes)	Major-6
Drainage Area	sq. km.	142,000			194,471(76% in country)	
Mean Annual Precipitation	mm	1,270 West) 5,080 (East)	1150		1,700	125 to 750
Annual Renewable River Recharge	BCM	1,111	50	1,869	224	171.0
Per Capita Availability (Year)	Cum/year	9500	75,000	2,205 (1990)	10,000 (2000)	< 1,200 (2004)
Water Uses						
Drinking Water	BCM/year	5	0.017	25	0.80	8.02
Irrigation	BCM/year	N/A	N/A	460	13.00	176.89
Industries	BCM/year	0.05	0.002	40	0.08	1.24
Hydro-electricity	BCM/year	N/A	N/A	-	1.00	-
Total	BCM/year	-	-	525	14.88	186.16

II. SOCIO-ECONOMIC STATUS AND INDICATORS

The socio-economic conditions of the region are improving with the number of people covered by potable drinking water and access to sanitary facilities increasing and health conditions generally improving. India as the largest country in the Region has the highest population exceeding the 1 billion mark, while Bhutan is the least populated country with just 0.668 million people. Bangladesh and Pakistan each have over 145 million while Nepal has over 22.5 million people. Bhutan and Nepal are well off compared to other countries in the matter of per capita water availability and hydro-power potential, both being blessed with perennial water resources from the Himalayas and mountainous topography. Table 2.1 gives some pertinent socio-economic indicators of five countries of HKH Region.

Table 2.1: Comparative Chart of Socio-Economic Indicators (Reference year in brackets)

Country		Bangladesh	Bhutan	India	Nepal	Pakistan
Population	Total (million)	146.74	0.668	1,065.462	25.164	153.578
	Rural (%)	75	85	72	86	71
	Urban (%)	25	15	28	14	29
Water Supply Coverage	Total (%)	75 (2002)	62 (2002)	86 (2002)	84 (2002)	90 (2002)
	Rural (%)	72 (2002)	60 (2002)	82 (2002)	82 (2002)	87 (2002)
	Urban (%)	82 (2002)	86 (2002)	96 (2002)	93(2002)	95 (2002)
Sanitation	Total (%)	48 (2002)	70 (2002)	30 (2002)	27 (2002)	54 (2002)
	Rural (%)	39 (2002)	70 (2002)	18 (2002)	20 (2002)	35 (2002)
	Urban (%)	75 (2002)	65 (2002)	58 (2002)	68 (2002)	92 (2002)
Under 5 Infant Mortality (per 1000 live births)		69 (2003)	85 (2003)	87 (2003)	82 (2003)	103 (2003)
Maternal Mortality Rate (per 10000 live births)		380 (2003)	260 (2003)	540 (2000)	740 (2000)	500 (2000)
Life Expectancy at Birth		62 (2003)	63 (2003)	59 (2003)	60 (2003)	61 (2003)
Gross National Income (GNI) Per Capita (US\$)		400 (2003)	660 (2003)	530 (2003)	240 (2003)	470 (2003)
Adult literacy rate, male %		49 (2000)	61 (2000)	68 (2000)	59 (2000)	57 (2000)
Adult literacy rate, female %		30 (2000)	34 (2000)	45 (2000)	24 (2000)	28 (2000)
% of Population below poverty line		36	NA	35	38	13

Source: UNICEF 2003/ 2004

Bangladesh

Total population of Bangladesh was 146.736 million in 2003. The rate of population growth has slowed to less than 2% per year, but in absolute terms this still means that the population is projected to increase by 40% from about 129 million in 2000 to 181 million by 2025 and 224 million by 2050. Most of the predicted population increase is expected to be in urban areas, where, partly due to rural-urban migration, the population will increase by 46 million in the next 25 years, from 27 million (21% of total) in 2000 to 73 million (40%) by 2025 and 136 million (60%) by 2050. Therefore, substantial investment and improved provision of social and economic infrastructure including the provision of freshwater and the treatment of waste water will be required in the urban areas.

Human Development indicators for Bangladesh are comparatively low. Bangladesh has an adult literacy rate of 40% (2000) and a life expectancy at birth of 62 years (2003), an under-5 infant mortality rate of 69 per 1000 live births (UNICEF, 2003), and a maternal mortality rate of 380 per 10000 live births (UNICEF, 2003). The Human Development Index (HDI) rank for Bangladesh is 139 (2003) and the corresponding HDI value is 0.520.

Water is the basic concern of health in Bangladesh. The rural areas of Bangladesh suffer from lack of quality drinking water. Surface water supplies are generally polluted and ground water, which is used to be the best source of drinking water, is contaminated with arsenic. Salinity intrusion from sea-water deep into the land in the southwest of Bangladesh are rendering groundwater unfit for consumption, while surface water sources are polluted by municipal and industrial wastes. Diarrhoeal diseases, arising largely from drinking unsafe water, are a leading cause of death in the rural areas. Lack of proper sanitation and drainage facilities are the primary causes of disease in the urban areas.

Bhutan

Bhutan is the least populated country in South Asia with the current population about 0.668 million, (National Environment Commission, Royal Government of Bhutan, Initial National Communication September, 2000). If the current growth rate of 3.1% is to continue, the present population is estimated to be doubled by 2025. Urbanization in Bhutan began with the launching of the country's first five-year plan in 1961. The capital Thimpu grew gradually but steadily during the 1960s with the establishment of infrastructural facilities for administration, education and health and migration of people filling the support services. Today, Thimpu has a population of roughly 90,000 growing almost at 10% per annum from the figure of 45,000 in 1994. It is estimated to cross the 100,000 mark by 2006. The second largest city of Phuentsholing has also been growing, if not as fast as the capital. Besides, there are 20 other townships having major urban areas.

Bhutan ranked 134 in 2003 and the corresponding HDI is 0.536, a significant improvement from its predecessor. The life expectancy at birth was only 35 years in 1960. It rose to 63 years in 2003. The under-5 infant mortality rate was 142 in 1984. It came down to 85 per 1000 live births in 2003. Similarly, maternal mortality came down from 773 deaths per 10,000 births to 260 for the same period. The adult literacy rate jumped to 47% in 2000 from the previous figure of 23.0% in 1984.

Overall 62% (UNICEF 2003) of the population had access to potable water and 70% had sanitation facilities in 2002. The health infrastructure had also been greatly improved from 4 small hospitals and 11 dispensaries with 2 doctors in 1961 to 28 hospitals and 145 basic health units served by 126 doctors and 928 paramedicals in 1998.

India

The progress that India has made in the main economic sectors like agriculture and food production, industrial development, and energy generation, are very remarkable. Improvements in the socio-economic conditions as well as in other areas have also been equally commendable. India now ranks amongst the ten most industrialized nations in the world. The country is also self-sufficient in food, life expectancy has improved, infant mortality rate has declined and the literacy rate has increased. On the other hand, the country is still struggling in bringing down the annual population growth rate and at the same time is faced with many undesirable consequences and unanticipated environmental problems as a result of rapid economic growth.

The population of the country has grown three times to over a billion (1.065 billion in 2003) from 361 million in 1951. The United Nations "World Population Prospects" released on 24th February 2005 in New York, estimates that there will be 1,395 million people in India by 2025. India was ranked 128 in terms of the HDI in the 1999 Human Development Report (UNEP 2001) – behind other developing countries like Vietnam, Brazil and Sri Lanka.

Nepal

Nepal is one of the least developed countries in the world. The last census in 2001 put the population of the country at approximately 23 million with a historical growth rate of 2.2%. The majority of the population is almost equally distributed between the Hills and the Terai with only 7.3% living in the Mountains. Despite steady improvements made in some of the social and economic conditions over the last decade, the country remains one of the poorest countries of the world with an annual per capita income of about US\$ 250, with many development indicators showing a bleak quality of life. Progress in the fight against poverty has been hampered and poverty is widespread with more than 35% of the population (about 8 million) living below the poverty line.

It has been estimated that the total urban population will be 12.3 million, out of the total population of 38.3 million by 2027, accounting for 32% of the total (WECS 2000). It has been reported that the HDI score for Nepal stands at 0.504 (UNDP 2004) – a promotion from low to medium status. Except Pakistan, Nepal's score is lower than that of the other South Asian nations.

In a more recent report (UNICEF 2004), the coverage for water supply have been shown as 84% of the total population, made up of 82% rural and 93% urban. Similarly, the sanitation coverage has been shown as 27% of the total population, made up of 20% rural and 68% urban.

Pakistan

Pakistan is a land of diverse landscapes in the South Asian region with varied terrain and elevation extremes between lowest being the Indian Ocean at 0 m and highest being the world's second highest mountain – the K2. Its landscape diversity translates into 4 distinct seasons despite being mostly arid. The country's population in mid-2004 was estimated at 148.72

million – 1.9% higher than previous year. This growth in population is the major source of pressure on Pakistan's natural resource base.

Huge labour force (estimated at 45.05 million), wide-ranging structural reforms, prudent macroeconomic policies, financial discipline and consistency in policies have translated into significant economic growth in the past few years. However, Pakistan's performance on its social indicators does not compare well with the average performance of middle-income countries. Nevertheless, a comparison of various social indicators for the period since 1998 - 1999 shows that indicators have significantly improved.

