Sustainable Development Policy Institute

Monograph Series: M-019

Regional Social and Environmental Assessment: An Irrigation Management Interface

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17 March 2002

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2002

A publication of the Sustainable Development Policy Institute (SDPI).

Sustainable Development Policy Institute is an independent, non-profit research institute on sustainable development.

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List of Acronyms

AERC	Applied Economics Research Centre
AWB	Area Water Board
BS	Balloki-Sulemanki Link Canal
BRBD	Bambanwala-Ravi-Bedian-Debalpur Link Canal
CBDC	Central Bari-Doab Canal (CBDC)
CBO	Community Based Organization
CDSG	Community Development Support Group
CIDA	Canadian International Development Agency
DSE	Development, Sustainability, Equity
EMP	Environmental Management Plan
FO	Farmer Organization
FPP	Farmers Participation Plan
GDP	Gross Domestic Product
IBIS	Indus Basin Irrigation System
IBRS	Indus Basin River System
IDS	Institute for Development Studies
IUCN	International Union for the Conservation of Nature
LBDC	Lower Bari Doab Canal
LCCE	Lower Chenab Canal Command
MAF	Million Acre Feet
MELGRD	Ministry of Environment, Local Government and Rural Development
NCA	National Commission on Agriculture
NCS	National Conservation Strategy
NDP	National Drainage Program
NRSP	National Rural Support Program
OFWM-IV	On-Farm Water Management Project - IV
O&M	Operations and Maintenance
PAC	Project Advisory Committee
PEP	Pakistan Environmental Partnership
PERI	Punjab Economics Research Institute
PHED	Public Health Engineering Department
PIDA	Punjab Irrigation and Drainage Authority
PIDE	Pakistan Institute of Development Economics
PID	Punjab Irrigation Department
PISIP	Punjab Irrigation System Improvement Project
PRSP	Punjab Rural Support Program
RRA	Rapid Rural Appraisal
RSEA	Regional Social and Environmental Assessment
SCARP	Salinity Control and Reclamation Project
SHD	Sustainable Human Development
SDO	Superintending Divisional Engineer
SPDC	Social Development Studies Centre
TOR	Terms of Reference

UM&EU	Umbrella Monitoring and Evaluation Unit
WAPDA	Water and Power Development Authority
WUA	Water User's Association
WWF	Worldwide Fund for Nature
XEN	Executive Engineer

Executive Summary

The Regional Social and Environmental Assessment (RSEA) for the area impacted by the proposed Punjab Irrigation System Improvement Project (PISIP) has been carried out in accordance with the World Bank operational guidelines (World Bank: 1996). The two project areas are the Lower Chenab Canal Command East (LCCE) and the Lower Bari Doab Canal (LBDC). The RSEA has been suggested to provide a focal point for environmental and social issues relating to the project, reflecting the high degree of interaction between environmental and social issues in participatory rural infrastructure development projects, such as the PISIP. Its primary objective is to provide a framework to address key social and environmental issues in the proposed project, in order to shape environmentally and socially sustainable investment strategies to achieve desired project outcomes.

Background

Around 80% of the arable lands and 90% of agricultural output (which accounts for more than a quarter of GDP) in Pakistan depend entirely on the Indus Basin Irrigation System (IBIS), which is the largest integrated irrigation network in the world. It consists of three major storage reservoirs, 19 barrages, 12 inter-river link canals, 43 irrigation canal commands, and over 107,000 watercourses delivering water onto the farms. Practically the entire system is unlined, resulting in system losses due to seepage, particularly at the watercourses. Annually, the system draws an average of 106 million acre feet (MAF) of surface water for irrigation, supplemented by another 43 MAF of pumped groundwater, much of which is by way of recovery from system losses due to seepage in areas underlain by fresh groundwater.

For the past forty years or so, agricultural policies in Pakistan have been defined by the so-called "Green Revolution" strategy of agricultural growth. This strategy was premised upon a sufficiency of both land and water. Major irrigation schemes (Mangla and Tarbela) were launched to harness this water and to apply it at both the extensive and intensive margins. The intensive application of water and chemical inputs to high yielding dwarf varieties did indeed enhance crop yields in wheat, rice, cotton and maize to a remarkable degree. However, preliminary evidence of resultant soil depletion is beginning to emerge. Also, severe waterlogging and salinity has surfaced due to the inability of the drainage system to cope with the excess water. As the Green Revolution benefits have begun to peak, an imperative need has emerged for reassessing strategy. The institutional environment has proved ill equipped to deal with emerging constraints, limits to land and water, a deterioration in their quality and the adverse impact on farmers. This suggests the need for a strategy that is more socially and environmentally sensitive.

The Project Area

The LCCE canal system irrigates parts of Sheikhupura, Faisalabad, and Toba Tek Singh. The LBDC canal system irrigates parts of Kasur, Okara, Sahiwal, Vehari and Multan districts. The areas are well served by a road network and communication system, although substantial rehabilitation is required due to deferred maintenance.

The LCCE Project area is part of the Rachna-Doab, which lies between the Chenab River in the northwest, Ravi River in the southeast, and the piedmonts of Jammu-Kashmir in the northeast. The canal command of the project area is west of the Ravi River and is spread over an almost rectangular land mass 115 miles long and 27 miles wide. It is bounded in the north by the Rakh Branch of the Lower Chenab Canal, the Qadirabad-Balloki link canal (Q-B link canal) in the east, canal command area of Upper Chenab Canal in the southeast, and Trimmu-Sidhnai in the west. The LCCE system comprises four branches, namely, Upper Gugera,

Mian Ali, Lower Gugera, and Burala branches. (See Chapter 2 for details and maps of the project area)

The Punjab Irrigation System Improvement Project (Pisip)

The project aim is to contribute to sustainable growth by focusing on poverty reduction, institutional development and improved public resource allocation. This is to be accomplished through the following project development objectives:

- Improve agricultural productivity and farm income;
- Contribute to poverty reduction and;
- Establish a decentralized, efficient, participatory and financially sustainable institutional apparatus for the operation and management of the Punjab's irrigation systems

The government has adopted an approach, which is consistent with the Bank's own strategy for the water resources sub-sector and is being supported through the Bank's various operations. The key thrust of this strategy is to foster an institutional policy and operational framework, which would be conducive to efficient and self-sustaining operation and management of the irrigation and drainage systems.

In line with this approach, the planned PISIP project includes a mix of physical, institutional and technical interventions. The Bank contributions for physical rehabilitation are conditional upon the achievement of concrete milestones in decentralized and participatory irrigation management. Towards this end:

- The PISIP aims to complement and supplement the GoPunjab's ongoing efforts to restructure the Irrigation Department into a Provincial Irrigation and Drainage Authority (PIDA). This authority is to be vested with regulatory functions and for dealing with inter and intra-provincial aspects of the Indus Basin River system (IBRS)

- Second, it will establish a commercially oriented Area Water Board (AWB) as a public utility company on each of the two canal commands. Among other functions, the AWBs will receive: a) irrigation water from the PIDA at the canal headworks and sell them to the various farmer organizations and/or any other entities falling within its operational jurisdiction and; b) drainage effluent from the FOs and/or any other entities falling within its jurisdiction and convey it through existing drainage structures to the outlets.
- Third, the project will facilitate and supervise the formation of farmer organizations (FO) at the tertiary irrigation level, with a view to eventually transferring its management to them. The farmers will be involved in the planning, design, implementation and management of the sub-projects (irrigation system improvement) within their area, once the process of social mobilization of the farmers is complete.
- The hard project options are barrage rehabilitation, canal, distributary and minor improvements, modernization of telecommunication and information systems. Supporting these are program interventions in the shape of project management, monitoring and evaluation and technical assistance and training.

The Regional Social and Environmental Assessment (Rsea)

The proposed RSEA for the Punjab Irrigation System Improvement project PISIP) is an attempt to mainstream environmental and social issues upfront in the proposed project, to further develop the institutional component and participatory approaches, and link institutional reform and physical works in order to meet project objectives, especially those of poverty alleviation, efficiency equity and sustainability.

As farmers, especially small and landless farmers, have a central role in project implementation, the social assessment becomes vital to respond and develop interventions to ensure:

- Socio-economic and gender equity and prevention of risks to potentially vulnerable segments of the rural population
- The readiness and capability of the farmers to assume the transfer of the management of the irrigation system
- That incentives are in place for both the users and the agency staff whose jobs would be affected by the transfer program
- Institutional capacity at appropriate levels to enable participation, resolve conflict, enhance service delivery and monitor results and;
- The newly established institutions – the FOs, AWBs and PIDAs are inclusive and represent the interests of the vulnerable groups

The recommended approach to organizing farmers should be participatory, transparent and monitored closely. No pre-defined templates should govern the process. But it should entail meticulous investigation, awareness creation, detailed consultations with the communities, prior to mobilizing them, and training. This, in turn, will define the pace at which these FOs are formed. Basically, there should be flexibility regarding functions, organizational approaches and the entities involved in FO formation. Allowance for innovation and experimentation will eventually reap dividends in terms of ensuring sustainability.

Second, as the proposed project covers about 1.6 million hectares it has many environmental issues that would be best addressed up front in the form of a strategic environmental assessment. Some of these are:

- Environmental impacts related to construction/rehabilitation of the systems – including dredge disposal
- Coordination of irrigation system rehabilitation with other related drainage and groundwater management projects
- Inter-sector water competition and water quality

- Pollution associated with increased fertilizer and pesticide application and agro-industry production; in particular the impacts on wetlands and biodiversity
- Downstream pollution and salinity impacts
- Institutional capacity and information flow arrangements to address environmental issues associated with the project

The environmental sustainability of project activities requires fostering three types of linkages: a) coordination between concerned departments, agencies and farmers for water quality monitoring; the project is not financially empowered to take up harder options, such as mitigation (wastewater treatment); b) lateral coordination between departments and projects tasked with irrigation, drainage and groundwater management; a corollary of this is the possible merger of farmer level involvement in such activities under one umbrella FO and; c) social-environmental interface at the community level to generate economic and health benefits and environmentally desirable outcomes. This activity was not originally contemplated in the project concept document but could prove key, given the increased incidence and diffused nature of water and soil pollution. In other words, while it is important that project activities not harm the environment, equally important their effectiveness should not be marred by environmental pollution and degradation.

Environmental Baseline

The environmental and socioeconomic baselines focus on developing a parametric frame of reference, which assists in the project design, appraisal and planning process and constitutes a benchmark for subsequent project impact assessment and evaluation.

***Natural Environment*:** The Rachna Doab, which includes the LCCE, consists of a huge mass of alluvium deposits of the Chenab and Ravi rivers, about 600 feet deep. Except for limited rock extrusions on either side of the Chenab River in its upper

reaches, ranging in elevation from 100 to 1,600 feet, the project area is generally flat with modest relief. The LBDC surface area has a gentle southwest gradient. The Sukh Beas nullah is the old bed of the Beas River and serves as the main drainage channel in the region. A low but pronounced ridge between the rivers Ravi and Sutlej rivers runs northeast to southwest.

The soils in the two canal commands are predominantly of three types: clayey, sandy- loam, and sandy. The clayey soils are best suited to irrigated agriculture but are poorly drained. Climatically the LCCE and LBCD project areas range from sub-humid in the northeast to semi-arid in the southwest and are characterized by large diurnal and seasonal fluctuations in temperature.

The Lower Chenab Canal Command Area, comprising LCC East and LCC West has a catchment area of about 6,000 square miles. This area is drained extensively with 1,321 miles of surface drains, designed for both seepage and storm water disposal. Most of the LCC East is underlain by saline groundwater, except along strips adjacent to the Chenab and Ravi rivers. The LBDC is underlain with fresh groundwater in its central portion and with saline groundwater in the northwestern and southeastern parts.

***Water Resources*:** The annual surface diversion to the LCCE averages around 4 million-acre feet (2.13 MAF in the *kharif* and 1.89 MAF in the *rabi* season). The LCCE is part of the main Lower Chenab Canal system, off taking from the left bank of the Khanki Headworks. The LBDC off-takes from the Ravi River at Balloki Headworks. Most of the water to the river is sourced in the Chenab and Jhehlum rivers and supplied through the link canals (Qadirabad and Qadirabad-Balloki).

Canal water supply in the LBDC provides only some 44% of the optimal crop water requirements at the root zone at current cropping intensities, reflecting poor delivery efficiency. In the LCCE, the delivery efficiency is much lower, resulting in only 31% of the total water requirements being met by surface flows. The recharge-to-wastage ratio is higher because of the relatively

larger saline water underlay in the LCCE. Public and private tube wells provide 37% of the total water requirements. The future prognosis is one of extreme water stress. The system was originally designed for a cropping intensity of 75%. This is presently close to 150%. While irrigation needs have expanded, supplies have both shrunk and become more erratic, as irrigation infrastructure has deteriorated due to deferred maintenance. At the same time, inter-sector competition, for household and industrial needs has increased.

***Land Use*:** The predominant land use is irrigated agriculture. The dominant cropping pattern in the LBDC is cotton-wheat. The crop data available from Balloki, Sahiwal, and Khanewal subdivisions indicates an overall cropping intensity of about 155 percent, distributed almost equally between the *kharif* (80%) and *rabi* (75%) crops. Cotton accounts for about 44% of the *kharif* cropped area and wheat for about 88% of the *rabi* cropped area. The LCCE project area is defined as a mixed cropping zone. The main crops grown are wheat, cotton, rice, sugarcane, maize, and fodder. The average of five years crop data indicates an annual cropping intensity of about 128.5%.

