

**ENVIRONMENTAL MANAGEMENT CONCERNS
IN WATER SECTOR AND INSTITUTIONAL
CAPABILITIES**

Engr. Muhammad Shafiq

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ABSTRACT

Environmental Management issues have become vital not only globally rather inhome situation these are on priority due to environmental degradations in water sector. The integrated irrigation network of Indus Basin, a backbone of economy of Pakistan, is under serious threat of water logging, hydro-salinity, adverse effects of pollutions and contamination of surface and ground water. In Pakistan during last four decades, the agricultural polices have remained mostly dominated by the so called 'Green Revolution", which meant nothing other than to maximize the agricultural yields by putting in the agricultural inputs; like water and chemical inputs to maximum limits. This has resulted not only in the soil degradation, as the preliminary evidences have begun to emerge, but also the problems like salinity and water logging have surfaced due to excess irrigation of the lands under cultivation. Simultaneously, the organizational capacity for the handling of such an adverse situation has also remained highly inadequate, especially with reference to the policy implementation and the equipments availabilities, etc. The environmental situation has been further deteriorated by the disposal of untreated industrial and urban effluents into the rivers, drains and irrigation canals whereby the quality of irrigation water becomes highly deteriorated rather hazardous. So these emerging immenses need for such strategies that are more socially and environmentally sensitive to be evolved by the public and private agencies with participation of all stakeholders. The institutional capabilities have to be reviewed and strengthened for modifications in their role to address environmental concerns in their operations and activities, so as to adhere to environment management procedures.

¹ Deputy General Manager, Punjab Irrigation and Drainage Authority (PIDA),

- B.Sc (Civil Engineering)
- M. Phil (Water Resource Management)
- Diploma in Environmental Laws

BACKGROUND

Out of total agricultural production of Pakistan, 90% is from Irrigated agriculture which mostly depends on the Indus Basin Irrigation System. While Agriculture is backbone of economy of the country and more than 25% GDP is from Agriculture sector. Out of 145 MAF of river water inflows, the Indus Basin Integrated Irrigation System directs 105 MAF of water to canals which is delivered to farms through a large network of distributary systems in 43 canal commands.

Practically, the entire irrigation system is unlined, resulting in system losses due to seepage in its delivery system and at farm level. In addition, water availability from ground water is to the tune of 43 MAF, of this 38 MAF is being abstracted by private tubewells much of which is by way of recovery from system losses due to seepage, in areas underlain by fresh groundwater.

The agricultural policies in Pakistan have been strategically aimed to deliver more and more water for agricultural growth which were based on the concept of sufficiency of both land and water. Major irrigation schemes (Mangla and Tarbela reservoirs) were launched to harness this water and to apply it at both the extensive and intensive margins. Besides inefficient practices of irrigation for surface water, the increasing trend of abstraction of ground water through tubewells has resulted in water quality concern besides water logging and salinity. The declining water quality, in the rivers, ground water and irrigation system itself, has further aggravated due to accelerating problem of urban and industrial effluents being put into water bodies, specially around the large towns.

The institutional capabilities to deal with emerging environmental degradations in water sector are either insufficient or not aware of the problem threatening not only the quality of water rather a serious threat to human health. So, such policies and strategies are necessary to formulate; socially acceptable and environmentally sensitive to address the environmental issues through participation of all stakeholders. The role of public Institutions has to be reviewed with the aim to sustain healthy environment in their operations and activities.

ENVIRONMENTAL PROFILE

(i) Land and Hydro-Salinity

Out of 80.40 Mha total land area of Pakistan, 32.0 Mha are suitable for agriculture and forestry. While only 26.6 Mha, at present is cultivated land, out of which about 16.2 Mha is irrigated. Culturable area commanded by canals is nearly 14.0 Mha.

Land and ground water salinization is one of the major desertification process in Pakistan wherein about 6.3 Mha of land are affected. About half of this lies in the canal command areas. Apart from a few localized areas, salt affected soils are confined to the Indus plain. Salt has always been part of the Pakistan Environment. Accumulation of salts at the soil surface is characteristic of arid and semi-arid environments, especially where irrigation is practiced. Secondary salinity (as a

result of human activities) exists on the Indus Plain is all related to the development of the modern irrigation system in Pakistan. Excessive seepage during delivery of canal water to the farms, has resulted twin menace of water logging and salinity which are principle threat to environment and causing sever injury to national economy.