Irrigation network of Pakistan is the largest continuous irrigation system of the world contributing approximately 25% to the country's GDP. Annual per capita income of Pakistan is US\$ 492 (approximately), economic growth is 5.1%, agricultural growth is 23.3%, and industrial growth rate is 23.5%.

III. MOST RELEVANT SOCIO-ECONOMIC PRESSURES AND IMPACTS

Pressures on river water quality occur in all the countries of the region, only varying in degrees. River waters in urban centres have gone to the extent of being almost converted into sewage in the absence of proper pollution control in some countries in the region while this problem has not been serious in case of Bhutan. Faecal contamination has been a major source of pollution in some urban centres and almost all the rural areas. Likewise, industrial effluents have become a major source of pollution in and around the city centres. Use of chemical fertilizers and pesticides for agricultural production has also become the non-point sources of pollution. Salinity intrusion as pollution of water is associated only with countries having coastal lines while it does not pose any problem to land-locked countries. Table 3.1 summarizes the major environmental priority areas where socio-economic pressures and impacts have been identified according the State of the Environment Reports of the respective countries.

Table 3.1: Comparative Chart of Major Environmental Priority Areas

S. No.	Socio-economic Pressures/Impacts	Bangladesh	Bhutan	India	Nepal	Pakistan
1.	Water quality/pollution	X	X	X	X	X
2.	Air pollution	X	X	X	X	X
3.	Forests/depletion	X	X	X	X	X
4.	Land degradation/soil erosion	X	X	X	X	X
5.	Bio-diversity	X	X	X	X	X
6.	Marine resources incl. inland fisheries	X	-	-	-	X
7.	Solid waste management	X	-	X	-	X
8.	Energy and renewals	-	-	-	-	X
9.	Climatic variation	-	-	-	-	X
10.	Hazardous wastes	X	-	X	-	X
11.	Salinity	X	-	-	-	X
12.	Water logging	X	-	-	-	X

Table 3.2 gives examples of inter-linkages of pressures, state, impacts and various policy responses to water uses related to the major environmental priority areas presented above.

Table 3.2: Inter-linkage of Pressures, State, Impacts and Responses

Pressures	State	Impacts	Policy Responses
Increase in population without sanitation facilities.	Fecal pollution of drinking water.	Increase in risk from water borne diseases.	Set up environment quality standards and increase treatment capacity of domestic sewage.
Increasing industrial settlements with increasing production near rivers.	High heavy metal load in rivers.	High fish mortality and loss of quality of fish as food.	Industrial EIA and effluent treatment plans to reduce pollutants load.
Increased use of chemical fertilizers, herbicides and pesticides.	Decrease in quality of surface and groundwater; Increase in soil salinity.	Degradation of urban and rural drinking water and irrigation water sources; Migration of fish and fish mortality; Loss of soil fertility.	Environmental Conservation Act and Regulations.
Low water flow in the river system in the dry season.	Decrease in quality of surface water.	Quality of surface water substantially reduced.	National Water Policy and EIA for water development projects to increase surface water flow in the dry season.

The pressures put on by rural urban migration, industry, agriculture, salinity intrusion, etc. have the tendency to pollute the urban water supply, reduce the fish population, increase the risk of waterborne diseases, affect the aquatic marine life, etc. brought about by the change in water quality from its natural state.

Bangladesh

Socio-economic Pressures - Bangladesh has the highest rural population density in the world with around 1000 people per km². Similarly, the capital city of Dhaka is already one of the most populated metropolises in the world. The rapid rise in population without sanitation facilities has given rise to faecal pollution of water bodies alarmingly both in urban and rural areas. The problem has already become serious in urban areas like Dhaka, Chittagong, and Khulna. Generation of domestic and industrial sewage in Dhaka is estimated at 1.3 millions m³ per day against the treatment capacity of just 0.12 millions per day. This is the only sewage treatment plant available in whole of Bangladesh. In such circumstances, both the industrial and domestic sewage is being disposed untreated into the wetlands and rivers in and around Dhaka city causing a serious environmental and sanitary problem as well as pollution of river waters. Sewerage coverage is about 110 km² against 360 km² of the city area serving 20 percent of its population.

Industrial plants are mostly situated along the banks of the rivers in the vicinity of the cities of Dhaka, Chittagong, Khulna and Bogra districts. The Department of Environment has listed 1,176 industrial plants that cause pollution. Most of the effluents produced by these industries are dumped directly or indirectly into the rivers. In case of industries located in Dhaka, they are discharged into Buriganga, Balu and Sitalakhya rivers badly polluting them. Some 300 mills and factories created in and around Khulna city currently discharge huge amounts of liquids waste

into the Bhairab River causing a severe pollution. In Chittagong, the main polluters are the pulp and paper, fertilizer and petroleum refineries industries located on the banks of the Karnafuli River and Kaptai Lake. Operation of ships, mechanized boats and ports cause marine oil pollution.

Bangladesh is mostly agrarian. Agriculture at present provides 26% to GDP. The cultivable area is around 8.28 million ha of which 4.6 million ha has irrigation facilities. Bangladesh has already reached self-sufficiency in rice in 1992 and cereal grains in 2000 producing a record 25 million tons of cereals. The rise in production of yields is attributed to the large-scale use of chemical fertilizers such as Urea, Triple Super Phosphate, Muriate of Potash, Gypsum, pesticides and herbicides.

Salinity intrusion is a process, which takes place once the interface between fresh water and saline water gets disturbed following the imbalance of the equilibrium state that existed earlier. This is exactly the situation that has been taking place in Bangladesh in its coastal areas of the Sundarbans following the imbalance between the fresh and sea water with the over-withdrawal of fresh water from the Ganges River upstream. Salinity intrusion is a major environmental impact affecting one third of Bangladesh. In some cases, the damage is irreversible. Many industries have been closed down with the increase of salinity in river waters. Farmers have been compelled to abandon agricultural lands due to increase of salinity in soil and lack of fresh water for irrigation. A large population in the south is suffering from shortage drinking water and people have started migrating towards the north for job opportunities and better living condition.

Socio-economic Impacts and Responses – In Bangladesh, pressures put on the rivers by the rising population and over-populated urban areas, growth of industries, excessive fertiliser application and pesticides in agricultural practices, and other causes mentioned above are the major adverse impacts on drinking water quality and fish culture.

Most of the rivers around the big cities like Dhaka, Chittagong and Khulna are already polluted due to lack of sewage treatment facility. Currently, both the industrial and domestic sewage is being disposed untreated into the wetlands and natural streams and rivers in and around the big cities causing a serious environmental problem and pollution of rivers, streams and wetlands.

As a response to the National Environment Policy, 1992, the following critical pieces of environmental legislation have been set as the framework for environmental management of the country

- i. The Bangladesh Environment Conservation Act, 1995
- ii. The Environment Conservation Rules, 1997
- iii. The EIA Guidelines for Industries, 1997
- iv. The Environment Court Act, 2000

The Bangladesh Environment Conservation Act (BECA), 1995 provides for the conservation of the environment, improvement of the environmental standards and mitigation of environmental pollution. Environmental Law means this law, the BECA, 1995, or any other law specified by the Government of Bangladesh in the official Gazette for the purpose of this act and the rules made under these laws. Provisions in sections of the BECA those are relevant to ecology,

formulation of environmental guidelines and power to make rules, exist separately. The Environmental Conservation Rules (ECR), 1997 are regulations made to enforce BECA, 1995.

The EIA Guidelines for Industries, 1997 cover significant water sector interventions, including flood control embankment, polders, dyke, water supply and sewage treatment, as well as roads and bridges. All these water sector interventions fall under the "Red" category, with the exception of bridges less than 100 m long and feeder and local roads. This requires the most stringent EIA process to be followed for proposed project construction, re-construction and extension.

The Environmental Court Act, 2000 (ECA) provides for the establishment of environment courts and matters incidental thereto for dealing with issues relating to offences committed in contravention of BECA, 1995.

The National Environment Quality Standards are given in the Environmental Conservation Rules (ECR) of 1997. Under Schedule 3 of ECR, quality standards for inland surface water and drinking water are given. Similarly, schedule 9 and schedule 10 give standards for sewage discharge and standards for waste from industrial units or project waste respectively. Schedule 12 gives standards for sectorwise industrial effluents. For this study, standards for inland surface water, drinking water, sewage discharge and waste from industrial units or projects waste are given from among these schedules in the Tables 5.1, 5.2 and 5.3 of Volume II: Appendix I.

There are little doubts that there are “hot spots” of surface water pollution due to industrial effluents and municipal wastes around the major cities of Bangladesh i.e., Dhaka, Chittagong, Khulna and Bogra. It is also true that they are not small problems that could be solved easily. It seems that time has now come to face the challenges confronted by these problems and that they have to be sorted out sooner than later.

Amongst the most polluted areas, the worst problems lie in the River Buriganga, situated to the south of Dhaka where the most significant source of pollution is from tanneries in the Hazaribagh area. In the dry season, DO level of the water of Buriganga River becomes very low to zero. At that point, the river becomes toxic.

Water quality samples at two stations of the River Buriganga taken at Hazaribagh and Chadnighat in 1998 showed that DO and BOD exceeded the allowable limits in the months of January, February, March and December with the worst situation prevailing during the months of January and February as seen from Figure 5.1 of Volume II. The low values of BOD for the months of March and December explain that the tannery factories might not be in operation during that period. The seasonal variation of river water quality in the Buriganga is very much linked with the seasonal variation of river flow and the operation of tannery factories. The quality of river water during the monsoon is fair with a lot of water to offset the pollution.