Both canal commands are being exposed increasingly to the effects of water pollution. The main sources of pollution are chemical and biological contaminants. These are sourced in industrial, household and agro-chemical runoff. Both upstream and downstream effects and the rural-urban interface implicit in such forms of pollution strengthen the rationale for a regional environmental analysis. Although information on such aspects is limited at present, Chapter 6 provides a sense of the water quality issues and the institutional constraints in addressing them.

***Biodiversity*:** 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. Five important wetlands are to be found in the two canal commands: Marala Headworks and Qadirabad

Headworks in the LCCE and Ghamaghar Lake, Kharar Lake Lal-Sohanra National Park and Islam Headworks in the LBDC. 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 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, waterlogging, salination, intensification of production and increased use of pesticides.

While the scanned, enlarged maps provide a fix on environmental characteristics in the two canal commands, they lack precision and some maps are dated. An accurate environmental impact assessment of project activities will require more accurate baseline information, and at much higher resolution levels. Specifically, the project will need detailed environmental information at the distributary level, since distributaries are the foci for all substantive project activities, both of a hard and soft nature. This also reinforces the need for a phased approach to FO formation, as generating such information will be a time-consuming process.

Socioeconomic Baseline

***Social Characterization*:** The estimated population in the LBDC is 4.91 million. The average farm-family size is 8.6 members. An estimated 22% of the population are original inhabitants of the area, 33% are the descendants of the first canal settlers, with the more recent migrants constituting the remaining 45% of the population. The overall average farm size in the LBDC is about 9 acres. Close to

80 percent of the farms (about 150 thousand) in the canal command are in the small farm category. This land distribution pattern in the LCCE, obtained from the Agriculture Census (1990) for Sheikhupura, Faisalabad and Toba Tek Singh districts, closely replicates that in the LBDC. The overall average farm size is about 8.3 acres. About 82 percent of the farms (163 thousand) in the canal command are in the small farm size category.

***Land Distribution and Tenure*:** Strong evidence of polarization is to be found in the two canal commands. The smallest farms have increased rapidly in number. The commensurate increase in area indicates that the average farm size (between 4-5 acres) has remained constant. It appears that this is the bare minimum subsistence level and that farmers prefer to seek off-farm occupation rather than permitting further – and uneconomical - sub-division. This appears to be an outcome of subdivision through inheritance. The declining proportion of large farms is a statistical artifact reflecting, basically, the growing number of small farms. The key finding is that there is only a small areal reduction: in other words, large farmers have been both resuming and consolidating their holdings.

Self-cultivation is the dominant ownership pattern in the LBDC. Owner-operators cultivate about 60% of the farms (112,000); sharecroppers who also farm their own land cultivate about 15% (29,100) and pure tenant–based cultivation accounts for about 25% (46,200). Land leasing has declined noticeably. Compared to 20 years ago, about 40% more farms and over 80% of this area are now operated by pure owners. Concomitantly, rented-in land has declined by almost a half (from 32% to 16% of the total.) Pure tenants, as a category, have remained constant as a proportion of the whole, although the area they are farming has declined, from an average 15 acres in 1970 to about 8 acres in 1990. In general, sharecropping is being replaced rapidly by cash tenancy arrangements; crop tenants have seen their command area fall from 72% in 1970 to 53% presently, while cash tenancy holdings have increased from 27% to 46% over the same period. Cash tenants tend to be more affluent, with access to outside financial resources.

About one-third farms of the farms are fragmented (two to three fragments per farm). Generally fragments are located on different watercourses (mostly adjacent), which means farmers have a stake in more than one watercourse. Fragmentation has diverse causes, including, land availability in parcels at the time of original allotment, sale and purchase over time, inheritance, etc. Consolidation at the small farmer level has proven to be socially and legally complex. Fragmentation often gives rise to disputes over water allocations.

***Poverty and Sustainable Livelihoods*:** Both poverty levels and income earning opportunities for poor people have been assessed. This is a more comprehensive approach as it invokes both the traditionally defined poverty norms, as well as the coping strategies of the poor. In this particular context, this refers to both the occupational distribution and income earning opportunities, based on the perceptions of the poor on what they view as the most onerous aspects of poverty. The traditional poverty criteria considered here includes the head count – the minimum income level required to ensure a prescribed calorie intake for a family -- and adequate service provision (health, education, water supply).

The poor are preponderantly small farmers and tenants, although, reflecting the emerging trends mentioned earlier, owner-operators have become the majority category. However, not all the poor are farmers. The data on the poorest of the poor, defined as "very poor" and "poor" in the classification above reveals the following occupational breakdown:

Table 1: Occupational Breakdown

Occupation	%age (LCCE)*
Farmers	45.67
Servants	13.13
On-farm labor	11.19
Off-farm labor	9.78
Tenants, farm sharing	9.78
Others	10.45

Small farmers and others engaged in farm related activities (on-farm labor, tenants) also engage in animal husbandry – own buffaloes, cattle, goats and sheep – as this constitutes an important source of income and nutrition (milk, meat, manure, work).

Respondents were asked to identify and rank the conditions they felt were most associated with poverty. The lack of arable land, jobs and high dependency were considered the three primary contributors to poverty, with the primacy of the land-poverty association being evident clearly. Also, both men and women showed an unanimity of responses.

Not surprisingly the lack of social services was not cited as a major contributor of poverty. It would be facile to put this down to a lack of perception about the links between health, education and productivity. In fact, as it turns out, access to social services in the LCCE is higher than the national average in most cases. The exceptions are drinking water and sewerage, where coverage is abysmal.

***Assessment of Cooperation/Conflict Among Farmers*:** In land disputes, the large landowners and the well connected tend to prevail, with little recourse to traditional or state judicial recourse, as established social and cultural norms weigh in against them. Land disputes amongst small to medium farmers are resolved by the village elder if the antagonists are from the same village and by the *panchayat* if they reside in different villages, although a *panchayat* ruling may be invoked if the dispute cuts across *biradri*s in the same village. The response to illegal water appropriations is also similar. Large farmers are the winners in this case as well, regardless of whether the appropriations are covert or sanctified by the irrigation department. The only difference is when two villages are pitted against each other, in which case the *panchayat* is called upon to mediate. State judicial recourse has become more prevalent as rural norms and traditions disintegrate and the *panchayats* are viewed as a measure of last resort.

Water conflicts tend to be more common between villages, and between farmers and the Punjab Irrigation Department (PIDA), than among farmers of the same village; in particular, tail-end farmers feel consistently discriminated against. All the farmer groups, except two, were confident that FO would be able to check tampering of outlets, and water thefts if given the mandate and the powers/authority to do so. They were convinced that illegal appropriations were not possible without the backing of PID staff and that if they were withdrawn, such incidents would diminish. The combination of collective social pressure and legal empowerment would constitute an effective check on the excesses committed by feudals and the politically influential.

Potential for Participatory Irrigation Management: Biradaries while figuring strongly in social and political affiliations, were not felt to be a source of water conflicts. In particular, all the farmer groups indicated that such segregation would not affect the sustainability of FOs and issues related to water management. On water related conflicts, the respondents preferred to talk about them individually than in the group sessions. They indicated that outlet tampering, water pumping and breaching were common practices, especially at the head reach of the distributary. The disregard of complaints by the PID, especially when political figures were involved, was cited as evidence of widespread collusion for profit.

No NGO or community organization of note exists in the LBDC. Some of the watercourses have defunct WUAs. On distributaries where the OFWM department is trying to establish FOs the defunct WUAs, are being revitalized and new WUAs constituted on watercourses where they do not exist. More recently, the Punjab Rural Support Program (PRSP) organized a few communities into multipurpose CBOs. While PRSP's primary focus is on micro finance, it is also organizing WUAs as building blocks for the FOs.

An Area Water Board (AWB) has been established on the LCCE, a pioneering effort in the Punjab. The AWB membership consists equally of department officials and nominated representatives from the farmer community – these tend to be influential/large farmers. The AWB has designated FOs at each of the distributaries on field

staff recommendations. The intent is to get these FOs registered with the AWB, prior to transferring management to them. The LCCE-AWB established FOs unilaterally on a large number of distributaries, essentially complying with PIDA's instructions, but without the benefit of farmer participation or consultation. This has been rectified to some extent, as subsequently FOs are being formed in a more consultative manner but social mobilization and participation still is, substantively, lacking.

Diverging sentiments among farmers regarding the viability of the new institutional arrangements are based on deliberate misinformation by the Irrigation Department. Examples of such misinformation are: the irrigation system would be handed over to expatriate investors; water rates would increase precipitately/would be charged on an hourly basis; meters would be installed on outlets (*mogahs*); executive members of the FO would get more water.

Not surprisingly, the operational PID staff (SDOs, XENs) are skeptical about the whole process. This reflects, partly, their lack of involvement in it and, partly, the fear of the loss of jobs and prerogatives. They also feel farmers are incapable of handling the technical aspects of irrigation management.

A large segment of responding farmers were unreservedly enthusiastic about the proposed management transfers, not least because they were unhappy with the performance of PID. Only on large distributaries did farmers feel a sense of inadequacy and supported joint (farmer-PID) management, although they were emphatic that the PID should, eventually, be phased out. The majority of the groups favored comprehensive and upfront transfer, which included rights and responsibilities, such as: a) the right to hire and fire staff, reflecting their disgruntlement with the PID operational staff and the revenue *patwari);* b) right-sizing the outlets (*mogahs*); O&M; collecting and distributing *abiana* (water rates) and; enforcing fines and penalties for water theft and outlet tampering. The farmers were confident that they could check misdemeanors, provided they were given the authority/powers and the support of the local administration.

Farmers felt their involvement would ensure equitable water distribution, namely, the tail reaches would not be deprived of water. Alternately, farmers without water would not have to pay *abiana* as they currently were doing. They were confident they could assess and collect *abiana*, although some expressed a need for technical training and guidance. All the farmer groups knew, approximately, how much *abiana* was collected annually from their village/watercourse and there were strongly worded sentiments to the effect that 'not a single *paisa* was spent on the O&M of the distributary.' If necessary, they were prepared to pay even higher rates, provided they were given the collective right to spend it.

Eight of the nine surveyed groups supported an open general body meeting, to review and nominate candidates for the FO executive body. A consensus process was preferred to elections, the concern being that elections could degenerate into political infighting and party alignments. No specific criteria or qualifications were specified for the members. However, farmers generally recommended nominating individuals, who were experienced, dedicated and possessed the requisite educational, economic and moral attributes. The suggested tenure for the members was 2-3 years, subject to removal or renewal by a two-thirds majority of the general body.

In response to equity concerns, such as representation of tail end and small and landless farmers in the executive body, the spread of responses was as follows:

- The chairman should not own more than 5 acres
- Fix a quota for tail-end farmers
- Let the FO be an open forum with no quota for anybody and let farmers discuss and decide.

The initial focus of the FO should be on water management. Once the FO had reached maturity, only then should it get involved in areas such as health, education, sanitation and agriculture-related activities (credit, inputs).

Project Environmental Impacts and Analysis of Alternatives

***The Context*:** A stand-alone analysis of the potential environmental impacts of project activities is likely to weigh on the side of benefits, a conclusion predisposed by the category-B rating of the PISIP project. However, a regional analysis captures overarching environmental effects, not visible in a localized analysis. The risk is that such effects may neutralize envisaged project benefits. Thus, additional interventions may be required, which were not originally conceived. This could take the form of lateral linkages between projects, policy and program coordination between departments and community participation in environmental management.

A corollary to this is that a with-and-without project analysis becomes a bit redundant in view of the regionally inclusive nature of the project. Additionally, there exists a non-reversible policy decision to commercialize and devolve irrigation management. In other words, while counterfactuals can be established, the policy fait accompli makes a with- and-without analysis redundant. Instead, the study assesses in qualitative terms the environmental impacts of an integrated approach to environmental management, relative to those arising out of the originally designed project activities.

There are more potential environmental benefits than risks associated with the project. First, physical irrigation system improvements are likely to lower the incidence of water logging and salinity as a result of reduced seepage from the canals, distributaries, minors and watercourses. Second, the institutional reforms, aimed at commercializing water distribution and transferring irrigation system management to the AWBs and FOs will ensure better O&M of the rehabilitated irrigation infrastructure and improved on-farm water conservation practices. Third, reduced seepage also means fewer adjacent water bodies and ponds, which tend to become breeding grounds for malarial vectors.

Environmental risks pertain largely to dredge accumulation and disposal during system rehabilitation.

However, as the identified benefits are largely derivative -- a result of project activities aimed at securing other objectives -- additional interventions are required to make them sustainable. Also, non-project related developments could pose environmental problems within the project area. Finally, parallel project activities have the potential to synergize environmental benefits, originally sourced in the project. In order to maximize such benefits and mitigate negative impacts, environmental issues need to be mainstreamed in the project, regardless of origin. This will require institutional modifications, enhanced scope for farmer participation and a greater involvement of women in project activities.

***Regional Aspects: Water Quality Deterioration*:** The need for a regional analysis is dictated by concerns with water quality deterioration, manifested in upstream and downstream impacts. Second, the growing inter-sector competition for water is likely to exacerbate the problem, as existing supplies are recycled more frequently to meet a steadily increasing demand.