(ii) State of Water Logging and Salinity

The emergence of problem is due to poor drainage, low delivery efficiency of the irrigation (35 to 40 percent from canal head to root zone) and inadequate drainage system. The semi-arid climatic conditions prevailing in Pakistan also lead to accumulation of salts in the root zone. In addition, irrigation supplies add more than 0.75 metric tons of salts per acre per year to the root zone. Groundwater pumpage, which is unregulated, further aggravates the situation by mobilizing salts dissolved in the ground water aquifer. Therefore, soil and hydro salinity are the principal threats to the sustainability of irrigated agriculture in Pakistan. About 44% of the gross command area (GCA) is waterlogged, with water table depth less than 10 ft (0-300 cm), of which 12% is severely waterlogged, with water table depth less than 5 ft (0-150 cm). Further about 25% of the surface soil is saline, of which 6% is moderately and 8% severely saline.

(iii) Water Quality Deterioration

- Water pollution poses an active threat to farming communities, as it affects both human health and biodiversity. Irrigation water is the main source of drinking water in many towns and villages, especially where the ground water is brackish. Thus, through no fault of their own, downstream residents are exposed to adverse health affects due to both biological and chemical contamination. Of course, local practices such as washing clothes in irrigation channels and livestock intrusions add to the problem. Further, there is an increasing trend for municipal bodies to contract out municipal waste water to farmers for vegetables cultivation. While such recycling is income generating, adverse health effects occur both directly, through ingestion of the produce and bore worms and indirectly, via seepage of such water into the groundwater table and runoff into the irrigation system. Water pollution also adversely affects biodiversity, particularly aquatic life in extant wetlands.
- The use of chemical fertilizers, pesticides, insecticides, and fungicides has increased tremendously over the years. The run-off from irrigation feeds into surface water and also seeps into sub-soil water, as crops do not utilize all chemicals. A survey by the Public Health and Engineering Department (Punjab) found 72% of the samples collected from wells and tube-wells throughout Punjab were biologically and/ or chemically contaminated. Over the years, there has been a change in the pollutant composition towards chemical sources.
- Deterioration of surface water quality by putting raw sewage and industrial toxic wastes and effluents into rivers, irrigation canals and drains etc.

(Untreated municipal sewage discharge into river Ravi from Lahore, a discharge of 1.5 Million M³/ day, all municipal waste from Hyderabad is discharged to the Phulleli Irrigation canal, Queeta, Bahawalpur, Rahimyar Khan and in other towns, raw municipal effluents are directed from open drains to farming lands, including vegetables and salad crops.)

- Ground water mining and lowering of water table are taking place in Irrigated areas of Indus Basin, Partially due to drought period, but largely due to development of private tubewells for irrigation purposes (more than 6,00,000 tubewells in Punjab during last few years), which has caused deterioration of ground water quality in sweet water areas by salt water intrusion.
- None of the three major consuming sectors of water: agriculture, industry and household/ municipalities have proper wastewater disposal systems. As a result the effluent/ run off contaminates water bodies / reservoirs creating serious health and environmental problems. Not only are the poor, even more vulnerable to their impacts, they also contribute heavily to water pollution. This vicious circle originates in the deprivation of social and infrastructure services, being essentially rooted in a development process, which tends to bypass the poor.
- While water pollution has many sources, touches number of sectors and has regional ramifications, the problem has only just begun to be documented. Detailed data on total wastewater discharge are available only for some major cities in the Punjab.
- A survey conducted by the Federal Environmental Protection Agency (EPA) shows that tanneries located in Kasur and Sialkot were discharging effluents with chrome concentrations ranging between 18.20 - 22.20 mg/ liter against standards of 1mg/ liter prescribed in the National Environmental Quality Standards (NEQS). These effluents also flow into rivers and, eventually, into the sea, with disastrous consequences for inland and coastal fisheries. A loss of about 5000 tons/ year in fish catch has been recorded in the River Ravi. Water quality deterioration occurs at each stage of bacterial and organic liquid and solid wastes, toxic metals, acids and other less toxic but still contaminating substances from industrial discharges and chemical pollutants in the form of pesticide and fertilizer run-off from agricultural lands.
- In most of the cities water is provided without any treatment or with inadequate treatment. Corrosion in pipes during conveyance adds to the contamination. The problem is further exacerbated by seepage from contiguously laid sewerage pipes as a result of pressure fluctuations. In slums, poor localities and villages the standard water supply sources are community stands posts. A recent World Bank report demonstrates that when a tap or a well is shared with neighbors, the likelihood of child or infant

mortality is much higher compared to access from a residential piped water system.