The second most polluted river is Sitalakhya flowing from the east of Dhaka. The major polluters of the river are Ghorashal Urea Fertilizer Factory and an oil terminal situated on the bank of the river. Industrial establishments at Narayangunj and Demra are also sources of pollution to this river. Monitoring data of the DOE demonstrated that the concentration of DO in the Sitalakhya River beside the fertilizer factory varies between 2.1 to 2.9 mg/l during low tide (DOE). Monitoring data of the Surface Water Modeling Center (SWMC) on the same river

showed a degrading trend for water quality over the years in the dry season. The lowest level of DO (less than one) was observed in the month of February 1998 as seen in the figure 5.2 of Volume II: Appendix I.

Water of the River Balu is badly contaminated by municipal and industrial wastes from the place called Tongi and the effluents flowing out through the Begubari Khal most of which gets generated from the Tejgaon industrial area in Dhaka. The water quality of rivers Balu and Turag becomes worse in the dry season with DO concentration touching zero (Saad, 2000).

While point sources of water pollution are easily identified and pollution control measures can be taken then and there, non-point sources of pollution cannot be easily identified, as they are more complicated to be traced. Non-point sources of pollution include but are not limited to agricultural run-off, urban run-off, fertilizers, pesticides, acid rain, animal waste, raw sewage, septic tank leakage, household waste etc. Since the sources of pollution are not known or identified, it becomes problematic to control their discharge into rivers and streams in a watershed. However, water quality problems caused by such sources may be significant to be identified for their proper treatment. Proper sampling techniques and long term monitoring of water quality at carefully selected stations can help to delineate “the sources” of such diffused pollution. Studies have emphasized the need of a National Surface Water Quality Assessment Program (NSWQAP) to solve the problems created by non-point sources of pollution within the broad framework of handling the national surface water quality of Bangladesh.

The water quality problems are serious in Bangladesh. The rapid deterioration in water quality has been brought about by intensive industrial development in and around the cities of Dhaka, Chittagong and Khulna - the major centers of industrial pollution over the last years. The rise of population in the urban areas without proper sanitary facilities has further aggravated the water quality problems in Bangladesh. The water quality problems now faced by Bangladesh have to be systematically addressed beginning with clean-up and rehabilitation of river waters in and around Dhaka, Chittagong and Khulna which are already popular as pollution hot-spots followed by other priority areas worst hit by pollution. The following options are put forward in a tabular form in Table 3.7 of Volume II to address the requirements of the National Environmental Policy and National Water Policy. This gives the water quality management options with their anticipated outcomes and possible actors (SOE 2001).

Bhutan

Socio-economic Pressures - Rural urban migration can be attributed to excessive urbanization and growth of cities, as well as employment opportunity in urban areas. Migration from rural areas is expected to reduce pressure on agricultural land, but impose a severe strain on the already inadequate urban services and pose serious development and environmental problems. Some such problems are shortage of safe drinking water and electricity, inadequate hygiene, lack of sewage facilities, unemployment and the proliferation of slums and squatter settlement.

Rapid growth and rural urban migration are the two major factors that give rise to pressure on the quality of water in Bhutan. Inadequate water supply and sanitary facilities resulting in

rampant defecation is likely to cause the faecal pollution of existing sources of water if proper attention is not given and control measure are not taken.

Industries small or large, by nature, have pressure on water resources depending on the size and nature of operation. Industries started in Bhutan in the 1970s with the dual purpose of creating job opportunities in the industrial sector and taking off some pressure from land for agriculture. The agricultural operation is limited due to topography of the land and off employment labour from agriculture is plenty and cheap. This gives the double bonus to the industry sector.

More than 85% of the Bhutanese people live in rural areas practising subsistence agriculture. Yet the current level of self-sufficiency is 65% and Bhutan has to import food from outside to meet the gap. With the demand growing from year to year and the government's policy to reach the self-sufficiency target, there is a tremendous pressure on Bhutanese farmers to grow more from the unit piece of land. The agricultural land is already saturated and there is no chance to expand it further because of topography of the land. Forest encroachment is not possible as the government has a policy to keep 60 % of the land area as forest.

Hydropower development in Bhutan has been more of a boon than pressure to rivers where hydropower electric projects are developed. Bhutan, which has been depending on fuel wood for 75% of its energy requirement, has been steadily developing hydroelectric projects. In spite of the positive aspect of hydro-electric development, some adverse impacts of hydroelectric projects such as depletion of water resources downstream of the diversion headwork affecting the aquatic life, local people in carrying out their traditional occupation of fishing and boating and displacement of local people is not ruled out. These effects have, however, to be fully addressed during the Environment Impact Assessment and Social Impact Assessment study carried out in order to minimize if not to eliminate the adverse impacts caused by the hydroelectric projects. Several hydropower projects, some of them with a capacity of 1,000 MW, are under construction, but it is anticipated that they will have minimum impact on fish fauna, due to the location of these projects. On the other hand, the reservoirs, under these projects offer considerable scope for expanding fish culture. Over fishing and introduction of exotic fish species may have direct impact on indigenous fish. This is already controlled with the need for all fish catchers to take permit. Besides, fishing by net is disallowed in order to prevent the large-scale catch at a time.

Socio-economic Impacts and Responses - The pressures put on the quality of river water by various causes mentioned above have resulted in poor drinking water quality, waterborne diseases, and destruction of fish culture.

In Thimpu, the available potable drinking water facility is overstretched with the tendency for people to take untreated water resulting in water related diseases. The migration of people from the rural to the urban area has also put pressure on existing waste disposal facilities. Of all the cities only Thimpu has a well planned waste disposal system where solid waste is carried by trucks to a landfill site which is already saturated and the second landfill site has been brought into operation. Elsewhere, the solid wastes are still to be properly planned not to be nuisances to the local surroundings and pollution problem.

Diarrhoea, dysentery, cholera, typhoid, Hepatitis A and helminthes (Parasitic worm) infections are some of the water health problems especially affecting children in Bhutan. As many as 600

infant deaths have been reported from diarrhoeal diseases every year. The causes identified 25 years ago with the advent of rural water and sanitary programme were unsafe drinking water supply, poor disposal of excreta and unhygienic conditions which spread germs and illness. The government together with such agencies as UNICEF has steadily improved water supplies and sanitation. The incidence of diarrhoeal diseases and other endemic diseases and worm infestations has steadily dropped in recent years.

The effluents produced by domestic and industrial wastes have both biological and chemical oxygen demands (BOD, COD) depending on the nature of the effluents produced. These effluents have the tendency to eat up the dissolved oxygen in the fresh water to the point of toxic state when the content of dissolved oxygen is zero and water is no longer fit for consumption by the aquatic life. It also indicates the worst state of water when small fingerlings and large fish start dying. The National Environment Commission is presently working to develop appropriate water quality standards. It is expected that the appropriate water quality standards will be in place by the year 2008.

In 1997, the NEC with the assistance of the Asian Development Bank (ADB) conducted a study to collect the baseline water quality database for major watersheds in Bhutan (NEC, 1997). Consequently from 2001 to 2003, NEC collected baseline data and information and started conducting water quality monitoring in the major river basins. Presently, such data are collected twice a year for wet and dry seasons. Monitoring is also carried out in wastewater treatment plants and major industries.

The findings of the NEC study show that the State of water resources of Bhutan in a macro-scale is very healthy with its main rivers and tributaries still in pristine condition barring a few exceptions where rivers pass through heavily populated and highly industrial areas. The natural quality of water in Bhutan is characterized as highly oxygenated, slightly alkaline with low conductivity and no salinity.

India

It has been reported that the five environmental priority areas of concern and requiring immediate action are land degradation, biodiversity, air pollution with special reference to vehicular pollution in cities, management of fresh water resources, and hazardous waste management with special reference to municipal solid waste management. Of these, except for air pollution, the remaining four have a direct bearing on the quality of surface water sources. Air pollution does have an impact on river water quality in so far as that the overall global warming phenomenon is one of the leading causes of climate change. Direct pressures emanate from deforestation, which is a type of degradation by itself as well as being responsible for other types of degradation like water erosion. The Ministry of Environment and Forest has reported that between 1980 and 1990, the annual forest depletion amounted to 0.34 million ha while afforestation efforts covered about one million ha annually (MOEF, 1999). It need not be emphasized that the loss of biodiversity has serious economical and social consequences to a country. The main causes of biodiversity loss in India are habitat destruction, over-exploitation, pollution, and species introduction. The pressures that is evident in the management of fresh water sources is the result of uneven resource distribution because of declining resource

availability, inequitable water supply, resource degradation, and inefficient resource utilization. The large and wide-spread generation of hazardous industrial wastes emanating from petrochemicals, pharmaceuticals, pesticides, paint and dye, petroleum, fertilizers, asbestos, caustic soda, inorganic chemicals and general engineering industries is to be expected as the Indian industrial sector is reported to have quadrupled in the last thirty years. This has led to the generation of hazardous wastes, which contain cyanides, pesticides, complex aromatic compounds, etc. At the same time, due to the rapid population growth and urbanization in the country, there has also been a significant increase in the generation of municipal solid wastes. It has been found that the per capita solid waste generation varies from 100 gm in small towns to 500 gm in large towns.