Water pollution poses an active threat to farming communities both within and outside the project area, as it affects both human health and biodiversity. Irrigation water is the main source of drinking water in many small towns and villages, especially where the ground water is brackish. Thus, through no fault of their own, downstream residents are exposed to adverse health effects 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 wastewater to farmers for vegetable 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 to be biologically and/or chemically contaminated. Over the years, there has been a change in the pollutant composition towards chemical sources.

***Lateral Project Integration and Departmental Coordination*:** The planning and implementation of irrigation and related activities in the two canal commands has followed a fairly random pattern. The practice has been to proceed sub-sectorally. Clearly, this is not the best way to generate synergies between related activities (irrigation, drainage, groundwater development, on-farm water management etc.), or to mitigate environmental concerns. For instance, it neglects critical issues of sequencing. In particular, a number of environmental and health problems (soil and water salinization, wetland degradation, mosquito infestation, etc.) could have been averted had a more integrated approach been adopted. However, the various sub-sectoral projects in the two canal commands include all the key components. The challenge is to strengthen linkages between the related activities with a view to improving efficiency, ensuring equity and achieving sustainable environmental benefits. Three projects underway, where such potential links exist are: a) the National Drainage Program; b) the Punjab Private Sector Groundwater Development Project and: c) the On-Farm Water Management Project – IV.

***Social-Environmental Interface*:** An important aspect of the RSEA approach lies in its recognition of the potential interface between social and environmental activities. The surveys in the two canal commands revealed how farmers and women could engage in environmental mitigation and conservation:

- Plantation of vegetation/trees/grasses which could provide both environmentally-related benefits (erosion control, N-

fixing, stabilizing slopes, etc.) and social/livestock benefits (fuel, fodder, food, income-generating materials)

- Gender focus: Social/health impacts of water quality, or the water quality impacts of social issues (washing, livestock intrusions). Women can be potentially engaged in environmental and health issues surrounding water quality: siting of drinking ponds, wastewater disposal, water treatment, re-designing water containers, hand washing, health advocacy
- Women's role in irrigation management: keeping livestock out of irrigation channels, washing clothes in canals and distributaries
- Waste water cultivation: its benefits (nutrient rich) and health impacts (bore worms, water pollution through seepage)
- Farmer involvement in irrigation/drainage management at the tertiary level for sustainable environmental benefits (reduced water logging and salinity)
- Farmer involvement in monitoring ground water balance
- Disposal/use of excavated earth in a constructive manner, such as embankment lining, paths, crop diversification, etc.

***Environmental Mainstreaming*:** The institutional and organizational initiatives represent efforts at environmental mainstreaming. There is an informational and awareness creation aspect to this as well which will lead to further improvements in environmental management. Specifically the following activities are envisaged:

- Investigation of water quality monitoring arrangements
- Assessment of water quality impacts (health, agricultural productivity, biodiversity) to feed into other projects, such as the Lahore Urban Development project as well as the project FOs.
- Creation of an environmental monitoring cell within the CDSG. These cells should eventually be replicated in the AWBs (mandate, structure and required skills to be determined during project implementation). Training of

farmers and officials of PIDA/AWB in environmental monitoring

- Identification of the key policies and institutions with a potential role in environmental monitoring and mitigation. Among others, these would include the following:
  - The Environmental Protection Act (1997)
  - Provincial EPAs
  - Provincial PDA
  - Provincial industry departments
  - PIDA
  - Agriculture departments
  - Fisheries departments
  - Forestry and Wildlife departments
  - WAPDA
  - WASAs
  - Municipal corporations and development authorities
  - PHEDs
  - Private sector, farmers, NGOs, ag. universities

- Examination of the institutional/legislative and legal precedents for regulating industrial and municipal discharges into 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.
- Recommendations for the development of RSEA capacity to aid information-based decision-making aimed at mainstreaming environmental issues. This would include:
- Information management (development of appropriate GIS/ management information systems).
- Training and awareness creation
- Monitoring and evaluation capability
- Consultation processes for multi-sector decision-making and conflict resolution
- Environmental baselines
- Assessment and propagation of new technologies: salt-resistant crops, fodder and grasses in these areas; recycling of drainage effluents; biological control measures; irrigation

with saline water; alternatives for pesticide and fertilizer dependant crops

Institutional and Policy Issues

Against a backdrop of a long history of state managed irrigation system, participatory irrigation management (PIM) presents quite a formidable challenge. The situation is complicated with the overriding laws, inadequate enabling laws and rules of business, lack of experience of the newly created institutions, apprehensions by various quarters on the social feasibility of the implementation arrangements, and vested interests that may lose control of the scarce resource and the discontinuation of the rents. Following is a review of the factors that may impede and slow down the transition to the new proposed institutional arrangements.

***Overriding and Enabling Laws*:** The Canal and Drainage Act of 1973 is still the dominant and overriding irrigation law. The Act legally ties water allocation to a specific piece of land and combines the land and water sale as synonymous. This is strengthened by the Land Reforms Act of 1972 that makes landowners responsible for water rates/charges. The other legal acts and laws include: the Canal and Drainage Act, 1873; the Punjab Minor Canal Act, 1905; the Soils Reclamation Act, 1952, the Cooperative Farming Act, 1976; the Land Revenue Act, 1967; and The On-Farm Water Management and Water Resources Association Ordinance, 1981.

The PIDA Act does not clearly recognize the FOs as legal entities. Even the act of transferring responsibility to assess and collect water charges and to ascertain the portion to be retained by the FOs for O&M is not clearly defined as a law and are determined in an *ad hoc* manner, as deemed fit by the AWB/PIDA. The FOs are to be governed by Rules and Regulations framed by the PIDA., and hence their position as legal entities is still unclear.

In order to enable the AWBs and FOs to function as legal independent entities, the relevant over-riding Acts need to be

amended. First, disputes (example section 20,68 and 68A of the Drainage and Canal Act, 1873) can not be resolved at FO or AWB or PIDA level and will continue to end up in the civil courts under the Arbitration Act, 1940. The PIDA Act should repeal and modify such provisions to allow redressal at the farmer.AWB.PIDA level, with appropriate legal coverage.

Second, the institutional reforms should bring in necessary amendments in the PIDA Act to strengthen the status of FOs as legal entities and provide flexibility in allowing water trading, de-link land ownership from water entitlements, with water ownership. system.

Third, in order to ensure permanency and legal cover for the transfer of management to FOs, PIDA should consider two options: either revise the PIDA Act and get this enacted, or request the government (competent authority) to promulgate an ordinance for a limited period subject to ratification by the provincial assembly.

Fourth, eliminate the ambiguity arising from the PIDA Act in the presence of Canal and Drainage Act and Land Revenue Act which makes farmers liable to double indemnity, in as much as they are required to pay an 'owners' rate' (value added/benefit drawn due to irrigation) in addition to the occupiers rate (as user charges).

***Institutional Capacity*:** The capacity to manage the transition at the required pace is hampered by the absence of designated personnel. In addition, the staff at the PIDA and AWB need to be sensitized about the social engineering aspects in general, and gender specific concerns in particular.

The FOs should represent the bulk of share holders within a distributary command. Also, technical assistance is required to strengthen the technical, financial, environmental and social capacities of the FOs. Two organizations that have shown

interest in assisting PIDA/AWB in organizing communities FO are IIMI and the OFWM department.

Monitoring and Evaluation Strategy

The monitoring and evaluation strategy should be governed by the generic project objectives of equity, efficiency and environmental sustainability. By the same token, monitoring and evaluation should entail full stakeholder participation, from the development of indicators to assessment of performance. The modalities for an umbrella framework to monitor farmer-managed irrigation systems, is presented below. Its purpose is to assess the effectiveness and sustainability of FOs and, based on such assessment, to recommend transfer, or otherwise of management responsibilities to the constituted FOs.

FO formation is mandated across a number of World Bank and Asian Development Bank funded projects engaged in irrigation/groundwater/drainage rehabilitation and management Pilot initiatives have already been launched in an attempt to develop sustainable and cost-effective approaches towards irrigation management. However, despite the many social and political complexities, there is robust evidence of success in other countries, with farmers' willingness to organize around water being a key-contributing factor.

Clearly replication of such innovations on a large scale in Pakistan will be a formidable task and needs to be monitored and supported at every stage; from inception to transfer to post-transfer operations. However, existing constraints should also be recognized. The devolution process has barely gained momentum. While the legal initiatives are in place, farmers are unaware of their envisaged role, institutional mechanisms are not in place and NGOs need to be identified and sensitized.

Therefore, a phased approach is recommended. Such an approach is less forcing and likely to encourage the spontaneous and voluntary participation of farmers and NGOs

via demonstration effects. Space is also created for appropriate mechanisms and programs to evolve for inter-departmental coordination, awareness creation and training – both among farmers and department staff. Essentially, FO formation should proceed with a view to making them viable institutions rather then just paper entities, which invites risk of process failure and reinforces entrenched mindsets against innovation.

***Umbrella Monitoring and Evaluation Unit*:** With the above in mind, it is intended to establish an Umbrella Monitoring and Evaluation Unit (UM&EU) with cross-project responsibilities. The unit should be activated immediately, eventually becoming part of the Project Development Support Group (CDSG), housed in the Punjab Irrigation and Drainage Authority (PIDA). One of its key tasks will be to assess the social, technical and financial competence of the FOs, based on a combination of pre-established criteria and collective judgment. Subsequently, the UM&EU will make a recommendation to PIDA on whether to sanction or with hold transfer of management. FOs recommended for such transfers will be supported in their operations by the CDSG for a period of one year.

Whil approval criteria should not be unduly stringent, making allowance for the fact that FOs will continue to obtain post-transfer support services from the PDSG, minimum conditions for effectiveness and sustainability need to be met. These are as follows:

- ***Equity***
    - Representation of sharecroppers, tenants and small/poor farmers (in both the general and executive bodies)
    - Representation of non-farmers/landless users of the irrigation system
    - Proportionate representation of small, medium and large farmers in the general and executive bodies (if there are more small farmers on the distributary,

they will have proportionately larger representation on the FO)
- Established and functioning judicial appeal mechanisms

- ***Organization***
  - Completion of detailed socioeconomic baseline surveys prior to FO formation
  - Training in social mobilization skills
  - FOs built up from the level of water users associations (WUAs) organized around watercourses
  - Entire length of the distributary represented in the FO (length will also determine the structure, i.e. number of tiers)
  - FOs initially developed around irrigation and drainage management
  - Executive body membership by rotation (either by consensus or election)

- ***Finance and Revenue***
  - Designated members trained in financial (accounts) and revenue management (*abiana*), land records)
  - Contractual arrangements formalized
  - Arrangements for farmer contributions formalized

- ***Technical***
  - Training in O&M (irrigation and drainage), instrument reading and communications provided
  - Contractual arrangements formalized
  - Training in participatory M&E

- ***Social-Environmental Interface***
  - Training in biological stabilization (community plantation -- trees, fodder, grasses)
  - Awareness of social and economic benefits
  - Awareness of water quality and health issues (potable water, waste-water vegetable cultivation)

Monitoring Indicators: The matrix form presentation of indicators in the report is visually convenient and also provides a sense of their cross-sectional importance. While the indicators have been distinguished by their physical and performance characteristics, a further subdivision by their input and output attributes and an objectively verifiable quantification will be undertaken. The indicators were developed based on discussions with PID, PIDA, AWB staff and in consultation with farmers who are actual or potential members of FOs and WUAs

Project Roadmap

The project roadmap attempts to sequence activities with a view to integrating effectively social and environmental concerns into the project. The desired outcomes are widely shared growth, poverty reduction and sustainable natural resource management, outcomes subsumed under the term sustainable human development. The key issues and concerns, which have been addressed separately in previous chapters, are as follows:

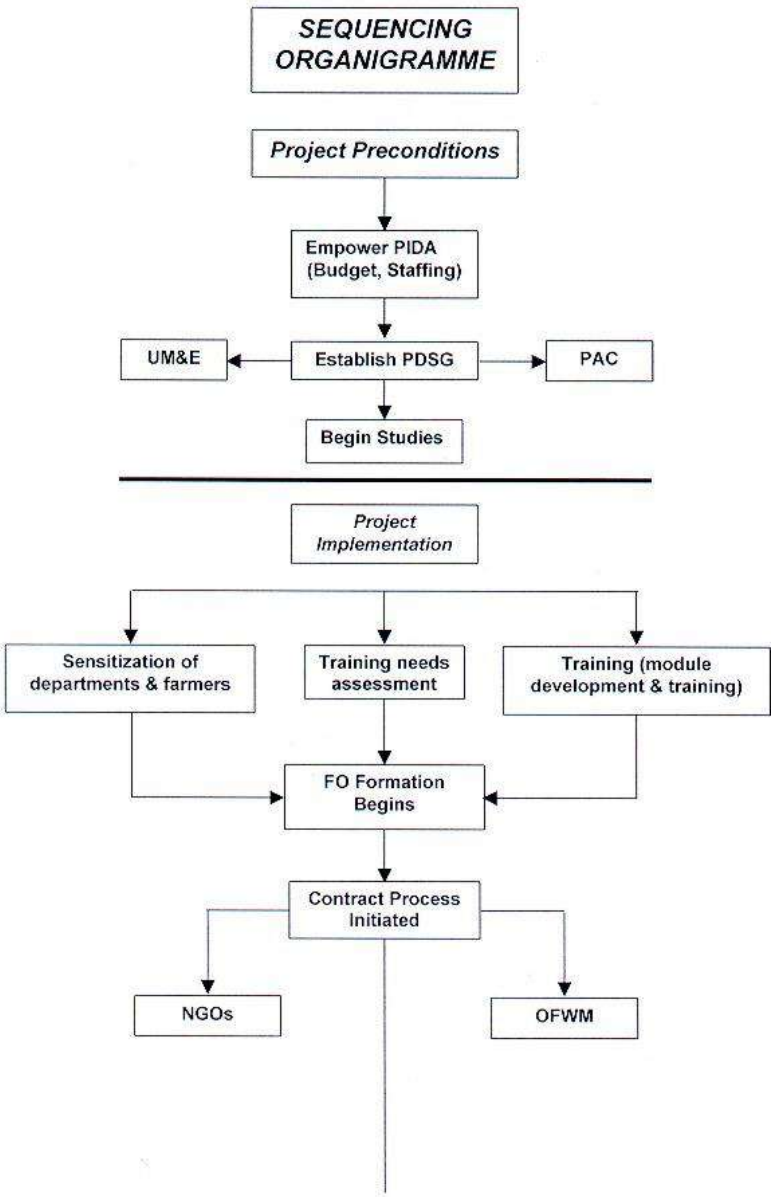
- Strategies for the inclusion of vulnerable farmers and other stakeholders (NGOs, CBOs, private sector)
- Assessment of the appropriate management roles for farmers
- Mitigation of environmental concerns
- Assessment of institutional capabilities and responsibilities, particularly with a view to poverty alleviation and environmental mitigation
- Legal and regulatory framework development (PIDA, AWBs, FOs)
- Assessment of the major social and environmental impacts of the project
- Monitoring and evaluation plan

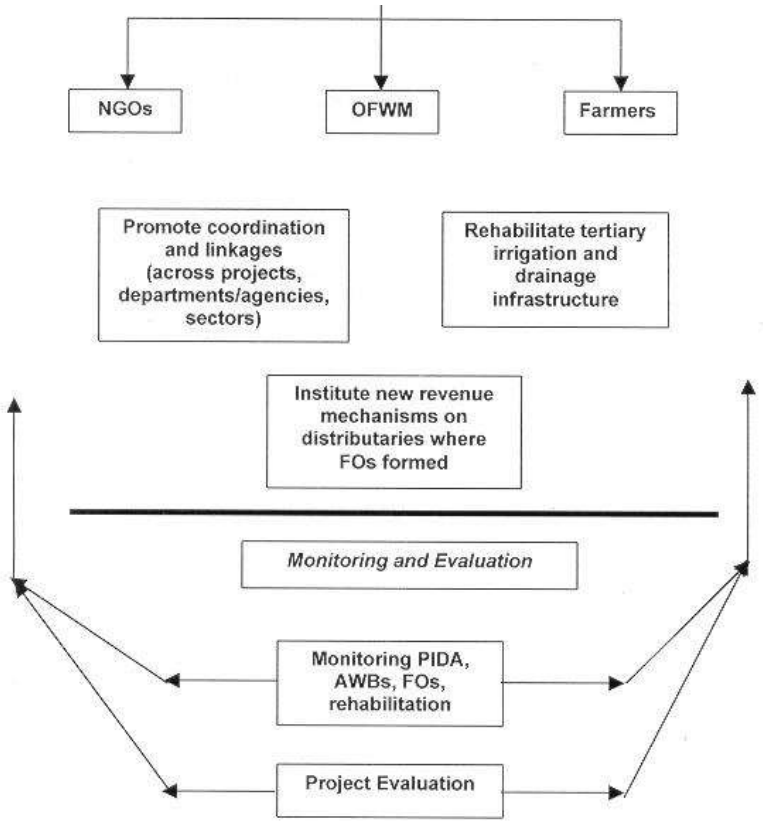
The chapter segregation is convenient for highlighting the different but related aspects of the project. However, a management plan is required to bring these aspects together as one integrated whole. This chapter attempts this by defining a clear sequence of activities and is proposed within three broad classifications, namely:

- Project Preconditions

- Project Implementation
- Project Evaluation

The proposed sequencing is presented in the organigramme below:


SEQUENCING ORGANIGRAMME
Project Preconditions
Empower PIDA (Budget, Staffing)
UM&E
Establish PDSG
PAC
Begin Studies
Project Implementation
Sensitization of departments & farmers
Training needs assessment
Training (module development & training)
FO Formation Begins
Contract Process Initiated
NGOs
OFWM


NGOs
OFWM
Farmers
Promote coordination and linkages (across projects, departments/agencies, sectors)
Rehabilitate tertiary irrigation and drainage infrastructure
Institute new revenue mechanisms on distributaries where FOs formed
Monitoring and Evaluation
Monitoring PIDA, AWBs, FOs, rehabilitation
Project Evaluation

Regional Social and Environmental Assessment: An Irrigation Management Interface

Abstract

Traditionally, Pakistan's agriculture development strategy centered upon the use of high-yielding hybrid seed varieties and intensive use of chemical inputs, premised upon a sufficiency of land and water and supported by enabling research institutions. In recent years, such a strategy has become increasingly unviable as land and water constraints emerge, coupled with growing evidence of soil and water degradation and declining productivity. Based on a case study approach, this monograph explores the scope for alternative approaches to sustainable agricultural development. It assesses farmer level and institutional responses to management innovations and proposes an approach to institute and monitor them. The key management interventions are farmer participation at the distributary level, market-governed water distribution, the integration of irrigation, drainage, agriculture and water quality monitoring activities at the department and project level and the promotion of a social-environment interface at the farmer level.

1
Introduction

The Regional Social and Environmental Assessment (RSEA) for the area impacted by the proposed Punjab Irrigation System Improvement Project (PISIP) has been carried out in accordance with the World Bank operational guidelines (World Bank: 1996). The two projects areas are the Lower Chenab Canal Command East (LCCE) and the Lower Bari Doab Canal (LBDC). The RSEA has been suggested to provide a focal point for environmental and social issues relating to the project. The joint RSEA reflects the high degree of interaction between environmental and social issues in participatory irrigation system rehabilitation projects, such as the PISIP.

The primary objective of the RSEA is to provide a framework to address key social and environmental issues in the proposed project in order to shape environmentally and socially sustainable investment strategies to achieve desired project outcomes.

1.1 Background

Around 80% of the arable lands and 90% of agricultural output (which accounts for more than a quarter of GDP) in Pakistan depend entirely on the Indus Basin Irrigation System (IBIS), which is the largest integrated irrigation network in the world. It consists of three major storage reservoirs, 19 barrages, 12 inter-river link canals, 43 irrigation canal commands, and over 107,000 watercourses delivering water onto the farms. Practically the entire system is unlined, resulting in system losses due to seepage, particularly at the watercourses. Annually, the system draws an

average of 106 million acre feet (MAF) of surface water for irrigation, supplemented by another 43 MAF of pumped groundwater, much of which is by way of recovery from system losses due to seepage in areas underlain by fresh groundwater.

For the past forty years or so, agricultural policies in Pakistan have been defined by the so-called "Green Revolution" strategy of agricultural growth. This strategy was premised upon a sufficiency of both land and water. Major irrigation schemes (Mangla and Tarbela) were launched to harness this water and to apply it at both the extensive and intensive margins. The intensive application of water and chemical inputs to high yielding dwarf varieties did indeed enhance crop yields in wheat, rice, cotton and maize to a remarkable degree. However, preliminary evidence of resultant soil depletion is beginning to emerge. Also, due to the inability of the drainage system to cope with the excess water and, indeed, problems of water logging and salinity emerged rapidly (see text box). The public sector Salinity Control and Reclamation Project's (SCARP) effectiveness in combating the twin problem is disputed. However, it did catalyze extensive private sector investments in groundwater development, which complemented its reclamation efforts and made possible both substantial and need-based additionality of irrigation water.

As the benefits of the Green Revolution began to peak and production began to level off a need for reassessing strategy became imperative. Factors contributing to the deceleration in production were limits to land expansion at the extensive margin; declining water availability, evidenced in the declining water table in many canal commands, diminishing returns to fertilizer use and the virtually complete diffusion of the Green Revolution technology. The institutional environment proved ill equipped to deal with emerging constraints and there have been few efforts to forge systemic links between economic, social and environmental forces. The emerging land and water constraints, the deterioration in their quality and the adverse impact on small farmers suggest the need for a strategy that is more socially and environmentally sensitive.

The Indus Basin Drainage and Irrigation System (Faruqee and Ahmad: 69: 1999)

The Context

The scope for increasing cultivation at the extensive margin has been exhausted in Pakistan. Similarly the upper limits of surface and ground water have been reached, as evident in declining water tables in many canal commands (NCS: 1992). The additional provision of 12 MAF in the Indus Water Accord (1992) would have ecologically adverse impacts on coastal resources (mangroves) and would exacerbate water logging and salinity as the drainage infrastructure is already overtaxed and would be unable to cope with the additional retention. At the same time, considerable scope exists for cropping intensity increases (8 million hectares according to the NCS, 1992), provided additional water can be made available. An environmentally-friendly option is improved water use efficiency, which can be achieved through a combination of pricing and institutional reform

System Constraints

The irrigation network, originally designed as a run-of-the-river system, has come under pressure, with its overlay of additional reservoirs, barrages and canals. The lack of natural drainage, compounded by the criss-cross of roads, railways, flood embankments and irrigation systems, tend to obstruct natural flows. Drainage investments in the shape of deep tube wells and horizontal drainage have only partly addressed the problem, as about 4.5 million hectares is still not served by the system. Poor drainage and low canal delivery efficiency (35%-40%) have given rise to endemic problems of water logging and salinity About 43% of the canal command area (CCA) is water logged and about 14% is moderately-to-severely salt affected. While, seepage contributes to groundwater recharge, considerable wastage also occurs, especially where the seepage occurs over saline zones.

Economic and Institutional Inefficiency

Water logging and salinity, overexploitation of fresh groundwater, low delivery efficiency, and inequitable distribution also reflect a policy failure; in other words, the tendency to treat water as a public good. Surface water is distributed free of cost under the 'warabandi' system, while groundwater extraction is subsidized (energy subsidies) and the lack of formally defined water rights hinder its sale to other farmers.

O&M charged by the provincial irrigation departments (PID) is low and has been decreasing over time, while capital cost recovery has been discontinued. This prevents system rehabilitation and improvement. Water charges are funneled into the provincial budget, rather than being used for O&M. The discrepancy between water rates and the true value of water to farmers encourages collusion with irrigation department officials, discrimination against small farmers, illegal water appropriations and deprivation of farmers at the tail reaches.

The PIDs tend to be locked into rigid mindsets and resist institutional, technical or management innovations and are encumbered by funding constraints. Weaknesses exist in the area of planning (poor investment planning, lack of integration between long-term sectoral plans and short to medium term development plans). Contracting/construction oversight of irrigation and drainage infrastructure is weak and there is little inter-agency coordination.

1.2 Need for the Rsea

The Regional Social and Environmental Assessment is a tool to help development planners design investment strategies, programs and projects that are environmentally sustainable for a region as a whole. The RSEAs take into account the opportunities and limitations represented by the environmental and social systems of a region and assess on-going and planned activities from a regional perspective (World Bank: 1996).

The PISIP institutes a continuing role for farmers in project implementation. The farmers will be involved in the planning, design, implementation and management of the sub-projects within their area once the process of social mobilization of the farmers is complete. The social assessment becomes vital to respond and develop interventions to ensure:

- Socio-economic and gender equity and prevention of risks to potentially vulnerable segments of the rural population
- The readiness and capability of the farmers to assume the transfer of the management of the irrigation system
- That incentives are in place for both the users and the agency staff whose jobs would be affected by the transfer program
- Institutional capacity at appropriate levels to enable participation, resolve conflict, enhance service delivery and monitor results and;
- The newly established institutions – the FOs, AWBs and PIDAs are inclusive and represent the interests of the vulnerable groups

The proposed project covers the rehabilitation of irrigation systems that irrigate about 1.6 million hectares. The proposed project has many environmental issues that would be best addressed up front in the form of a strategic environmental assessment. Some of these are:

- Environmental impacts related to construction/rehabilitation of the systems – including dredge disposal
- Coordination of irrigation system rehabilitation with other related drainage and groundwater management projects
- Inter-sector water competition and water quality
- Pollution associated with increased fertilizer and pesticide application and agro-industry production; in particular the impacts on wetlands and biodiversity
- Downstream pollution and salinity impacts

- Institutional capacity and information flow arrangements to address environmental issues associated with the project

The proposed RSEA for the Punjab Irrigation System Improvement project PISIP) is an attempt to mainstream environmental and social issues upfront in the proposed project, to further develop the institutional component and participatory approaches, and link institutional reform and physical works in order to meet project objectives, especially those of poverty alleviation, efficiency equity and sustainability.