- In peri urban areas, sewage water is used for irrigation. Adverse health impacts result when vegetables that are eaten raw, are watered with municipal discharges carrying toxic chemicals. The Indus Basin is underlain by an extensive and largely fresh groundwater aquifer covering approximately 16.2 million hectares. However despite the evidently ample supply hardly any of the drinking water is deemed acceptable by WHO standards.
- The intrusion of urban waste water into the canal irrigation and river systems is a major problem that is likely to become more severe in future as residential and industrial expansion continue a pace.

Overall the problem is inherently complex and requires extensive monitoring and close inter-departmental and cross-provincials coordination.

(iv) Bio-diversity

The Indus Basin ecosystem sites many wetlands. These are a migratory flyway of global importance and the habitat for the Indus River dolphin. At present, they are under grave threat from water diversion and drainage, agricultural intensification and toxic pollutants. Over the past sixty years, many of Pakistan's natural wetlands have disappeared as a result of irrigation and drainage projects aimed at providing more land for food production and housing.

Agro-ecosystems have almost replaced entirely the original tropical thorn forests, swamps and riverain communities of the Indus Plains. Much of the original forests have been cleared for cultivation. Extensive cutting for timber fuel wood and fodder etc. has made concurrent depredations and over grazing has reduced the stands to stunted and sparsely distributed scrub. The irrigated plantations and scattered wetlands – both natural and anthropogenic are the only remaining evidence of the original ecosystem. Further, the agro ecosystems are also experiencing a number of trends damaging to biodiversity. These include soil loss, water logging, salination and intensification of production and increased use of pesticides.

MAIN ENVIRONMENTAL CONCERNS

- Water logging and salinity
- Water quality issues.
 - Intrusion of urban wastewater and industrial effluents into rivers, irrigation canals and drains or in to depressions.
 - Mining of ground water and deterioration of its quality by intrusion of saline water.
 - The growing and diffused nature of water and soil pollution and the attendant biodiversity loss.

- Operational issues of agencies regarding in efficient water management i.e. mis- management, wastage & seepage, inequity in distribution, neglect of rehabilitation of Irrigation and Drainage System, limited O&M funding, low cost recovery and highest establishment expenses etc.
- Lack of integrated drainage system for safe disposal of saline water and effluents.
- Lack of due participation of stakeholders in planning, development & operation of water related projects and entities.
- Adverse environment impacts to human life and biodiversity due to inefficient water management practices and services.

ENVIRONMENTAL MANAGEMENT ISSUES

Environment Management has become an essential tool in developing activities and programmes. Not only in global context, rather in home, all major projects and programmes to be undertaken by private and public have to provide inbuilt environmental management plan and process for approval and implementation of said projects. Some major environmental management issues are discussed below:

- **Sustainable Development**

Generally, the term “Development” has been understood as economic growth but it badly effects the environment, specially with fast growing urban concentrations and industries. Globally linkage between Development and Environment is well admitted and addressed in the term of “Sustainable Development”. It refers to development seeking to satisfy the needs of the present generations while respecting the environment for the needs of future generations. So the “Sustainable Development” is a basic issue to maintain healthy environment in all sectors of developments, operations and activities.

- **Participatory Approach**

Public and stakeholders participation in all stages of planning and development of programmes and projects has been considered a basic tool to protect the environment and sustain them environmentally. So, it is necessary to adopt participatory approaches for sustainable development, poverty alleviation, efficiency, equity and sustainability.

- **Environment Impact Assessments (EIA)**

Environment Assessment looks at the environmental impacts of a major project like; construction of dams, Irrigation and drainage work or highway etc. In Pakistan the Environmental Protection Act 1997, laid the ground work for initiating Environmental Assessment prior to major projects undertaking. EIA assesses significant impacts that will arise from a proposed project and helps determine whether or not it should be implemented. It also facilitates acquisition of financial assistance, as well as decision making on

the use of natural resources. EIA should essentially include, an Environmental Management process needs to be developed to mitigate negative impacts and proper monitoring thereof.

- **Awareness and Capacity Building**

Creation of awareness among public, stakeholders and community is necessary for ensuring that project activities are environmentally sustainable. Every project may require specific interventions to respond to its needs and problems, and to develop capacity to deal with them. For irrigation and drainage Projects, awareness and capacity building is a basic requirement to address quality issues of water, equity in distribution of water, promoting water use efficiency, ground water management and implementation of biological stabilization measures, effects of pesticides and fertilizers on crop production and environment etc.