As a result of these pressures on the land and forests, estimates of actual land-use and vegetation cover reveal that 80 million ha out of 142 million ha under cultivation is substantially degraded and about 40 million ha out of 75 million ha under the forest departments has a canopy cover of less than 40%. This has manifested in soil erosion with both on-site and off-site consequences leading to degradation of river water quality. The issue of ecological water needs is further highlighted by the gradual depreciation of clean water for multi-purpose uses, restoring and maintaining fish habitats and protection of the aquatic environment in general.

Though the availability exceeded requirements in most of the agro-ecological zones except the two zones covering the Eastern Plains of Kutch and the northern plains, where it is less than the demand, it is envisaged that demand will exceed availability in five of the twenty zones by 2047. The overall situation has been made worse by the poor execution of policies at the field level, lack of proper policies at the state level with respect to resource management and conflict resolution, and over exploitation due to inadequate legislation for water abstraction. Regarding resource quality, pristine water quality has generally been maintained in the less populated upper reaches of rivers, where human interference is minimal. The picture changes dramatically as the rivers enter the plains and the water begins to get exploited for irrigation use and starts receiving pollution from different sources. The conditions have deteriorated by most of the biomedical wastes being collected without segregation and tend to be disposed along with municipal wastes, creating a health hazard to sanitary workers besides creating adverse environmental conditions.

Steps to address the problem are currently being implemented under appropriate programs like watershed management, preparation of soil erosion maps and working on various aspects of soil conservation, which are being carried out by the state governments as per the guidelines of the central government. Furthermore, a number of legislative regulatory measures are in place and there are institutions working on various aspects related to biodiversity. The Botanical Survey of India and the Zoological Survey of India conducts surveys and inventorization of the fauna and flora resources. The policy responses that exist cover in situ conservation of natural habitats and ecosystems in the form of protected areas of National Parks and Wildlife Sanctuaries, and forest preservation plots; and programmes like “Eco Development” with local communities, Biosphere Reserve for conserving specified ecosystems, scientific management and wise use of fragile ecosystems, and significant wetlands declared as Ramsar sites, etc.

Other responses, specifically with reference to water quality monitoring, prevention and control of pollution initiatives including plans and programs, have been described in detail in the Volume II – Appendix III. Also, many pertinent policies and legislations guiding the

management of water resources and its quality are in place but need to be carried out more vigorously. The Ganga Action Plan, launched in 1985 by the Government of India, is one such initiative aimed at cleaning up the Ganga River through elaborate plans to construct sewer systems, treatment plants and pumping stations. Though it has been reported that the overall result has not been that encouraging as a result of poor management, the efforts made are commendable as this type of river conservation plan is the appropriate solution for pollution abatement of other river systems as well. This has been followed up by the Central Ganga Authority by undertaking pollution abatement programmes in other polluted major and medium rivers in the country. These fall under the National River Conservation Plan covering 18 national rivers traversing 22 states of the country. This has now been extended to cover 29 rivers flowing through 22 states. The primary focus is on cleaning the rivers through the interception and diversion of domestic sewage followed by treatment for safe disposal in natural water courses or application on agricultural land for irrigation. The National River Conservation Directorate also maintains close liaison and co-ordinates its activities with the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCB) for installing effluent treatment plants by industrial establishments that are likely to pollute the rivers. Industrial pollution of the rivers is also monitored by the respective SPCBs in association with the CPCB. Encouraged by the outcome of National River Conservation Action Plan launched by National River Conservation Directorate (NRCDD), a Master of Technology (M.Tech) course in "Conservation of Rivers and Lakes" has been fully sponsored by Ministry of Environment and Forests, Government of India. The course is of two years duration with ten seats and is offered by Alternate Hydro Energy Centre, Indian Institute of Technology, Roorkee (India) since 2004. The course intends to build up the capacity of personnel working in various departments/agencies at central/state level in the area of Conservation of Rivers and Lakes.

The issue of progressive deterioration of the quality of water in the sources plus lack of adequate water treatment facilities and leaking distribution systems have also added to the danger of water-borne diseases becoming endemic are not receiving the required attention due to the sheer magnitude of the problem, on the one hand, and the paucity of resources, on the other. National programmes that include National River Conservation, the Accelerated Rural Water Supply and the Rajiv Gandhi National Drinking Water Mission of the Central Government are, however, underway to assist the states in addressing the inadequacies and challenges resulting from both the quantity and quality of the water being supplied to the people. It has been reported that as of 1 April 1999, 18.8% of the total habitations are still not covered or are only partially covered. Regarding the urban scenario, about 88% of the population, on average, has been covered with organized drinking water supply in Class I cities and Class II towns of the country. Of the 299 Class I cities only 77 cities have universal water supply coverage. Rural sanitation is the responsibility of the state governments under the Minimum Needs Programme and is further supplemented by the Centrally Sponsored Rural Sanitation Programme being implemented with the objective of increasing coverage and eradicating manual scavenging. The Ninth Plan target is to provide basic adequate sanitation facilities to at least 50% of the total rural population of the country.

Nepal

Due to the limited availability and poor quality of the water at demand centers, there is immense pressure on the water resources. Additional pressures on the river ecosystems have been brought about by domestic pollution, industrial effluents, toxic contamination, and other physical pressures like morphological disturbances and water-induced disasters. Besides landslides and river erosion, which are very common during the monsoon season, the Himalayas of Nepal are quite susceptible to land degradation caused by glacial lake outburst floods (GLOF).

Rapid and haphazard urbanization has exerted tremendous pressure on the environment. The most visible indicator is the generation of solid waste in the urban centres and heaped under unsanitary conditions in city streets and river banks. Migration to cities, especially from the Hills, seeking better employment and education opportunities, has been the main cause for the rapid growth in the urban population. Changing consumption patterns and breakdown in traditional waste management systems have aggravated the problem. The sharp increase in the use of chemical fertilizers has adversely affected recycling and the production of organic fertilizers.

Besides solid waste and domestic wastewater other major sources of contamination of water bodies are industrial wastes, man-made disasters, increase in the use of agro-chemicals and land use patterns. In 1991/92, 40% of the total industrial establishments were grossly polluting water courses. Also, 72% of the polluting industries were in the Kathmandu Valley contributing about 7% of the total domestic and industrial effluents. In 1991, 125 industries were identified as being pollution “hot spots”, out of which as many as 60 were in the highly- polluting category.

The water quality of the major rivers is within acceptable standards as a result of the large volumes and limited human interference. This is, however, not the case with urban rivers and in the immediate vicinity of major sources of pollution. Poor and unsanitary wastewater disposal systems and interconnections with storm-water drains are the major issues as far as water pollution in urban areas is concerned. Some of the earlier studies that have been done of the River Bagmati, both near the source at Sundarikal and near the Chobhar gorge outlet point at Sundarighat, have shown that water quality at the latter point is very poor as established by the higher concentrations of BOD and chloride ions. This site has also shown increasing trends in the concentrations of these two parameters. These trends are clear indications of the fact that the downstream sites are affected by anthropogenic factors. Aquatic bio-diversity has also been disturbed.

In brief, the rich but fragile environmental conditions have posed numerous physical and human challenges. It is a known phenomenon that the rugged topography, young geology and monsoon climate have all resulted in high rates of runoff, erosion and sedimentation. Besides frequent related natural calamities, human activities have also resulted in unsustainable pressures on both biological and physical resources including aquatic species and habitats. Water resources development, therefore, needs to be carried out in a more sustainable manner and overall water resources management directed towards enhancing the environmental conditions with special emphasis on preserving river water quality over the long term. Though much remains to be done, the Government has taken some noteworthy steps to address the problems highlighted. Some of the major responses covering policies and strategies, legislation, and action plans cum

programmes that have been initiated are: (i) enactment of the Water Resources Act 1992 and its Rules 1993; (ii) formulation of the Irrigation and Drinking Water Rules under the umbrella WRA 1992; (iii) enactment of - Environmental Protection Act 1996 and its Rules 1997, Solid Waste Management Act 1987 and its Rules 1989, Electricity Act 1992 and its Rules 1993, Soil and Watershed Conservation Act 1982, Aquatic animals Protection Act 1965, and Patent, Design and Trademark Act 1965; (iv) on-going efforts to develop water quality standards and industrial effluent standards; (v) policy statements dealing with the environment, drinking water and sanitation; (vi) wastewater management efforts in the Kathmandu Valley; (vii) signatory to a number of broader international conventions and treaties like the Ramsar Convention, Network of Aquaculture Centres in Asia and the Pacific, and Convention on Biodiversity; (viii) adoption of the Nepal Water Resources Strategy 2002; and (viii) approval of the National Water Plan 2005.

Furthermore, the adoption of the Nepal Water Resources Strategy 2002 and the approval of the National water Plan 2005 will ensure sound environmental planning and sustainable water resources development.

Pakistan

Problem of scarcity of water is steadily rising mainly due to population growth, urbanization and industrialization. At the time of independence, Pakistan was a water-rich country but now the country has become water deficit with per capita annual water availability of less than 1200 m³. In 2004, Pakistan stated a population growth rate of 1.9% while the projected figures reach 173 million by 2110 and 221 million by 2025. These estimates suggest that the country would slip below the limit of 1000 m³ per capita per year from 2010 onwards. More than 80% of domestic, municipal and industrial diversions return to the system with degraded quality.