1.3 Scope of the Rsea

The RSEA's scope involves a broad definition of the social and natural environment and its inter-linkages and, hence, covers much more spatial extent and disciplines than a traditional project-level assessment. The areal extent may be larger than the immediate project area for analyzing any significant cumulative and downstream impacts of project components, as they relate to social, economic and environmental outcomes. In particular the tasks of the RSEA are to undertake the following the following:

- Assess the environmental and social issues and help establish an integrated development policy for the two canal commands and for the proximate region
- Provide guidelines for planned project investments spread spatially and temporally over the project region. The key elements, relating to vertical, lateral and social-environmental linkages, are as follows:
    - The scope, feasibility and nature of project activities promoting lateral coordination (between departments, between projects and across stakeholders – departments, NGOs, universities, research institutions, autonomous and semi-autonomous bodies)
    - The prospects for a social-environmental interface in promoting community-based environmental management

  - The approach to social mobilization and pace of social organization aimed at devolved farmer-based irrigation management
  - The institutional prerequisites and problems associated with decentralized and commercial approaches to irrigation management

- Evaluate the environmental and social performance of the project, with adequate monitoring indicators and evaluation strategies
- Establish cross-policy synergies to maximize project effectiveness and sustainability

1.4 The Objectives of the Rsea

The overall development objectives of the PISIP are to:

- Improve agricultural productivity and farm income, and thereby contribute to poverty reduction, and;
- Foster an institutional framework that will be appropriate for the efficient, equitable and fiscally sustainable operation, management and maintenance of the irrigation and drainage systems of the Punjab, which accounts for nearly two-thirds of Pakistan's irrigated lands

The specific objectives of the RSEA, aimed at optimizing project outcomes, are to:

- Help identify potential social and environmental benefits and concerns relating to the project
- Recommend appropriate safeguards and mitigation measures
- Better integrate the irrigation and drainage and inter-sectoral issues for the proposed project areas
- Establish linkages with ongoing and proposed programs and projects (including the sequencing of activities)
- Develop an Environmental Management and a Farmer's Participation Plan

- Establish baselines, monitoring and evaluation indicators for estimating positive and negative social and environmental impacts
- Develop a monitoring plan and information management and capacity building for farmer's participation and environmental management

1.5 Rsea Methodology

Social, economic and environmental information for the RSEA has been obtained from secondary sources, and primary data collection through different methods, including focus group discussion, scoping sessions, semi-structured interviews and questionnaires.

The sociologist contacted relevant individuals and departments/sections of The World Bank and The Punjab Irrigation Department. He used the case record review method to extract information not directly available. In addition, he consulted research reports, documents, and monographs prepared by other agencies, NGOs or/and line departments. The data was analyzed and is presented in a form that is easy to use by other members of the team and the PID. For this purpose consultation meetings and a seminar were organized for the officials of the PID.

In order to plug data gaps and fine-tune the data from secondary sources, the sociologist organized scoping sessions with farmers and with different stakeholders, including women to get a collective view. He also conducted semi-structured interviews.

1.5.1 Project Description

The project overview is based on available reports and documents. Fact sheets for each project component, elaborate the social, institutional, and environmental issues and concerns.

1.5.2 Overview of Baseline Conditions

Socioeconomic and environmental baseline conditions of the project-impacted area are presented, based on available reports/information/secondary data. Also identified are the missing data and information gaps required for a comprehensive social and environmental impact assessment.

1.5.3 Social and Environmental Baseline

The key aspects covered in the environmental baseline are:

- General (maps)
- Climate and topography
- Physiography
- Water resources
- Water quality and salinity
- Land and biodiversity
- Environmental hotspots

Potential environmental costs and benefits are identified at three levels: a) project specific (area and components); b) regional (upstream and downstream effects) and; c) intersectoral (the effects of urban and industrial pollution on irrigation water quality). Inclusion of each of these elements is key to an integrated analysis.

About 30 scoping sessions carried out on selected distributaries in the two canal commands, collected information on social, environmental and economic aspects: ethnicity, land tenure arrangements, farm size distribution, access to irrigation under various tenure arrangements, and livelihood strategies of the rural poor. The sessions also assessed the organization, irrigation management and conflict resolution potential among farmers and their perceptions regarding the institutional reform process. Additional surveys generated information for constructing poverty profiles and gender participation in irrigation management.

The sessions also elicited responses about community perceptions regarding environmental benefits and costs associated with the

project. The key issues related to: a) the impacts of water logging and salinity on crop productivity; b) salt water intrusion from surrounding areas; c) fertilizer and pesticide impacts on soil and water quality; d) benefits of improved drainage; e) health impacts of water pollution; f) flood plain benefits versus flood control; g) value of biodiversity/genetic varieties; h) benefits of monocropping versus crop rotation; i) importance of wetlands. The broad purpose was to determine whether farmers were aware of the adverse environmental consequences of switching from traditional to modern agriculture, if so, what were the mitigatory measures required, whether they could be implemented in a participatory manner and what were the training and advocacy requirements for sustainable agriculture.

1.5.4 Environmental and Social Screening

A social, environmental and institutional screening was carried out. The matrix enumerated the following sequence of activities: project activities; potential field actions associated with such activities; the impacted stakeholders and region; the institutional social and environmental impacts; proposed mitigations; key outcomes as a basis for developing indicators/monitoring frequency; and the associated risks.

1.5.5 Project Impact and Analysis of Alternatives

A stand-alone analysis of the potential environmental impacts of project activities is likely to weigh on the side of benefits, a conclusion predisposed by the category B rating of the PISIP project. An analysis of alternatives is proscribed by a non-reversible policy decision to commercialize and devolve irrigation management. In other words, while counterfactuals can be established, the policy fait accompli makes a with- and-without analysis redundant. Instead, the study assessed the environmental benefits and costs arising out of an integrated approach to environmental management.

Three key aspects have been addressed: a) overarching concerns, such as, inter-sector water competition and the growing and diffused nature of water pollution; b) lateral department and project coordination to address water logging and salinity problems as well as conjunctive use of surface and groundwater and; c) the social-environmental interface with a view to sustainable environmental management. Clearly, the environmental issues are complex and many of them cannot be addressed by the project. Nonetheless, a holistic assessment is precedent to identifying feasible levels of intervention.

1.5.6 Institutional/Policy Issues

A review of the policy, legal, and institutional framework was carried out and consultations held with various stakeholders to solicit their concerns and perceptions regarding the consequences of decentralization and the reduced role of the state. The review also assessed the institutional arrangements and implementation capacity for mainstreaming social and environmental issues in various stages in the project cycle. This included:

- A capability analysis of PIDA, AWBs, FOs, WUAs, and their terms of partnership, drawing upon reports and discussions with DOI and PIDA staff.
- An assessment of the constraints likely to be faced by various entities due to divergence in the mandate, legal status, autonomy and how these should be addressed to ensure integrated irrigation, drainage and groundwater management;
- Identifying the locus of reform leadership within the key DOI entities and ascertaining their readiness to champion the proposed reforms;
- Reviewing and documenting the types of reforms being proposed for key DOI entities and the pre-requisites to launch, institutionalize and sustain the reforms;
- Developing realistic time-lines for the proposed reforms;
- Evaluating NGOs capabilities to mobilize communities and establish FOs;

- Developing modalities for strengthening community mobilization capacity, improving inter-agency coordination, training, and general institutional strengthening

1.5.7 Monitoring Strategy

A monitoring and evaluation strategy is proposed, governed by generic criteria of equity, efficiency and environmental sustainability. By this token, monitoring and evaluation should entail full stakeholder participation, from the development of indicators to the assessment of performance. In this context, indicators are presented with the understanding that they be part of an iterative process, reviewed continuously and modified as stakeholder participation increases.

The modalities for an umbrella framework to monitor farmer-managed irrigation systems, are presented. Its purpose is to assess the effectiveness and sustainability of FOs and, based on such assessment, to recommend transfer, or otherwise of management responsibilities to the constituted FOs. The framework will take into account the integrative aspect of the project as well as its social, environmental and institutional dimensions. However, an assessment of institutional effectiveness is implied in this framework; indicators to measure institutional performance are also developed.

1.5.8 Consultations

The RSEA is informed by extensive consultations with various stakeholders. These include, beneficiaries, the Irrigation Department, the Agriculture Department, NGOs, implementing agencies of other irrigation projects. The thrust of the consultations will be on: a) the perceived environmental and social impacts (both positive and negative); b) mechanisms for establishing linkages with other related projects; c) processes to ensure the participation of key stakeholders, such as farmers and other marginalized groups and; d) feedback modalities during

project implementation and also during the participatory M&E process.

1.5.9. Farmer Participation Plan (FPP)

The FPP, underpinned by a participatory approach, integrates and mainstreams social issues and concerns in various stages of the project cycle. Its aim is to ensure that all the stakeholders, directly or indirectly, related to the project are able to optimize benefits and minimize the negative impact and risks that may accrue to them from the project. The plan is also constructed to ensure that likely project affected persons have an effective role in the designing, implementation, and monitoring and evaluation of the project.

1.5.10. Environmental Management Plan/Project Roadmap

The Environment Management Plan/Project Roadmap is developed in a regional context to take both upstream and downstream effects into account. Second, because of the involvement of many sectors, institutions and stakeholders, the plan also includes suggestions for vertical and horizontal coordination at different levels, to include all the key players and entities in project implementation. Third, in view of its crosscutting nature and the proposed institutional decentralization, the plan has been developed consultatively. Fourth, attention has been given to the sequencing of activities. Fifth, a training and advocacy component has been included. Finally, the plan includes a component for technical and managerial up gradation of departments (EPA, WAPDA's Environmental Wing).

2
Project Description

This chapter describes the project area. It outlines the project objectives, components and activities. Those components relevant to addressing social and environmental issues are considered in greater detail. Maps are included to provide an approximate idea of the location of various project components.

2.1 The Project Area

The LCCE canal system irrigates parts of Sheikhupura, Faisalabad, and Toba Tek Singh. The LBDC canal system irrigates parts of Kasur, Okara, Sahiwal, Vehari and Multan districts. The areas are well served by a road network and communication system, although substantial rehabilitation is required due to deferred maintenance.

The LCCE Project area is part of the Rachna-Doab, which lies between the Chenab River in the northwest, Ravi River in the southeast, and the piedmonts of Jammu-Kashmir in the northeast. The canal command of the project area is west of the Ravi River and is spread over an almost rectangular land mass 115 miles long and 27 miles wide. It is bounded in the north by the Rakh Branch of the Lower Chenab Canal, the Qadirabad-Balloki link canal (Q-B link canal) in the east, canal command area of Upper Chenab Canal in the southeast, and Trimmu-Sidhnai in the west. The LCCE system comprises four branches, namely, Upper Gugera, Mian Ali, Lower Gugera, and Burala branches.

The base maps below locate the two canal commands in the region, delineating the major landmarks, such as the districts, the major canals and link canals, cities and towns.

2.2 Project Aim and Objectives

The project aim is to contribute to sustainable growth by focusing on poverty reduction, institutional development and improved public resource allocation. This is to be accomplished through the following project development objectives:

- Improve agricultural productivity and farm income;
- Contribute to poverty reduction and;
- Establish a decentralized, efficient, participatory and financially sustainable institutional apparatus for the operation and management of the Punjab's irrigation systems

2.3 Project Approach and Components

The century-old irrigation and drainage infrastructure is in a state of disrepair and rapid deterioration, due to utilization beyond design capacities, tampering of control structures, human and animal damages to canal banks, and utterly inadequate routine and major maintenance. These inefficiencies in the operation and management of the systems can be attributed largely to almost exclusive control of the irrigation and drainage systems by public sector entities (provincial irrigation departments, WAPDA). In order to address these limitations, the government has adopted a completely new approach, which is consistent with the Bank's own strategy for the water resources sub-sector and is being supported through the Bank's various operations. The key thrust of this strategy is to foster an institutional policy and operational framework, which would be conducive to efficient and self-sustaining operation and management of the irrigation and drainage systems.