- **Conservations of natural resources**

Depletion of natural resources i.e. surface water, groundwater, agro-ecosystem, bio- diversity etc. due to either in planned utilization or bad management leading to wastages. For sustainability of natural resources, it is very important to improve the management system of natural resources and besides their conservation, and efficient uses, their replenishment, protection and regeneration aspect are paramount to be considered and put as a part of any development project or in operational activities of existing bodies and works.

EXISTING ENVIRONMENTAL LEGISLATIONS

1. Till 1983, when “Pakistan Environmental Protection Ordinance” was issued as a first “Environmental Legislation” in Pakistan, the sectoral legislations existed which were primarily for streamlining the activities and functions of concerned sector, also provided some protection to water quality, discharged as effluent or as a secondary function to be care off by it. Such main legislations include following:

Canal & Drainage Act 1873

No provision to regulate effluents disposals into rivers, canals, drains etc. except prohibition of corruption and fouling of canals etc.

Factories Act 1934

Relevance to Industries for safe wastes and effluents discharges and fines for polluters.

WAPDA Act, 1958

No provision to protect water quality, it depends on C&D Act 1873.

Punjab Soil Reclamation Act,
1952

Regulate the ground water in SCARP areas to sustain water levels etc. Provisions not implemented to regulate

Provincial IDA Acts, 1997	ground water abstraction. Empowered to regulate Irrigation and Drainage systems, develop and maintain water resources on sustainable basis through participation of stakeholders and farmers.
Punjab Local Government Ordinance, 2001	Provides environment control, sewage treatment plants, control over water resources and its regulation etc. but no enforcement by local government bodies so far.

The provisions of these laws to protect environments (in whatsoever manner) had been never implemented due to deficiencies in legalities, non- application of fines, lack of public and official ignorance of environmental issues, and also political commitments etc. The sectoral legislations have totally failed to pay their even limited role in environmental protection.

2. In 1997, environmental legislation expanded to address the environmental issues in global context, and Pakistan Environmental Protection Act (PEPA) 1997, was promulgated. This Act mainly emphasises, on Industrial and Municipal effluents disposal, which also specify National Environmental Quality Standards (NEQS) for such disposals. The provisions of this Act also could not be implemented due to implications and certain flaws in legislation.

3. Deficiencies in legislations

- The sectoral legislations other than PEPA Act, are of punitive character of law, with soft fines etc. with no applications to Environmental remedial actions.
- Although local Government are empowered to environmental control etc. but their in-capabilities are reflected, by non- responsiveness during last four years.
- The Pakistan Environmental Protection Act (PEPA) 1997, also lacking to address the environmental issues and concerns of water sector, other than Urban and Industrial effluents i.e. issues related to Irrigation and drainage, water quality of surface and ground water, social, economical and ecological well being etc.
- Certain standards of NEQS like, 3500 Mg/l (PPM) for Total Dissolved Solids (TDS) for effluents, are un-realistic for drainage of saline water having more TDS than this limit.

- NEQS related to outfall values of the effluents having no concern with the ambient conditions appertaining to the rivers, streams, lacks, canals, drains wetland etc.
- The provision of dilution of treated effluent in NEQS, of 1:10 ratio to water bodies did not account for the quantum of flow of water body and its quality.
- PEPA Act did not provide mechanism for existing Industry to produce effluents as per NEQS, rather pollution charge fine has been provided to, even for new industries, which did not provide environmental remedy, rather, a low cost escape to polluters, under cover of law for indefinite period, while pollutions will remain to continue by the Industries.

ROLE OF INSTITUTIONS IN ENVIRONMENTAL MANAGEMENT

(i) Existing Institutional Capabilities

The existing institutions dealing with Management, Development and Operational activities in water management and drainage includes; WAPDA, Provincial Irrigation Departments, Public Health Engineering Departments, Authorities and Municipalities of Towns etc. These institutions mainly develop and manage the physical infrastructures of water bodies with engineering and technical approaches. The associated problems and ill effects of water logging and salinity also have been addressed by evoking engineering approaches within a limited and local area based temporal solutions. Similarly for development activities in water resources management projects for Irrigation & Drainage, industrial and urban water uses and effluents disposal etc. mitigation measures to address adverse impacts of activities are either not carried out or insufficient, at any stage, ranging from planning to operations. All such on-going activities have resulted into adverse environmental effects on each sector of life which includes degradation of surface water bodies in quality, water logging and salinity with associated environmental problems, salt water intrusions in fresh ground water, depletion of land and water resources, loss of wild life habitat (wet land degradation and biodiversity) and resettlements issues etc. The Environmental Protection Department / Agencies are responsible to regulate the urban and industrial effluents but their presence on ground is non-existent, due to number of factors.