This scarcity combined with increasing competition between multiple users has led to improper and untreated disposal of sewerage, industrial wastes and saline drainage effluents in freshwater bodies, lack of treatment facilities, contamination through extensive use of agro-chemicals (fertilizers and pesticides), and saline water intrusion in fresh aquifers. Eventually, these have adversely affected quality of both surface water and groundwater.

The high pollution level of rivers and groundwater lead to different environmental consequences such as increase in water related diseases, decrease in agricultural productivity and reduction of biodiversity. It is estimated that 30% of all the reported cases of illness and 40% of deaths in Pakistan are attributable to water born diseases. In addition, mismanagement of water resources has strong socio-economic repercussions, especially on food security and health.

Due to water shortage, accompanying pollution and deforestation, many wild animals, plants, aquatic species, birds and other forms of flora and fauna are adversely affected and many of these may be annihilated in the near future.

IV. REVIEW OF EXISTING POLICIES AND LEGAL INSTRUMENTS

Water policies have been formulated to deal with the water related problems in the countries of the Region. Some of these policies had been in place in the form of national water policies for a long time. Some have just been worked out in the recent past and some are being worked out even now to meet the new challenges faced in the management of water resources. New policies have been compliments to the already existing. Together with water policies, national water strategies and national water plans with the different perspectives of development over years have been charted out in line with the growing demands for water from various sectors. Other policies such as environment policy, fishing policy, industrial policy, agricultural policy etc. have also been formulated in harmony with the water policy.

Various acts associated with water and environment, were enacted in line with policies formulated for their meaningful implementation. The environment related Acts have been promulgated in all the countries of the Region. Where water related specific act does not exist, the possible recourse is to use the existing environment related act, which has relevant covenants to deal with the water related problem.

Bangladesh

Existing Policies - The National Water Policy of Bangladesh, formulated in 1999, lays down the broad principles of development of water resources and their rational utilization. It will help guide both public and private future actions for ensuring optimal development and management of water that benefit both individuals and the society at large. The objective of the National Water Policy is to provide direction to all agencies working with the water and institutions that relate to the water sector in one form or another, for achieving the objectives. The policies set forth are considered essential for addressing the objectives of improved water resources management and protection of the environment. Every public agency, every community, village and each individual has an important role to play in ensuring that the water and associated natural resources of Bangladesh are used judiciously so that the future generations can be assured of at least the same, if not better, availability and quality of those resources.

The National Policy for Safe Water Supply and Sanitation (1998) was issued by the Local Government Division of the Ministry of Local Government, Rural Development and Co-operatives, with a call for nationwide access to safe drinking water and sanitation services at an affordable cost. It aims to improve the public health and produce a safer environment by reducing water borne diseases and contamination of surface water and groundwater. Under the policy, the Government of Bangladesh encourages increased user and public participation including the active support and involvement of other partners—both non-governmental Organizations (NGOs) and International non-governmental organizations (INGOs), market oriented business organizations and similar private organizations in water and sanitation development.

The National Environmental Policy was drawn up in 1992 based on the IUCN concept of sustainable development, which was an outcome of the National Conservation Strategy. The objectives of the NEP have been discussed in Vol. II.

The 1995 National Environment Management Action Plan (NEMAP) aimed to institutionalize both the Policy and the NCS into a strategy that could be implemented. NEMAP was based on a national consultative process to identify the main environmental issues in the country, including those that relate to water pollution and scarcity.

There was no consolidated national fisheries policy until 1998 when the National Fisheries Policy 1998 was formally adopted and declared for the first time with the objective of developing sustainable fishery and aquaculture, fish being the staple food of Bangladesh, the new policy has tried to encompass all the issues related to the development of fishery in Bangladesh.

Bangladesh has diversified its agrarian economy to a developing industrial economy, which involves the multifarious uses of water that call for attention. The Government of Bangladesh has formulated the policy for industry covering zoning regulations, monitoring of effluent disposal, effluent standards, and “polluter pays” principles.

Constitutional and Legal Provisions - No specific provision on water or water use is learnt to have existed in the Constitution of Bangladesh.

Pollution of Water Resources is covered by Clause 20, sub-clause 2(a) of the Bangladesh Environment Conservation Act, 1998 empowering the government to determine the water standards for drinking and industrial effluents. Water quality standards for the inland surface water and drinking water are given under Schedule 3 rule 12 of the Environment Conservation Rules while the standard for the industrial effluents under Schedule 9 of the same rule. The environmental component of the Flood Action Plan, FAP 16, prepared a set of EIA guidelines for use in the water resources sector in 1992. In addition to water resources EIA guidelines, FAP 16 drafted a manual in 1995 for carrying out EIA with the intent of assisting people to familiarize the EIA work. Under the Sustainable Environment Management Program (SEMP), the DOE has prepared 18 sets of sectoral EIA guidelines.

Bhutan

Existing Policies - The Bhutan Water Policy is a reflection of the Royal Government’s intentions on the conservation, development and management of the country’s water resources. It recognizes that water is a precious natural resource and a heritage, important to all aspects of social, economic and environmental integrity. This policy adopts an integrated approach. Emphasis is placed on water resources management within river basins and aquifers, including both upstream and downstream water users. Surface and ground water are seen as two forms of the same resource, often with close linkages. Both water quantity and quality are important and interlinked. Though there is no legal provision for allocation of water in the absence of Water Act, there is already a general priority ranking principle in Bhutan in the present Water Policy of Bhutan for various uses as drinking water and sanitation, irrigation, hydropower, industries and other uses.

The National Environment Strategy (NES), known as “The Middle Path”, is the main policy document for the environment sector designed to guide environmental consideration in Bhutan. It aims to minimise or mitigate the impacts likely to result from the development process to achieve the Gross National Happiness.

Constitutional and Legal Provision - There is no specific provision for water in the Bhutanese Constitution.

Water Resources - There is no comprehensive specific water law at present in Bhutan. Only certain clauses related to water are found in the few existing Acts such as the Land Act, 1979, Forest and Nature Conservation Act, 1995, Environment Assessment Act, 2000, Bhutan Electricity Act, 2001 and Water and Sanitation Rules formed in pursuance of the Municipal Act, 1999. These clauses are sometimes contradictory to each other. Farmers practise different customary rights coming from the age-old tradition in matters of sharing water for paddy cultivation and other crops. There is, therefore, an urgent need for a comprehensive Water Act, which covers all uses of water in a sustainable way. It is learnt that the Royal Government of Bhutan is presently working to constitute such an Act.

Environment Assessment Act, 2000 (EAA, 2000) - In the absence of Water Resources Act, the Environment Assessment Act, 2000 is a unique Act to deal with the water related pollution problems. The National Assembly of Bhutan passed the EAA in July 2000. The regulations under the Act for the Environmental Clearance of Project and the Strategic Environmental Assessment were adopted in 2002. Under the EAA 2000, an environmental clearance is a prerequisite prior to commencement of any development activity. This was a major step towards the maintenance of water quality in Bhutan, as many issues related to environment dealt with water one way or another. So, even in the absence of Water Act, the EAA 2000 was helpful in maintaining the water quality of Bhutan. The Water Act is still required to deal with several issues related to its use and conflict resolution arising from them.

India

The 1950 Constitution of India specially requires that environmental protection be treated as a fundamental duty. On the policy front, the Government of India has enunciated three policies having a direct bearing on water resources, viz., Policy Statement for the abatement of Pollution 1992, National Conservation Strategy and the Policy Statement on Environment and Development 1992, and National Water Policy 2002. Provisions have been made to ensure that both ‘reactive’ and ‘comprehensive’ approaches are adopted “to integrate environmental and economic aspects in development planning, preventive aspects for pollution abatement, and promotion of technological inputs to reduce industrial pollution, through reliance upon public co-operation in securing a clean environment”. Other issues like planning of water resources projects, making best use of the available water, water pricing, water quality, water zoning for proper management have also been addressed. Besides development, conservation, sustainable utilization, and management, the need to be governed by national perspectives has been emphasized. Improvements in existing strategies, innovation of new techniques for elimination of surface as well as groundwater pollution, and improvements in water quality in general have also been taken care of. Another important aspect is the implementation of regular water quality monitoring programmes by the concerned agencies for both surface and groundwater in order to ensure pollution control at the source itself.

The Policy Statement for the Abolition of Pollution is a demonstration of the commitment by the Government of India for undertaking the needed actions to arrest the further deterioration of the environment. Besides the development of the needed regulatory and legislative frameworks, provisions have been made in the Policy Statement regarding the promotion of voluntary initiatives in environmental protection and improvement through appropriate incentive mechanisms. The emphasis is on integration – incorporating decision making at all levels, pollution prevention at source, adoption of best practices, controlling pollution through “polluter pays” mechanism, focusing on heavily polluted river stretches and areas, and involving the public in decision making. The Environment Action Programme was initiated in 1993 to prepare action plans for the integration of environmental concerns into the development process. Institutional strengthening and promotion of decentralization systems have been given high priority. A comprehensive national policy on the environment is also in the offing, with the Ministry of Environment and Forests in the process of developing it.