Fig 2.1: Main Rivers and Canal

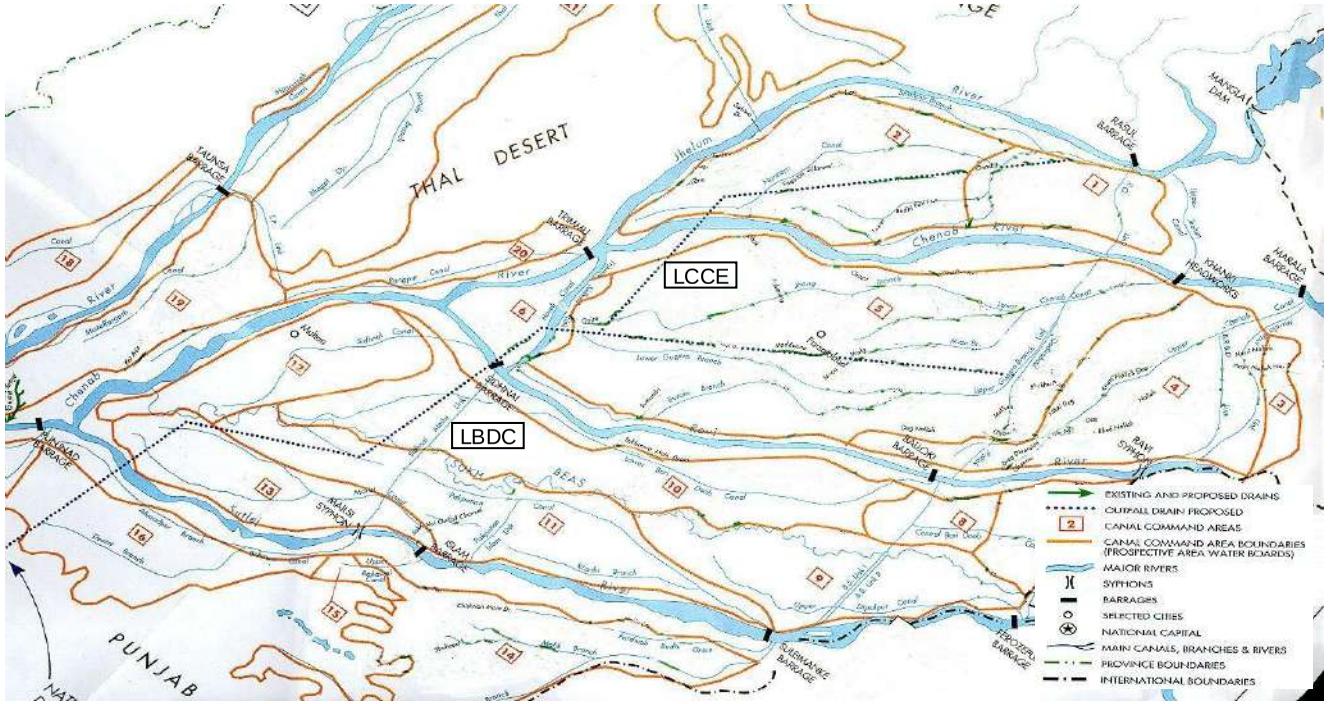
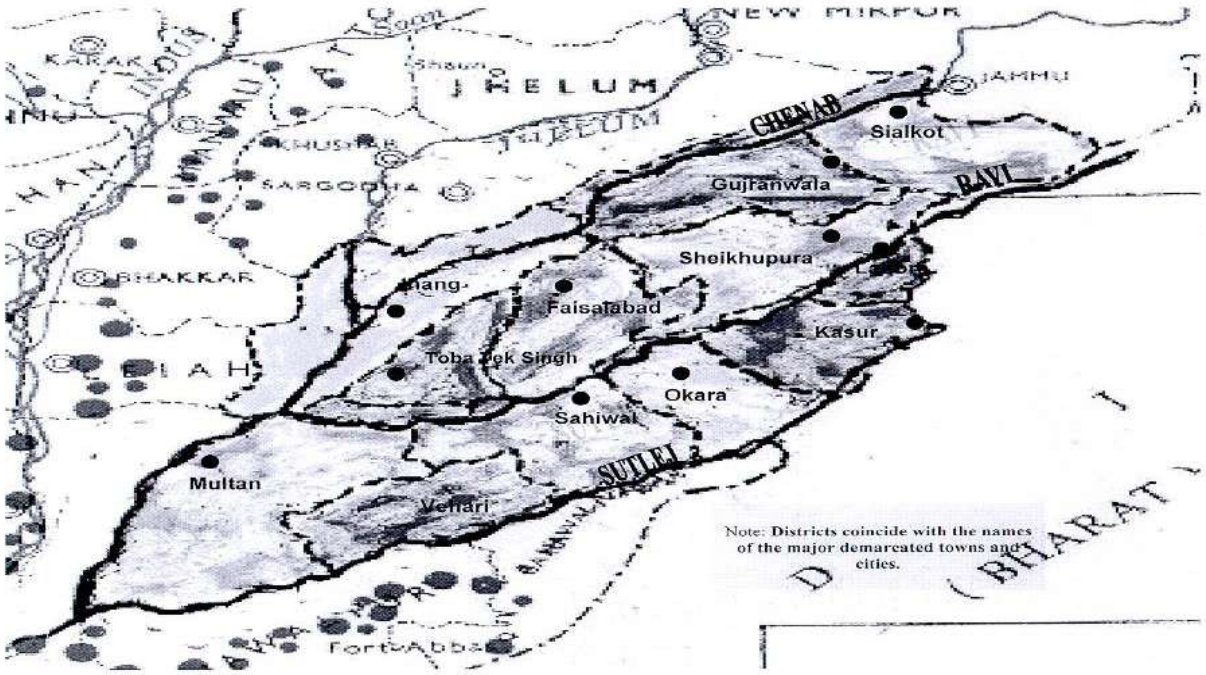


Fig. 2.2 Districts Towns and Cities



The project aim, objectives and approach define the project components in the two canal commands. These are described below. The soft (policy and operational) components are both preconditions and adjuncts to the hard (infrastructure rehabilitation) components.

Table 2.1: Project Components

	Component	Category
1.	Establishment of Area Water Boards	Institutional
2.	Community Development and Support Program	Institutional
3.	Improvement of Irrigation Facilities • Main and branch canal • Distributaries level • Watercourse improvement program	Physical
4.	Rehabilitation of Barrage	Physical
5.	Improvement of Link Canals	Physical
6.	Telecommunication and Information System	Physical
7.	Monitoring and Evaluation	Institutional/Program
8.	Project Management	Institutional/Program
9.	Technical Assistance, Training and Future Project Preparation	Program

2.4 Institutional. Social and Environmental Focus

The project will complement and supplement the GoPunjab's ongoing efforts to restructure the Irrigation Department into a Provincial Irrigation and Drainage Authority (PIDA). This authority is to be vested with regulatory functions and for dealing with inter and intra-provincial aspects of the Indus Basin River system (IBRS)

Second, it will establish commercially oriented Area Water Boards (AWBs) as public utility companies on the two canal commands. Among other functions, the AWBs would receive: a) irrigation water from the PIDA at the canal headworks and sell them to the various farmer organizations and/or any other entities falling within its

operational jurisdiction and; b) drainage effluent from the FOs and/or any other entities falling within its jurisdiction and convey it through drainage structures.

Third, the project will facilitate and supervise the formation of farmer organizations (FO) at the tertiary irrigation level, with a view to eventually transferring its management to them. The recommended approach (described in more detailed in the following chapters) favors transparency, participation and close monitoring. There can be no pre-defined templates to guide the process. But it entails meticulous investigation, awareness creation, detailed consultations with the communities, prior to mobilizing them, and training. This, in turn, will define the pace at which these FOs are formed. Basically, there should be flexibility regarding functions, organizational approaches and the entities involved in FO formation. Allowance for innovation and experimentation will eventually reap dividends in terms of ensuring their sustainability.

Fourth, the environmental sustainability of project activities requires fostering three types of linkages: a) coordination between concerned departments, agencies and farmers for water quality monitoring; the project is not financially empowered to take up harder options, such as mitigation; b) lateral coordination between departments and projects tasked with irrigation, drainage and groundwater management; a corollary of this is the possible merger of farmer level involvement in such activities under one umbrella FO and; c) social-environmental interface at the community level to generate economic and health benefits and environmentally desirable outcomes. This activity was not originally contemplated in the project concept document but could prove key, given the increased incidence and diffused nature of water and soil pollution. In other words, while it is important that project activities not harm the environment, equally important their effectiveness should not be marred by environmental pollution and degradation.

3
Environmental Base Line

This and the following chapter present the environmental and socioeconomic baselines for the two project canal commands: the Lower Chenab Canal Command East (LCCE) and the Lower Bari Doab Canal command (LBDC). The focus is on developing a parametric frame of reference, which assists in the project design, appraisal and planning process and constitutes a benchmark for subsequent project impact assessment and evaluation.

3.1 Environmental Baseline

3.1.1 Natural Environment

3.1.1.1 Topography, Soils and Climate

The Rachna Doab, which includes the LCCE, consists of a huge mass of alluvium deposits of the Chenab and Ravi rivers, about 600 feet deep. Except for limited rock extrusions on either side of the Chenab River in its upper reaches, ranging in elevation from 100 to 1,600 feet, the project area is generally flat with modest relief. The low-lying areas track the abandoned river course. The narrow corridor along the river is the active flood plain, while the abandoned flood plain is located in the central and northern parts of the project area. The lower southern half of the project area can be classified as Bar upland. The LBDC surface area has a gentle southwest gradient. The Sukh Beas nullah is the old bed of the Beas River and serves as the main drainage channel in the region. A low but pronounced ridge between the rivers Ravi and Sutlej rivers runs northeast to southwest.

The soils in the two canal commands are predominantly of three types: clayey, sandy loam, and sandy. The clayey soils are best suited to irrigated agriculture but are poorly drained. These soils are highly calcareous and tend to be found in low-lying areas. They exhibit high, but manageable concentrations of salinity/sodicity levels and are, generally, marred with higher water tables. The loamy soils are reasonably drained with moderate water holding capacity and are well suited to irrigated agriculture. However, in some pockets the productivity is constrained by poor relief and a high water table. The salinity and sodicity content in these soils is manageable. The sandy soils are well drained but low in organic matter and with poor moisture holding capacity. These soils are poorly suited to irrigated agriculture and are susceptible to wind and water erosion.

Climatically the LCCE and LBCD project areas range from sub-humid in the northeast to semi-arid in the southwest and are characterized by large diurnal and seasonal fluctuations in temperature. During summer (April–August), the maximum daily temperature varies between 105^{o} F and 120^{o} F. The hottest months are April, May, and June, during which high temperature build-ups occur. This period experiences extreme dryness and occasional dust storms. The bulk of the precipitation occurs during the monsoon months (July-September), reaching 350-400 mm in the northeastern parts and 200-225 mm in the southwestern regions. During the winter months the average daily maximum temperature oscillates around 70^{o} F, with night temperatures reaching 35^{o} during December and January. In the northern parts of the LCCE, the night temperatures occasionally approach freezing point. Winter months are generally dry with occasional rains brought in by northwesterly winds.