(ii) Reforms in Irrigation Sector

In 1995, Government of Pakistan decided to initiate the Institutional Reforms in Irrigation Sector by replacing existing Irrigation Management set up with more responsive, efficient, transparent and effective in operation and maintenance of Irrigation and Drainage Networks on sustainable basis. The basic concept of the Reforms, is to involve the beneficiaries i.e. farmers in

Irrigation Management on Participatory Management Approach, through creating farmers based entities at all tiers of Irrigation Management.

The Institutional Reforms included limiting the role of the traditional Irrigation Departments to that of a regulatory authority and establishment of independent autonomous Provincial Irrigation and Drainage Authorities (PIDAs), which were established in 1997 in all the provinces. PIDAs' main aim and duties are to promote such policies and strategies, and plans for efficient management of surface water and ground water w.r.t quantity and quality on sustainable basis. For transparent arrangement of water distribution, the participation of farmers and other stakeholders at all levels of Irrigation and Drainage system management have been ensured by establishing farmers based entities.

Since 1997, Punjab, Sindh, NWFP and Baluchistan Irrigation & Drainage Authorities, are in process of implementation of Institutional Reforms by establishing Farmers Organizations (FOs) at Distributaries level and Area Water Boards (AWBs) at Canal Command level and transferring of Irrigation Management to FOs. Thus the beneficiaries are to be strongly represented in the Irrigation and Drainage Authorities (IDAs) and is the dominant group in PIDAs and AWBs.

(iii) Potential Role of PIDAs in Environmental Management

Effective Environmental Management required new interventions in water management to address the environmental aspects from planning stage to designing and implementation of development and rehabilitation schemes of Irrigation and Drainage, Industrial effluents and urban disposals, and their conveyance in water bodies etc. The role of PIDAs in environmental management efforts may be viewed in the following contexts;

- As discussed earlier to address water management issues and problems, Provincial Irrigation and Drainage Authorities (PIDAs) in all provinces have been established. The Irrigation and Drainage systems are being rehabilitated / developed with a view to rectify technical, environmental, institutional and sustainability inadequacies. The provisions in PIDAs legislations, rules and regulations provide opportunities in planning and implementation of irrigation and related activities to mitigate environmental concerns.
- In Punjab Irrigation and Drainage Authority Act, the concept of development and to make the Irrigation and Drainage Network, and flood control system in the province, sustainable and introduction of participation of beneficiaries in the operation and management thereof, has been provided as main aim and duties of the Authority. Further, the Authority has been empowered to formulate and implement policies in water resources sector for effective, efficient, economical and optimal utilization, preservation and improvement of

such water resources by the water users of the province on sustainable basis.

Within this framework, Pilot Area Water Board (Pilot AWB) has been established in one canal command i.e. Lower Chenab Canal (East) Circle Faisalabad where “Farmers Organizations” (FOs) have been formulated and Irrigation Management transferred to them, while in Lower Chenab Canal (West) Command, Area Water Board (AWB) also has been approved where FOs are being established. In Chashma Right Bank Canal (CRBC) area, D.G.Khan FOs are also being formulated. These FOs have not only been empowered in complete autonomy in management, operation and maintenance of distributaries rather among their functions also includes the protection of the environment within its area including the water quality of the channels.

Such provisions also exist in Sindh Irrigation and Drainage Authority (SIDA) legislations and Rules / Bye laws framed for FOs, to take step for efficient water management through Farmers participations.

- From above, it is clear that PIDAs can play most effective role in environmental management concerns, not only in their development and operational activities, also at sub-sectrol areas through participation of water users to mitigate the adverse impacts of water pollutions, Industrial and Municipals effluents into channels, rivers, drains etc. and to preserve the ground water quality.
- As the PIDAs are undertaking rehabilitation and development activities of Irrigation and drainage infrastructures, the preparations of IEE and EIA under Pakistan Environment Protection Act (PEPA) 1997, are carried out. However during implementation and execution of works environmental concerns like; continuity of water supply, rehabilitation of effectees and other problems in local areas for works like; lining of canals, remodeling / rehabilitation of canals / drains and new constructions of bridges, canal falls and Barrages etc. have to be addressed which needs awareness of environmental needs and capacity building of engineers, field staff, contractors and other related stakeholders.