Environmental laws on pollution prevention in water as well as other environmental regulations also exist and these have to be reviewed and improved upon to conform with revised policy issues. In keeping with the spirit of the Constitution, the conservation and protection of water resources and the environment have been incorporated in various Acts, Rules and Notifications promulgated over the years by the Government. There are over a dozen pertinent pieces of legislation that have a bearing on water resources and the environment in general and have been briefly described in the relevant sections of the Country Background Report (Appendix –III) and is presented in summary form in Table 4.1, which highlights the legislation, policies and Acts. Of these, the major ones are Water (Prevention and Control of Pollution) Act 1974 (and as amended in 1988), Water (Prevention and Control of Pollution) Cess Act 1977 (and subsequently amended in 1991), River Boards Act 1956, Environment Protection Act 1986

(EPA) and Environment (Protection) Rules 1986, Hazardous Waste (Management and Handling) Rules 1988, and Municipal Waste (Management and Handling) Rules 1999.

Nepal

Though water is common to hydro-power, irrigation and drinking water, an integrated and comprehensive water resources policy has not yet been formulated. This has resulted in conflicts in uses of water resources and conflicting legislation and regulations. Traditional water rights have not been recognized. Separate policy documents exist for the different water uses. However, the National Water Resources Strategy 2002 has addressed the water sector in an integrated manner and the National Water Plan 2005 has been developed accordingly. Comprehensive policy documents exist for the environment, hydro-power, water supply and sanitation, and irrigation, amongst others. All of them have stressed the need for sustainable development of the sector with due consideration given to environmental conservation and protection along with pollution control.

Various environment and water related legislations exist and these have been discussed in the Country Background Report (Volume II, Appendix I). There are three separate regulations under the WRA 1992 to regulate the use of water for irrigation, drinking water and other uses. These and some other main related legislations are: Electricity Act 1992 and Electricity Regulation 1993, Environmental Protection Act 1996 and Environmental Protection Regulation 1997, Local Self Governance Act 1999 and Local Self Governance Regulation 1999, Nepal Water Supply Corporation Act 1989, Drinking Water Regulation 1998, Industrial Enterprises Act 1992, Aquatic Animals Protection Act 1962, Solid Waste Management and Resource Mobilization Center Act 1987 and Solid Waste Management and Resource Mobilization Regulation 1989, and Irrigation Regulation 2003.

Pakistan

The Pakistan National Conservation Strategy (PNCS) 1992 provides a national structural policy to deal with environmental problems including water quality management. The main objectives of the policy are to establish and maintain standards for potable/domestic water; ensure that effluent from wastewater is treated before disposal; and preservation of surface and groundwater resources to ensure sustained supply.

Regarding environment and water quality, Pakistan Water Sector Strategy adopted in 2002 envisages to:

- make the water quality in rivers, reservoirs, coastal areas and other water bodies including groundwater a national priority for improvement to acceptable standards by 2025 through improved agricultural drainage, municipal, rural and industrial wastewater treatment and effluent disposal;
- promote measures, as part of all future plans for water resources development that reduce or eliminate contamination of surface water bodies and groundwater aquifers from industrial and domestic emissions of pollutants, over-use of agro-chemicals and urban

run-off, all of which adversely affect water quality, natural eco-systems and public health; and

- reduce the incidence of water pollution by regulating disposal of effluent in the municipal, industrial and agricultural sub-sectors.

The National Environmental Policy, 2005 provides framework to address environmental issues facing Pakistan. The Policy while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provides broad guidelines to the Federal Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources. The main objectives of the Policy are:

- Conservation, restoration and efficient management of environmental resources.
- Integration of environmental considerations in policy making and planning processes.
- Capacity building of government agencies and other stakeholders at all level for better environmental management.
- Meeting international obligations effectively in line with the national aspirations.
- Creation of a demand for environmental through mass awareness and community mobilization.

The Government of Pakistan has committed adherence to international declarations, viz., the Declaration of UN Conference on Human Environment at Stockholm 1972 and the Rio Declaration 1992. It has also created legal structures and enacted rules for the implementation of various international environmental agreements.

The Constitution of Pakistan contains provisions for environmental protection and resource conservation. The promulgation of the Environmental Protection Ordinance 1983 was the first codifying legislation on the issue of environmental protection. Later, the Government passed and promulgated the Pakistan Environmental Protection Act 1997. The act is fairly comprehensive, providing for the protection, conservation, rehabilitation and improvement of the environment. The requisite rules and regulations have been enacted including National Environmental Quality Standards (Self-monitoring and Reporting by Industries) Rules, 2000. The Federal Government has established two Environmental Tribunals one each in Karachi and Lahore. The Karachi Tribunal has jurisdiction over the provinces of Sindh and Balochistan while the Lahore Tribunal covers the provinces of the Punjab and the NWFP.

V. INSTITUTIONAL ARRANGEMENTS AND REGULATORY FRAMEWORK

Two types of governments are in place in the 5 countries of the South Asian Region - the Central and Federal. The activities of water by nature are spread over various ministries and their departments. The clear responsibility of executing, controlling and monitoring rests in most cases with one individual organisation designated by the government, with other organisations of the government playing the supplementary roles in keeping the water clean. In the Federal System of Government, the Government at the Centre as well as the States or Provinces individually play the key roles in managing the pollution of the surface water.

Bangladesh

There are several government organizations in Bangladesh dealing with water pollution and scarcity problems. Among them the Department of Environment (DOE) under the Ministry of Environment and Forest deals with pollution issues while Ministry of Water Resources, Ministry of Communication and Ministry of Agriculture deals with scarcity of water through their departments.

DOE has been monitoring water quality data of 78 rivers, one lake and one beel (a locally used term for small water pools), in total 80, as given in the Table 5.5 of Volume II, Appendix I. The Bangladesh Water Development Board (BWDB) also collects data on suspended sediments and surface water salinity. There are many important NGOs with environmental interest. These include IUCN, National EIA Association, International Centre for Living Aquatic Resources Management (ICLARM), Bangladesh Centre for Advanced Studies (BCAS) and Bangladesh Environmental Lawyers Association (BELA).

Bhutan

The Royal Government of Bhutan has appointed the National Environment Commission (NEC) as the apex body for co-coordinating the management of water resources in the country. NEC has formulated the Water Policy, Water Vision and draft Water Act in collaboration with the Bhutan Water Partnership and Stakeholders. The Water Act, once finalized, will be submitted to the Royal Government of Bhutan for approval.

Among the NGOs, Bhutan Water Partnership has been playing a helpful role and continues to collaborate with the Government in water related issues. NEC as the lead agency for the enforcement and implementation of the EAA 2000 assessed and reviewed more than 164 development projects including water and other related projects in 2003 alone. It has also been conducting the monitoring of development activities. NEC has, therefore, made a modest endeavour to monitor the quality of water of the country's water bodies. In this respect, it has started conducting the monitoring of the quality of water of 4 major river basins in the country. Analysis is being conducted at the several sampling locations in the river basins and tributaries

of major rivers. The Department of Power under the Ministry of Trade and Industry has also set up sampling stations to collect and monitor the data.

Besides the NEC, agencies such as the Ministry of Trade, Ministry of Works and Human Settlement, Bhutan Power Corporation, Bhutan Electricity Authority and some private organizations have environment cells. Some of the environment cells maintained by the government agencies are designated as competent authorities under the provisions of the Regulation for the Environmental Clearance of Projects 2002 for monitoring of respective activities as listed in Annex II of the said Regulation.

NEC has been conducting Environment awareness and training workshops for Dzongkhag Yargay Tshogchung (District Development Committee) and Geog Yargay Tshogchung (Block Development Committee) Members towards establishing Dzongkhag Environmental Committees in all the twenty districts and preparing Micro Environmental Action Plans in the government's decentralization process of implementing the environmental action plans.

The Organisation Chart of the Royal Government of Bhutan shows the institutional arrangement of the Bhutanese Governance with inter-linkages as shown in Figure 5.1 of Volume II, Appendix II.

India

In 1985, the Ministry of Environment and Forests (MOEF) was constituted as the nodal agency of the Central Government responsible for the protection and management of the environment of the country. It is also entrusted with the planning, promotion, co-ordination, and the overseeing of the national environmental and forestry programmes.

The MOEF, CPCB and SPCBs constitute the core regulatory and administrative core. In addition, other ministries and agencies are also involved while carrying out various pertinent functions, policies and schemes to promote environmental management. The central and the state pollution control boards have been specifically set up to control and monitor environmental degradation in the country. The chart and the tables illustrating the different agencies and network responsible for monitoring, reporting, and studying environmental pollution and management have been presented in Figures 5.1 and 5.2 and Table 5.1 of Volume II, Appendix III. The other organizations responsible for the conservation and pollution control of water resources and the environment are: Ministry of Rural Development, Ministry of Urban Development, Ministry of Agriculture, Ministry of Power, Central Water Commission, National Water Development Agency, and Central Ground Water Board. For co-ordinating the efforts of the various agencies referred to above, the Water Quality Assessment Authority was established in May 2001 with the mandate to exercise the powers under the EPA. The following responsibilities falling within its domain are: issuing directions to investigating agencies, unifying water quality monitoring network, sponsoring Research and Development programmes, standardising, collecting and disseminating data, ensure restoration of water quality, giving recognition to environmental laboratories, and preparing guidelines for prevention, control and abatement of water pollution.