Fig. 3.1 Soil Characteristics

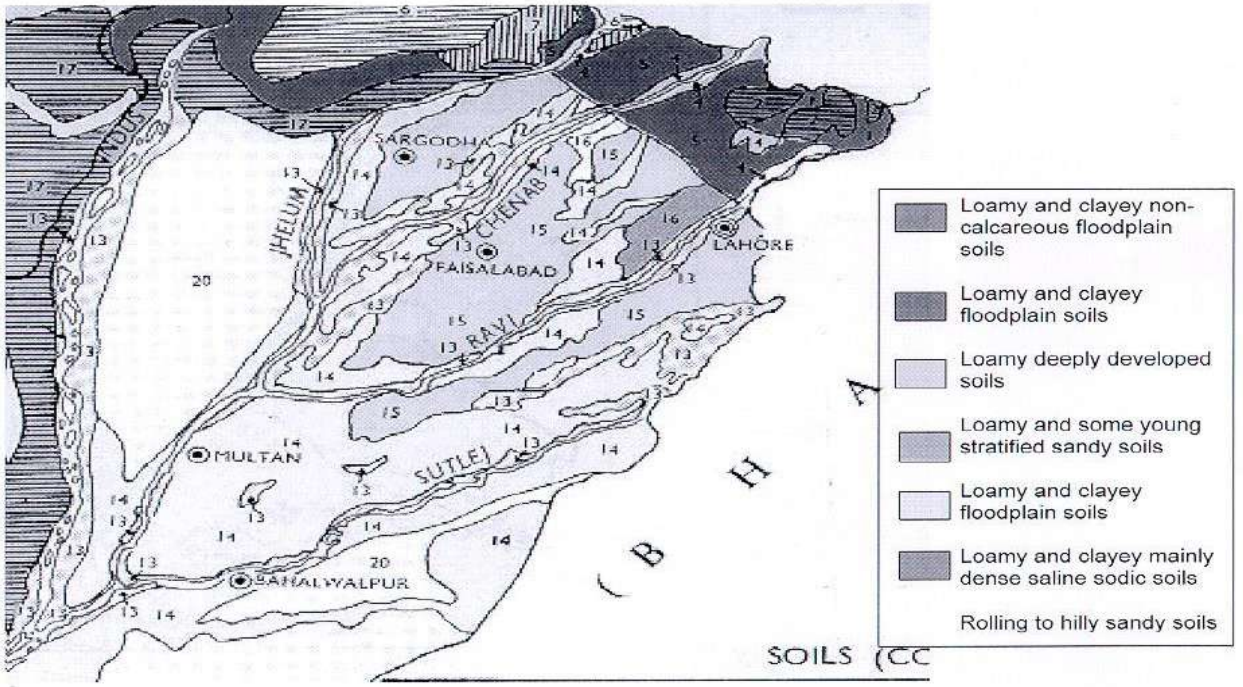


Fig. 3.2 Climate

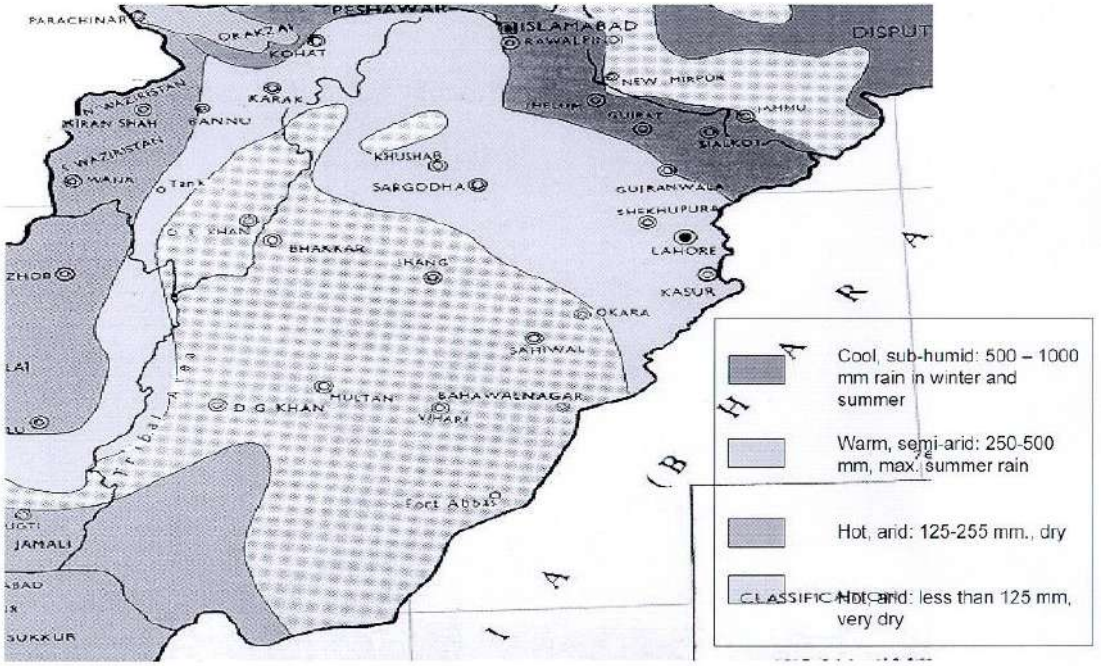
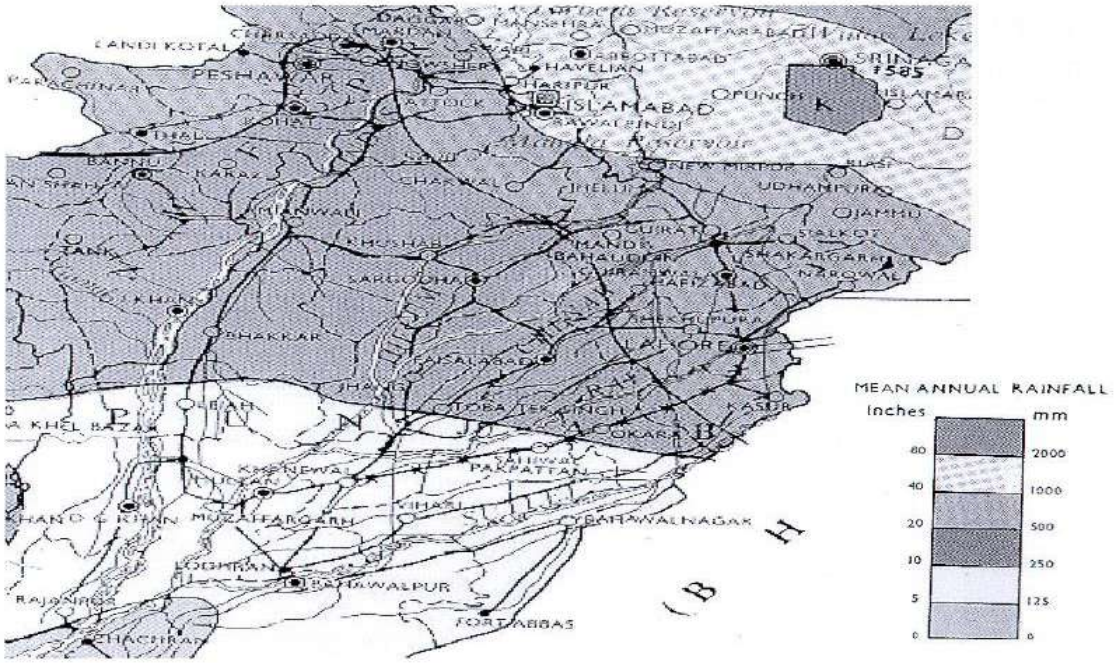


Fig. 3.3 Annual Rainfall



3.1.1.2 Water Resources

***Drainage Systems*:** The Lower Chenab Canal Command Area, comprising LCC East and LCC West has a catchment area of about 6,000 square miles. This area is extensively drained with 1,321 miles of surface drains, designed for both seepage and storm water disposal. Most of the LCC East is underlain by saline groundwater, except along strips adjacent to the Chenab and Ravi rivers. This area also has extensive sub-surface (vertical) drainage; in fact it is the site of the earliest SCARP-1 project, initiated in the mid-sixties. Patches of waterlogging exist, mostly on the southwestern side, with a water table depth of less than 5 feet.

The Project area falls into two drainage circles, namely, the Faisalabad and Sumundri divisions. The area within the command area of the Mian Ali branch drains into the Chenab River. Five drainage systems form part of the Upper Gugera Branch. They are Marh Salar, Ahmadpur Kot Nikki, Jaranwala, Deg Nullah, and Sumundri drainage systems. The first two fall into the Ravi River, while the remaining three drain into Chenab River. The two rivers, on a relatively lower contour, act as natural drains. Due to the extensive drainage network, the water table in the canal command area is generally low, except in the low-lying areas, which are slow in draining the excess water.

During field visit it was observed that the surface drains are poorly maintained. Farmers expressed willingness to construct tertiary links with the main system if the main and secondary drains are maintained enough to dispose the additional supplies from on-farm drainage as well.

The LBDC is underlain with fresh groundwater in its central portion and with saline groundwater in the northwestern and southeastern parts. Water logging and salinity are not serious problems, except along the Northwestern stretch adjacent to the Ravi River, which requires sub-surface drainage. A waterlogged area also exists adjacent to the Balloki-Sulemanki

Link Canal. As can be surmised, there is greater surface salinity in the LCCE than in the LBDC. Natural drainage provided by the Sukh Beas nullah has become ineffective over time, due to a combination of natural and anthropogenic forces. This has led to three interventions by WAPDA:

- Separating the upper portion of the Doab, below the Bambanwala-Ravi-Bedian-Debalpur (BRBD) Link Canal and discharging its drainage water into the Sutlej river through the Pandoke drain;
- Draining the rest of the area above the Balloki-Sulemanki (BS) Link Canal in the Ravi river and into the link canal itself and;
- Channelizing the Sukh Beas Nullah and constructing an outfall channel (Sukh Nai Outfall) to drain water to the Sutlej.

Rehabilitation of the highly degraded surface drainage system in the LCCE (due to deferred maintenance) was begun under the National Drainage Program in 1998. Since then desiltation, rehabilitation, extension, remodeling and construction activities have begun under a three-year rolling plan. The present focus is on desiltation and rehabilitation. Additionally, the NDP plans to transfer the O&M of drains less than 15 cusecs to drainage beneficiary groups. The waterlogging problem is threatening to resurface as a result of government disinvestment in the SCARP program and reluctance shown by the private sector to adopt it.

Farmers have sunk their own private (smaller capacity) tube wells and monitor conjunctive (mixing) use of both surface and ground water carefully. However, due to the brackish nature of the ground water salt accumulation does occur and continuous leaching is required. While the bulk of the effluent is discharged into the Ravi and Chenab rivers, part of it flows back into the canal system.

Under NDP financing, the OFWM directorate has already facilitated 4 FOs in the Lower Canal Command East (LCCE) to

different stages of maturity, with more being targeted annually. A precondition is revitalization of dormant WUAs. Concurrent activities are watercourse improvement and drainage rehabilitation (drains under 15 cusec capacity).

***Water Availability*:** The annual surface diversion to the LCCE averages around 4 million-acre feet (2.13 MAF in the *kharif* and 1.89 MAF in the *rabi* season). The LCCE is part of the main Lower Chenab Canal system, off taking from the left bank of the Khanki Headworks. The LCCE also receives water from a feeder canal off-taking from the Qadirabad-Balloki link canal (inter-river diversion from the Jhehlum river). The gross command area (GCA) is about 2.06 million acres, with a culturable command area (CCA) of 1.64 million acres.

The LBDC off-takes from the Ravi River at Balloki Headworks. Most of the water to the river is sourced in the Chenab and Jhehlum rivers and supplied through the link canals (Qadirabad and Qadirabad-Balloki). The Ravi also supplies some water during the flood season. The annual surface diversion averages around 4.91 MAF (2.78 MAF in the *kharif* and 2.13 MAF in the *rabi* season). The gross command area (GCA) is about 1.83 million acres, with a culturable command area (CCA) of 1.67 million acres.

Table 3.1 presents the monthly surface water deliveries at the head.

Table – 3.1: Surface Water Deliveries

Monthly Surface Deliveries	LBDC		LCCE	
	Kharif ('000 cfs)	Rabi ('000 cfs)	Kharif ('000 cfs)	Rabi ('000 cfs)
April	7.3		5.7	
May	7.8		5.9	
June	8.1		6.0	
July	7.0		5.7	
August	8.1		5.9	
September	7.9		6.1	
Sub-total (MAF):	2.78		2.13	
October		6.85		5.9
November		7.15		5.7
December		5.50		5.2
January		2.60		5.6
February		6.35		3.5
March		6.60		3.4
Sub-total (MAF):		2.13		1.89
Total (MAF):		4.91		4.02

Source: Euroconsult-NESPAK, 1999

Canal water supply in the LBDC provides only some 44% of the optimal crop water requirements at the root zone at current cropping intensities, reflecting poor delivery efficiency. While seepage is a source of groundwater recharge, it constitutes wastage in areas underlain by saline water. On the whole, about 34% of the irrigation needs are met from ground water, leaving a shortfall of 22%. In the LCCE, the delivery efficiency is much lower, resulting in only 31% of the total water requirements being met by surface flows. The recharge-to-wastage ratio is higher because of the relatively larger saline water underlay in the LCCE. Public and private tube wells provide 37% of the total water requirements. Thus, the estimated deficit is 32%. While precipitation offsets a substantial part of the deficit in the two canal commands, its concentration in the monsoon season contributes to flooding, while *rabi* shortages continue to remain substantively unaddressed. The existing shortfalls are compounded further by theft (tampering with outlets, breached

embankments, pumping) and inequities in distribution, in the shape of collusion between large farmers and irrigation department staff to withdraw excess water. Often the extraction exceeds needs and produces wastage.

The future prognosis is one of extreme water stress. The system was originally designed for a cropping intensity of 75%. This is presently close to 150%. While irrigation needs have expanded, supplies have both shrunk and become more erratic, as irrigation infrastructure has deteriorated due to deferred maintenance. At the same time, inter-sector competition, for household and industrial needs has increased. Presently unquantified, the project will need to make a careful projection of these needs as a precondition to better water management which, in turn, should embrace supply programming, use efficiency, conservation and crop adaptations.

***Groundwater Level Fluctuations*:** The average depth of ground water in the LCCE is reported to be about 10 feet in 80% of the canal command. While this figure conceals seasonal variations in water logging, it basically reflects the high rate of water abstraction. An estimated 13,500 tube wells draw up about 1.89 MAF of ground water. The public sector tube wells, installed under various SCARP projects to lower the ground water table and supplement canal availability, pump out an additional 0.88 MAF. The combined net withdrawal is 2.00 MAF. In contrast, groundwater recharge is 2.07 MAF in the usable zone. Careful monitoring, coupled with legal and regulatory checks are needed to arrest the groundwater mining and prevent encroachment of the saline water into the fresh lenses. During the field visit, farmers, especially those located in the Burala Branch, reported a discernible drop in the water table. The groundwater recharge in the saline zone (0.26 MAF) is another source of freshwater, and can be extracted through appropriate extraction technologies. Additionally, seepage losses could be prevented through canal lining. The water quality is fresh in 70% of the CCA and moderately saline in about 18%, requiring conjunctive use with surface water. About 12% of the area is underlain with highly saline (hazardous) water, which is unfit for agriculture.

Groundwater resources in the LBDC are almost fully utilized. An estimated 20,000 tube wells are operating in the area. As in the LCCE, groundwater extraction is beginning to exceed recharge capabilities in many areas, although unlike the LCCE, the risk of saltwater intrusion is not as severe. The estimated additional potential is about .25 MAF, distributed equally between the upper (Balloki) and lower (Khanewal) zones. No further tube well installation is advised in the middle (Sahiwal) zone as groundwater mining has reached critical levels. The upper and lower zones also contain the majority of the saline pockets with limited scope for tapping the freshwater overlays in these areas, using a combination of canal lining and innovative extraction techniques. The estimated potential is about 0.21 MAF. The map below illustrated the saline and fresh groundwater distribution.

***Industrial, Household and Agrochemical Discharges into the Canal System*:** The main sources of water pollution are chemical and biological contaminants. These are sourced in industrial, household and agro-chemical runoff. Both upstream and downstream effects and the rural-urban interface implicit in such forms of pollution strengthen the rationale for a regional environmental analysis. Although information on such aspects is limited at present, Chapter 6 provides a sense of the water quality issues and the institutional constraints in addressing them. The tabulated information below represents typically the extent of water pollution to be found in and around most of the large towns and cities of the Punjab.