FUTURE PERSPECTIVES FOR ENVIRONMENT MANAGEMENT

Keeping in view the environmental concerns in water sector and their impacts on overall environment of an area, the policy framework and mitigation measures required to be taken by the relevant institutions may be summarized as under:

1. Devising such policies and strategies for intra-provinces coordination for integrated environmental management, standardization of

- environmental indicators and parameters for ground water abstractions and effluents disposals in to water bodies etc.
2. Ensuring the inter-departmental coordination and strengthening partnerships between farmers, NGOs, Government Departments and the private sector to address environmental issues.
 3. Subsuming traditional inter, intra and cross-sector rivalries under the new institutional arrangements in irrigation sector to ensure efficiency gains, in turn generating environmental benefits in all sectors.
 4. Creation of awareness and capacity building of public, farmers and community groups, urban community, Farmers Organizations and Irrigation Department staff and other stakeholders for neglected environmental and social front in water quality aspects and its impacts (health, agricultural productivity, bio diversity).
 5. Examining institutional, legislative and legal precedents for regulating industrial effluents and municipal discharges in to rivers, drains, canals and water bodies (information flows and levy protocols). Based on these, establishing modalities for interdepartmental coordination based on the policy and institutional analysis above.
 6. Establishing environmental monitoring cells in departments dealing with water resources management, enhance skills and capacity of the cells staff in environmental baselines data collection and analysis, environmental legal framework, ground water management and consultation process, and development of management information system to develop an integrated monitoring and evaluation framework for water quality monitoring.
 7. Assessment and propagation of new technologies, recycling of drainage effluents, biological control measures, alternatives for pesticides and fertilizers, irrigation with saline water, conservation of water and salt resistant crops etc.
 8. Developing measurement, monitoring and implementation guidelines for conjunctive use of surface and ground water, salinity assessment, acceptable effluents disposals in water bodies, ground water sustainability parameters etc.
 9. Develop policy guidelines for wetland management, strategies for protection of bio-diversity (tree plantations and biological stabilization on slopes on channels etc.) with participation of Farmers Organizations and community.
 10. Additional legislations and strengthening of legal frameworks i.e. PEPA Act 1997 to remove shortcomings and to address the Environmental issues relating to Irrigation and drainage, salinity, cost sharing of conveyance of effluents in Irrigation Drains, canals, rivers

etc. environmental auditing system and implementation processing etc.

11. Strengthening the role of institutions like: Local Government Authorities, Municipalities of towns etc; in discharging treated effluents into water bodies and protection of groundwater quality, through legislations and political commitments in providing funds for environmental friendly operations and activities of such institutions.
12. Support to Provincial Irrigation and Drainage Authorities to implement the provisions of respective legislations to regulate the water resources on sustainable basis through participation of stakeholders and to adopt such strategies and frame plans for their operations and activities so as to adhere to Environment Management procedures.
13. Develop Rules and Regulations under provisions of PIDAs legislations to regulate groundwater, conveyance of effluents through Irrigation drains, natural drains, rivers and other water bodies etc. and for protection of surface water pollutions and groundwater contaminations.

RECOMMENDATIONS

1. Awareness raising among general public, students, water users, policy makers and government functionary etc. by the NGOs and public institutions regarding Environmental degradations and their adverse impacts, developing civic sense for healthy environment and to stress the concerned responsible institutions to adopt mitigation measures.
2. Establish the Environmental Management Regulatory Agencies at federal and provincial levels; for coordination and implementation of legislative obligations of different public institutions to mitigate the environmental degradation in their operations and activities; arrange resources and funds for remedial measures; Develop political support and commitments to sustain healthy environment in all sectors of life; ensure efficient utilization of natural resources and their regeneration / replenishment; perusing the participation of stakeholders in developments activities in public and private sectors; advise Government to adopt environment sensitive policies etc.

REFERENCES

1. Environmental Management Plan – Framework for action under NDP February, 2001.
2. Proceedings International Seminars on Salinity Mitigation for efficiency water resources Management, September 25, 2004, Lahore.
3. Punjab Local Government Ordinance, 2001.
4. Reforms in Irrigation Sector, (Vision, Strategy, Implementation, Achievements) Punjab, 2005.

5. Regional and Social Environmental Assessment of the proposed Punjab Irrigation system improvement project (Draft report), November 30, 2000.
6. Scheme for Transfer of Irrigation Management, Farmers Organizations in Punjab, 2005.
7. The Pakistan Environmental Protection Act, 1997.
8. The Punjab Irrigation and Drainage Authority Act, 1997.