Voluntary Instruments - Non-Government organizations (NGOs) and other voluntary organization are likely to play significant role in training the farmers, industrialists, general public in the planning and implementation of water conservation measures as well as pollution reducing measures. At present such arrangements have not been properly institutionalized. However, given the impact of water quality on socio–economics and health of rural masses, there is a need to make the legal instruments as well as voluntary instruments more effective.

Nepal

The organizational structure of water administration has three levels viz. coordination and policy, implementation and operational, and regulatory. At the level of Coordination and Policy, following organizations are in place: (a) National Development Council (NDC); (b) National Planning commission (NPC); (c) National Water Resources Development Council (NWRDC); (d) Water and Energy Commission (WEC); and (e) Environment Protection Council (EPC). The Ministries that are, by and large, involved in coordination and policy formulation are: (a) Ministry of Water Resources (MOWR); (b) Ministry of Physical Planning and Works (MPPW); (c) Ministry of Environment, Science and Technology (MOEST); (d) Ministry of Local Development (MOLD); (e) Ministry of Forest and Soil Conservation (MOFSC); and (f) Water & Energy Commission Secretariat (WECS). At the implementation and operational level, the government departments involved are: (a) Department of Irrigation (DOI); (b) Department of Electricity Development (DOED); (c) Department of Water Induced Disaster Prevention (DWIDP); (d) Department of Water Supply and Sanitation (DWSS); (e) Department of Hydrology and Meteorology (DHM); (f) Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR); (g) Department of Forest (DOF); (h) Department of Soil conservation and Watershed Management (DSCWM); and (i) Department of National Park and Wildlife Conservation (DNPWC).

Though regulation is an important function of the government, there are no permanent and full time regulatory bodies as such in place. However, there are Committees and Commission that have been given this responsibility. Amongst others, mention needs to be made of bodies like the District Water Resources Committee (DWRC), the Water Resources Utilization Investigation Committee, the Water Source Dispute Resolution Committee and Electricity Tariff Fixation Commission (ETFC), which have been established under different Acts, to regulate tariff fixation and for dispute resolutions in the water sector. These agencies have not been able to function effectively on the whole and there is the need for a clear separation of roles of implementer and regulator. The Drinking Water Supply Tariff Fixation Commission Ordinance 2005 was promulgated in April 2005 to provide reliable and quality water supply and sanitation services to consumers at reasonable cost and to protect the interest of the consumers. The Ministry of Physical Planning and Works is currently in the process of setting up the Commission concurrently with major institutional reforms that are being introduced in the Nepal Water Supply Corporation.

Role of NGOs - The institutionalization of civil society in Nepal is relatively recent, but has seen dramatic growth in relatively short period of time. The PRSP values their contribution in the

socio-economic development of Nepal, and has placed a significant emphasis on their enhanced participation in the planning, management and monitoring of development activities.

Nepal's Foreign Aid Policy-2002, which forms an integral part of the overall policy for mobilizing external resources for development, calls for donors, INGO and NGOs for enhanced transparency and realignment of their resources with the national and local government priorities.

Although there are many NGOs active in social development, human rights and advocacy activities, very few of them work exclusively on water, sanitation and hygiene promotion at the national level. These national level NGOs engage local civil society groups to deliver water supply and sanitation projects. Because of their community focus, NGOs are found to be more effective in the implementation and software aspects of water supply, sanitation and hygiene (WSH) programme delivery. Not all NGOs are capable and, therefore, need capacity building of varying degrees.

Some of the larger INGOs that have a long record of involvement in water, sanitation and hygiene are WaterAid Nepal/UK, DISVI International/Italy, Winrock International/USA, PLAN International, Action Aid/UK, HELVETAS and Red Cross Society of Japan. Local national level NGOs that deserve mention are NEWAH, ENPHO, NGO Forum for Kathmandu Water and Sanitation, SAPPROS, NFIWUAN, Action Aid Nepal and LUMANTI.

Pakistan

The principal components of the institutional framework are the federal government and its constituent ministries, the four provincial governments and their departments, the five city Water and Sanitation Agencies (WASAs) and the Karachi Water and Sewerage Board (KWSB). The Pakistan Environment Protection Council, headed by the Prime Minister has been constituted to formulate policy and provide guidelines for enforcing the law. The Pakistan Environmental Protection Agency, headed by the Director General is in place for effective implementation of the provisions of the law. The Ministry of Environment, Local Government and Rural Development through its various federal and provincial environment agencies is the relevant ministry regarding development of policies and implementation of environmental regulations. The Ministry of Water and Power carries out the various functions related to water through Water and Power Development Authority (WAPDA), Indus River System Authority (IRSA) and the Federal Flood Commission (FFC). The Pakistan Council of Research in Water Resources (PCRWR) under the Ministry of Science and Technology is responsible for research and training activities related to all aspects of water including water quality. The Ministry of Agriculture, Food and Livestock is also responsible for environmental matters regarding agriculture and livestock development. The provincial departments involved are the Departments of Irrigation and Power, Public Health Engineering and the Water and Sanitation Agencies (WASAs).

Involvement of NGOs and community-based organizations has been to a limited extent. Presently the private sector has no formal representation in the framework.

VI. IDENTIFICATION OF GAPS

There is general awareness in the five countries of the South Asian Region about the deteriorating quality of the surface water, though lately. The policy, legislation, regulatory framework and monitoring body are in their own places. However, lack of proper regulatory framework, failure to enforce existing laws and absence of an active national monitoring body are the major gaps in the implementation of water pollution control programmes. There exist inconsistencies and conflicting provisions as well as inadequacies in existing Acts, which impede the action plans from being implemented. There are also gaps between action plans and programmes where paucity of resources becomes the major constraint in implementing the programmes as planned. Inadequacy of obtaining information on water quality, their storage, analysis and dissemination are other matters of concern in the management of water quality control in the South Asian Region.

Bangladesh

A single institution, even if big and capable, would find it difficult to handle the water pollution problem singly. So public-private venture, involvement of NGOs and INGOs and other partners should be brought into play for making real inroads into water pollution control in Bangladesh. This has not been done yet. Looking at the immensity of the water pollution problem, only enforcement will not bring in a big change in water quality. There should be some action plans in the lines of Ganga and Jamuna Water Action Plans already initiated in India to clean up the badly polluted river waters. There are gaps between the studies done and the action plans in Bangladesh due to the possibility of lack of fund for implementation. Many government organizations are involved in the matter of water management and water quality control in Bangladesh their action plans and programs need to be harmonized and coordinated to the basic needs of the country.

The Department of Environment under the Ministry of Environment and Forest is the principal organization, which has the greatest responsibility to carry out the onerous task of keeping surface water clean. It should be fully staffed with capable and motivated technical staff with skills and expertise to address the environmental concerns faced by the country.

Bhutan

A policy to maintain a proper balance of rural urban migration is lacking, putting pressure on limited water resources and stretching facilities available in the urban centres especially in Thimpu and Phuentosoling.

A well-defined land policy for land use is lacking. There are no rules and Acts to control land degradation arising from man made forest fires like “Slash and Burn”, shifting cultivation and cultivation on steep slopes.

A natural water resource management plan embracing all uses also after uses from the household and industry does not exist.

Currently, there are no separate rules for handling solid waste and infectious and hazardous waste from hospitals.

Infectious and hazardous waste from hospitals should be carefully handled separate from other wastes and disposed off in sanitary conditions.

India

Based on the review of the issues regarding the existing environmental policy principles, legislation and institutional mechanism the important gaps that are evident in the current set up are listed below:

- Functions of concerned agencies with respect to policy formulation, implementation and decision making are not clearly defined
- Duplication of functions amongst the agencies has resulted in poor co-ordination
- Lukewarm attitude of agencies and personnel towards the adoption of a decentralized approach in the management of natural resources and the environment
- Absence of adequate participation of all stakeholders in decision-making
- Poor performance due to weak enforcement mechanisms
- Lack of a “command and control” approach in addition to insufficient transparency and accountability coupled with the absence of well-defined regulations
- Poor monitoring and reporting systems in the existing enforcement mechanism
- Inconsistencies and conflicting provisions as well as inadequacies in the existing legislation with respect to - (i) non-specificity of water rights and ownership; (ii) lack of sub-ordinate enabling legislation; (iii) lack of harmony amongst related legislations; and (iv) lack of adequate legal provisions to encourage private sector participation in multi-purpose projects.

Nepal

Though the main thrust of both the NWRS 2002 and the NWP 2005 is to follow the principles of integrated water resources management (IWRM), this has not been fully implemented. The aspects lacking are: (i) accepting and mainstreaming the principles IWRM and river basin concepts in all water policies and water resources development activities; (ii) implementing an appropriate Decision Support System in relevant water planning agencies; (iii) developing river basin plans for all the basins; and (iv) establishing appropriate institutions for river basin planning.

A review of the existing legislation has also shown that there exist inconsistencies in the Water Resources Act (WRA) and the various regulations that have been formulated there-under. Conflicting provisions exist in the WRA and the Local Self Governance Act (LSGA) regarding the right over water resources. Similarly, customary water rights have been ensured by the Country Codes (Mulki Ain) which is again in conflict with the WRA. Gaps also exist in the policies and legal provisions with respect to aquatic ecosystem management as broader issues have not been encompassed. Conflicting provisions and lack of clear jurisdiction also exist. Furthermore, timely amendments and improvements have not kept pace with the country's demand and the international scenario.

The water policy framework has suggested the need to develop the resource in an integrated and sustainable manner involving stakeholders in all water management initiatives. From the review of the existing government organizations in the water sector, the absence of an appropriate institutional framework for an integrated management becomes apparent. There is also a need to create new organizations, redefine functions of some of the existing organizations, rationalization of organizational structure, and restructure some organizations to achieve the stated objectives enumerated in the Water Resources Strategy.

Pakistan

The issue of river water quality is one of the key environmental issues of concern. The major gap between the issues/problems regarding water quality and prevalent provisions to address them is the lack of regulatory mechanism and non enforcement of existing laws. Moreover, the laws were enacted at various time and situation to address specific issues; thus there is lack of harmony between them. This has led to uncontrolled disposal of pollutants by almost all sectors (municipal, industrial, and agriculture). Present mechanism of obtaining information on water quality, their storage, analysis and dissemination facility are inadequate because problems are not understood to the required level. Although the Environment Protection Act and the implementing agencies are in place, actual control of water pollution is not yet effective. The main reason for this is the lack of a monitoring agency at the national level.

VII. CONCLUSIONS AND RECOMMENDATIONS

Various issues pertaining to river water quality and socio-economic pressures and impacts have been briefly mentioned and summarized above. These have been discussed in greater detail in the accompanying Vol. II: Appendix I – V. The purpose of this section is to consolidate the findings with respect to the different countries and synthesize the recommended actions that are generally applicable in the region as a whole. It is seen that indiscriminate discharges from both domestic and industrial premises without proper treatment is the prominent cause of the rapid deterioration in the quality of river water. To control and rectify the situation urgent action is needed to ensure that the appropriate legislations are enacted and the necessary enforcement and regulatory mechanisms are in place. The other issue pertaining to impoundment and damming of rivers has not been highlighted in the two main references cited above and as such has not been discussed in this report. It appears that this is not of immediate concern to the countries, except in the case of India, where civil societies and activists active in environmental issues have been quite vocal, as has been reported in the media quite extensively in the past with respect to the Narmada and Tehri projects. However, this is an issue that will need to be addressed more earnestly in the future, because of the immense hydro-power potentialities of the region and the fact that high dam projects will continue to be considered and studied.

Table 7.1 summarizes the major pressures that are predominant in the HKH region and which require special attention vis a vis river water quality management.

Table 7.1: Major Pressures on Rivers of HKH Region

S. N.	Country	Socio-Economic/Legal Parameters				
		Domestic/Industrial Pollution	Damming/ Impoundment	Land Degradation/ Soil erosion	Salinity	Water-logging
1.	Bangladesh	X	-	X	X	-
2.	Bhutan	X	X	X	-	-
3.	India	X	X	X	-	-
4.	Nepal	X	X	X	-	-
5.	Pakistan	X	-	X	X	X

7.1 Conclusions

It may be concluded that there is a water stress situation in the HKH region due to growing water demand from the various sectors due to the fact that the needed amounts are not available at the required time. This uneven distribution of water resources and the seasonal variation in availability has been further complicated by the progressive deterioration in the quality of river water. Widespread over-exploitation of the water resources to meet the ever-widening gap between demand and supply and the indiscriminate disposal of wastes from urban centres and industries are indeed alarming. Only negligible quantities compared to the total volume of the wastes generated undergo some form of treatment. Severity of water pollution problems has been further aggravated by frequent occurrences of drought and flooding as the consequence of the geographical setting of the countries. The water pollution problem is anthropogenic.

The problems are more profound in the affluent urban centres where rivers tend to be polluted with the increased activities of people moving from the rural areas to urban centres, for job opportunities. The head reaches of the rivers in the sparsely populated areas are still pristine and in their best shape. Wherever the rivers carry considerable volumes of water, the effect of pollutants tends to be reduced after traversing some distance downstream of the potential points of pollution. In most of the cases, the permissible limits for various parameters with respect to both domestic and industrial wastewater have been set out and their compliance is binding.

The institutional framework is generally in place to handle the environmental problems arising from industrial effluents and municipal wastes. The environmental problems are quite acute, whereas more concerted efforts and resources to correct this are lacking. In financial terms, it is a costly affair and is also time consuming. Not enough effort has gone into the mobilization of all stakeholders like the government, donors, NGOs and INGOs, and above all, the people, to keep the river water clean and fit for human use. Though not to the desired extent, environmental laboratories do exist and their capacities cum capability are improving. The monitoring and regulation of river water quality has been quite effective in the case of India, where the Central and State Pollution Control Boards and related agencies are quite active. In the case of the other countries, however, the required monitoring and regulatory mechanism has not developed to the desired extent.

The countries of the region are blessed with abundant water resources providing excellent opportunities for overall development of the country. Harnessing water resources is one such avenue for development of hydropower for which, proper management plans are being developed.

As agricultural land is generally limited, the normal tendency to extend agricultural practices in steep terrains will bring in land erosion as well as landslides, disturbing the ecosystem of the area, and should be avoided at all cost. The excessive use of chemical fertilizers and pesticides has also further polluted the water bodies. The use of organic compost manure as far as practicable with the balanced growth of livestock and fodder to feed the stock has not been promoted to the desired extent. Other areas needing urgent attention and specific to some of the countries are salinity in the case of Bangladesh and Pakistan. The latter is also faced with the severe problem of water-logging due to excessive irrigation and poor drainage.

The present growth rate of population is fairly high even in all the countries of the region. If the present trend continues, the populations are expected to double in the next two to three decades. This will put tremendous pressure on the available water resources with tendencies towards scarcity for drinking water, problem of disposal of domestic sewage, increased growth of industrial effluents, and settlement problems due to haphazard urbanization.

Realizing that water resources must be addressed from the point of view of its importance ecologically, economically and socially, government and other organizations have initiated actions towards the adoption of appropriate sector reforms and related development programmes. Policy and information gaps, however, exist. Water disputes between agricultural and drinking water become quite pronounced at times and the importance of trade off between the two for more economic benefits has still to be fully realised. The policy and legal provisions for managing both the urban and the aquatic environment encompassing the many inter-related sectors, therefore, continue to be crucial. The formulation and improvements in the various

policy and legal provisions are urgently needed, as their effective implementation and enforcement are currently fairly weak.

The importance of community mobilization in program implementation has been recognized by all the countries of the region. The success of such programs is closely tied up with community awareness, which is gradually coming up. An initiative that deserves mention is community-lead total sanitation programs in communities and a similar approach by schools in school-lead total sanitation programs. This needs to be approached in the overall context of information dissemination, education and training of appropriate units and beneficiary groups as part of capacity building.

7.2 Recommendations

A conscious effort needs to be made towards integrating environmental planning to development planning, if sustainable development is to be attained.

From the review of the many issues and gaps that exist in water resources quality management and elaborated in the preceding sections, it is recommended that the following actions be taken on a priority basis.

Combating river water pollution - Governments will need to give top priority to this through the following actions:

- introducing more infrastructures for the collection and treatment of domestic and industrial wastewater for efficient municipal and hazardous waste management;
- land zoning for industries;
- initiating model clean up programmes in areas which are seriously affected by municipal wastes and industrial effluents, to be gradually replicated in other areas needing urgent action;
- ensuring better water quality monitoring;
- enforcing the relevant provisions Water Pollution Control and Environment Conservation Acts and Rules more effectively; and
- formulating and undertaking pollution clean up strategies and actions through the mobilization of both non-government organizations and the public in general, including public-private partnership approach.

Policy, Plans and Institutional Reforms - Future programmes and initiatives should focus on building institutional capacity, harmonizing various policy issues that are conflicting, and raising awareness building in environmental concerns. All water resources related activities should preferably be consolidated with the appropriate number of departments under one ministry. This will greatly help in coordinating and implementing the different programmes.

Enactment of Water Resources Act - A comprehensive Water Resources Act should be formulated and enacted. This is needed for more effective enforcement of the legal provisions

that already exist but are scattered under different Acts. This will also facilitate the execution of water resources plans and programmes in a more co-ordinated manner.

Environment Policy and Legislation – Though very sound environment policy and strategy documents do exist, these still need to be given legal status fully through amendments in the existing Acts and Rules for translating the existing/revised policies and strategies into action.

Introduction of appropriate technologies and practices – Community awareness campaigns, information dissemination, education and training to be made integral parts of low cost-effective systems in the implementation of the following:

- Promotion of appropriate local-level actions in the conservation of surface waters
- Adoption of more efficient management practices for optimal utilization of the water resources
- Recycling of wastewater
- Protection and restoration of catchment areas
- Maintenance of minimum flows in natural water courses
- Recharging ground water through rain water harvesting
- Expansion of community-lead total sanitation and eco-san practices

Capacity Building and Institutional Strengthening – In order to ensure more effective enforcement of the legal instruments with special reference to monitoring and regulation of river water quality, training of personnel of different categories at all levels needs to be imparted in the prevention and regulatory aspects of water pollution control. In addition, beneficiary groups and other stakeholders need to be educated through proper information dissemination and training as part of overall capacity building.

Introduction of River Conservation Action Plans – Appropriate comprehensive river water quality improvement action plans need to be developed for grossly polluted sections of all major and medium river systems. These will need to be implemented with priority in a time-bound and phase-wise manner. This initiative has proved to be successful in India and mutual exchange of experience and knowledge would be beneficial to the countries of the Region.

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