Fig 3.4

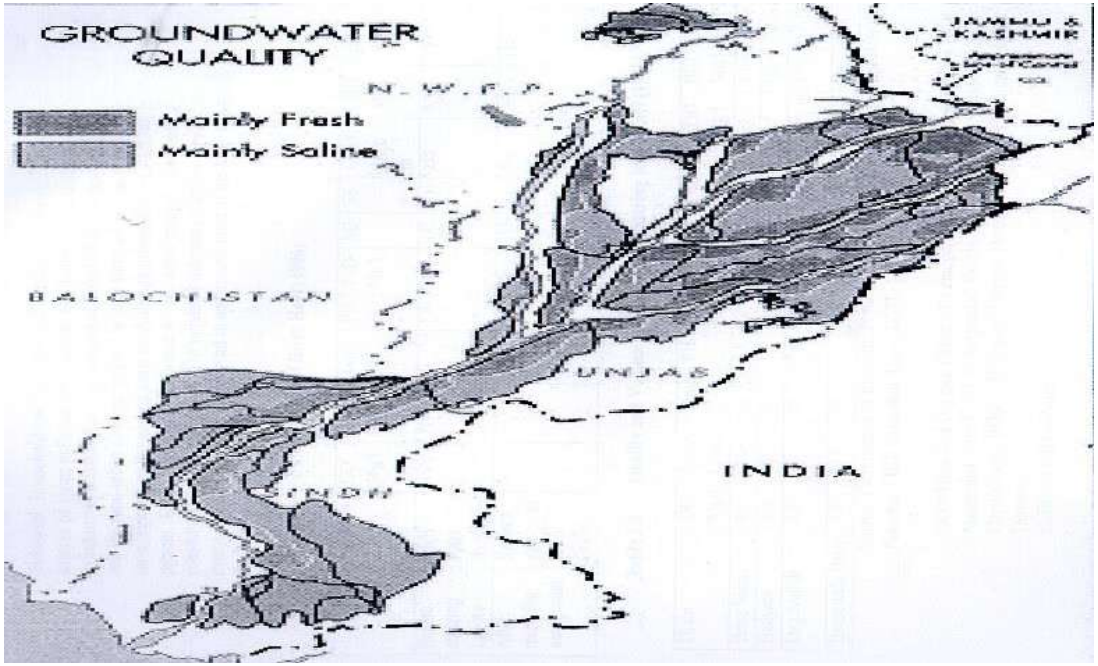

GROUNDWATER QUALITY
Mainly Fresh
Mainly Saline
JAMMU & KASHMIR
N.W.F.P.
BALOCHISTAN
PUNJAB
INDIA
SINDH

***Table3.2*:** Water Quality of River Ravi (1996)

	Location	DO Mg/l	Disch. Cusecs	Temp C°	PH	TSD Mg/l	SD	SS	Cond µm/cm	COD Mg/l	BOD Mg/l	Colif. MPN/100ml
Before entering Lahore	BRB Ravi Syphon	8.6	2740	17	8.0	130	142	0.1	255	6.5	1.8	$2.6x10^3$
After receiving wastewater	Eastern side of Bara Drain	0.2	--	21	7.1	710	195	1.1	930	260	112	$4.7x10^9$

***Table 3.3*:** Quality and Volume of Wastewater Entering River Ravi (1996)

Drain	DO Mg/l	Disch. Cusecs	Temp C°	PH	TSD Mg/l	SD	SS	Cond µm/cm	COD Mg/l	BOD Mg/l	Colif. MPN/100ml
Babu Sabu	0.0	150	23	7.3	620	250	3.5	940	525	210	--
Hadyara	0.0	202	23	7.7	710	285	4.2	1000	490	180	$6.2x10^{10}$
Deg Nullah	0.2	114	20	7.66	1290	470	18	1600	330	110	$3.7x10^4$
Baranwala Drain	3.6	30.4	29	7.2	2080	1270	58	1760	2130	710	--

Source: Government of Pakistan. 1998. *Compendium of Environmental Statistics of Pakistan.* FBD. Islamabad. Page 28-231

DO = Dissolved Oxygen, Disch.= Discharge, Temp = Temperature, TSD = Total Suspended Solids, SD = Suspended Solids, SS = Settleable Solids, Cond = Conductivity, BOD = Biological Oxygen Demand, COD = Chemical Oxygen Demand, Colif. = Total Coliform

3.1.1.3 Land and Biodiversity

Land Use- Agriculture: The predominant land use is irrigated agriculture. Cropping patterns essentially reflect the waterlogging salinity situation.

The dominant cropping pattern in the LBDC is cotton-wheat. The crop data available from Balloki, Sahiwal, and Khanewal subdivisions indicates an overall cropping intensity of about 155 percent, distributed almost equally between the *kharif* (80%) and *rabi* (75%) crops. The total cropped area is about 2.6 million acres, with about 1.33 million acres being cropped during *kharif* and 1.25 million acres during *rabi*. Cotton accounts for about 44% of the *kharif* cropped area and wheat for about 88% of the *rabi* cropped area. Tables 3.4 and 3.5 present a more detailed breakdown by crops and yields.

Table 3.4: *Area Under Crops and %Age Shares (LBDC)*

Crop	Area 000 acres	%Age Share in Season	%Age Share in Total Area
Kharif			
Cotton	583.0	43.87	23.14
Maize	238.0	17.91	9.45
Fodder	161.0	12.12	6.39
Sugarcane	82.8	6.23	3.29
Rice	78.6	5.91	3.12
Vegetables	54.0	4.06	2.14
Legumes	29.0	2.18	1.15
Millets	26.0	1.96	1.03
Miscellaneous	11.4	0.86	0.45
Oilseeds	5.4	0.41	0.22
Orchards	21.8	1.64	0.87
Forest	37.8	2.84	1.50
Subtotal (*Kharif*)	1,328.8	100.00	52.74
Rabi			
Wheat	812.0	64.93	31.48
Fodder	119.0	9.52	4.61

Continued…..

Oilseeds	90.7	7.25	3.52
Sugarcane	83.0	6.64	3.22
Vegetables	79.0	6.32	3.06
Miscellaneous	5.4	0.43	0.21
Pulses	1.7	0.14	0.07
Orchards	21.7	1.74	0.84
Forest	38.0	3.04	1.47
Subtotal *Rabi*	1,250.5	100.00	48.48
Total	2,579.4		100.00

Table 3.5: Area and Yield of Major Crops (LBDC)

Crop	Area in 000 acres	Production 000 tonnes	Yield in kg/acre
Cotton	583.0	512.4	879
Maize	238.0	145.9	613
Rice	79.0	41.8	529
K. Vegetables	54.0	206.8	3,830
Millets	26.0	8.0	308
K. Oilseeds	5.5	1.2	218
Legumes	29.0	13.2	455
K. Fodder	161.0	906.3	5,629
K. Miscellaneous	11.0	2.0	182
Wheat	807.0	692.7	858
Oilseeds	91.0	40.7	447
R. Pulses	1.7	0.6	353
R. Fodder	119.0	1,523.8	12,805
R. Vegetables	79.0	395.8	5,010
R. Miscellaneous	55	2.0	36
Sugarcane	83	1,299.1	15,652
Orchard	22	84.6	3,845

The LCCE project area is defined as a mixed cropping zone. The main crops grown are wheat, cotton, rice, sugarcane, maize, and fodder. The average of five years crop data indicates an annual cropping intensity of about 128.5%. The seasonal cropping intensities are 54.3% in *kharif* and 74.2% in *rabi*. The total cropped area is about 2.1 million acres, distributed between *kharif* (0.89 million acres) and *rabi* (1.21 million acres). *Kharif* cotton and sugarcane each account for a little over 20 percent of the

cropped area, while rice and maize account for just over 12%. *Rabi*, wheat covers 55 percent of the cropped area and sugar cane about 16 percent. A more detailed breakdown by crops and yields is presented below.

Table 3.6: Area Under Crops and %Age Shares (LCCE)

Crop	Area 000 acres	%Age Share in Season	%Age Share in Total Area
Kharif			
Cotton	185.2	20.89	8.82
Maize	113.7	12.82	5.42
Fodder	131.9	14.88	6.28
Sugarcane	194.6	21.95	9.27
Rice	122.0	13.76	5.81
Vegetables	28.4	3.20	1.35
Millets	21.1	2.38	1.01
Miscellaneous	26.1	2.94	1.24
Oilseeds	19.3	2.18	0.92
Orchards	36.0	4.06	1.72
Forest	8.3	0.94	0.40
Subtotal (*Kharif*)	886.6	100.00	42.24
Rabi			
Wheat	668.6	55.15	31.85
Fodder	183.0	15.09	8.72
Oilseeds	73.9	6.10	3.52
Sugarcane	194.6	16.05	9.27
Vegetables	24.8	2.05	1.18
Miscellaneous	23.2	1.91	1.11
Orchards	36.0	2.97	1.72
Forest	8.3	0.68	0.40
Subtotal *Rabi*	1,212.4	100.00	57.76
Total	2,099.0		100.00

Table 3.7: Area and Yield of Major Crops (LCCE)

Crop	Area	Production 000 tonnes	Yield in kg/acre
Cotton	185.2	453.3	2,448
Maize	113.7	70.2	617

Continued…..

Rice	122.0	71.3	584
K. Vegetables	28.4	169.6	5,972
Millets	21.1	6.2	294
K. Oilseeds	19.3	37.0	1,917
K. Fodder	131.9	682.4	5,174
K. Miscellaneous	26.1	5.8	222
Wheat	668.6	632.6	946
Oilseeds	73.9	32.2	436
R. Fodder	183.0	2,246.8	12,278
R. Vegetables	24.8	114.1	4,601
R. Miscellaneous	23.2	7.4	319
Sugarcane	194.6	3,692.0	18,972
Orchard	36.0	155.7	4,325

3.1.1.4 Wetland Locations and Types

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. Five important wetlands are to be found in the two canal commands: Marala Headworks and Qadirabad Headworks in the LCCE and Ghamaghar Lake, Kharar Lake Lal-Sohanra National Park and Islam Headworks in the LBDC. 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. Several new lakes and marshes have been created upstream of dams and barrages on many of the major rivers. The Marala, Qadirabad and Islam Headworks are examples of these. Other wetlands have been created as a result of faulty drainage systems and overspill from irrigation canals. Several of these now provide excellent habitat for waterfowl.

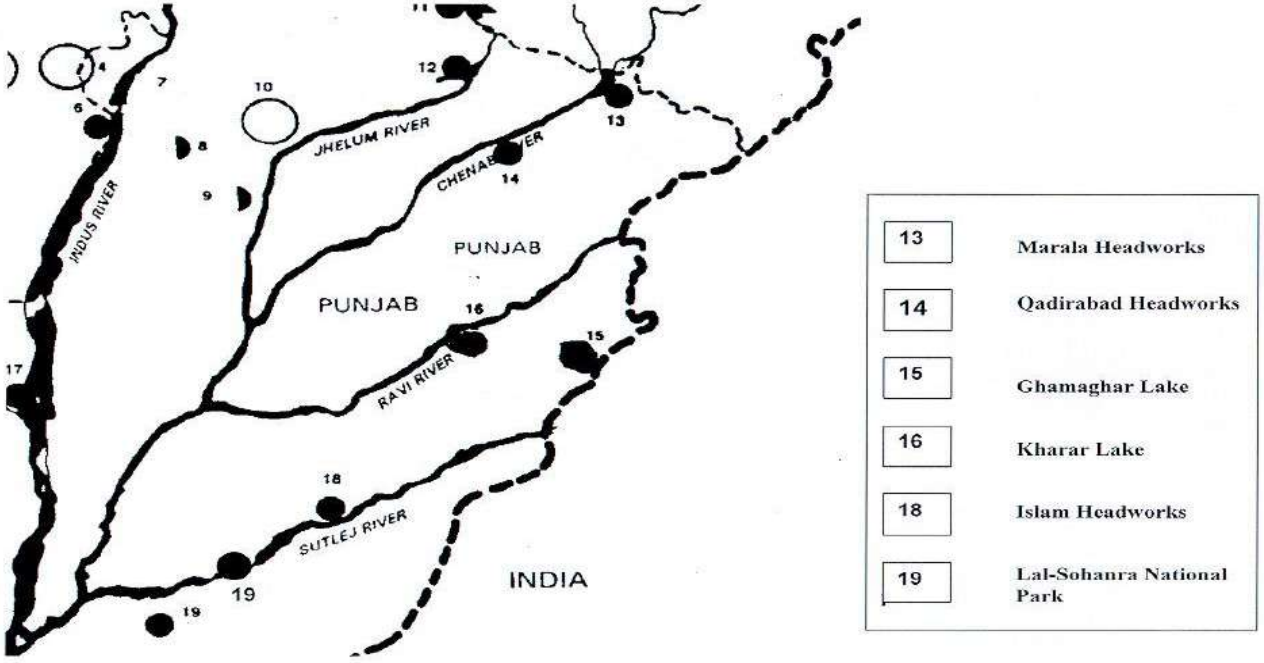
Table 3.8 provides a few details on the status and characteristics of these wetlands. On-site surveys during project implementation are recommended to update the information base and make it more comprehensive.

Table 3.8: Status and Characteristics of Wetlands in the LCCE and LBDC

	Category	Meets Ramsar criteria	Locally threatened mammal species	Globally threatened species	Flora	Causes of degradation
LCCE						
Marala Headworks						
Qadirabad Headworks	Game reserve			Ferruginous duck (aythya nyroca)		
LBDC						
Ghamaghar Lake			Fishing cat (felis viverina)			Increased cultivation, reduced water supply, cattle grazing, fishing and reed burning, illegal hunting
Kharar Lake	Wildlife sanctuary. An inland water body (shallow saline lake). Falls in the Indus Flyway	Yes.		White-headed duck (oxyura leucocephala). Marbled teal (mamaronetta angusti rostris)	Remnants of tropical thorn forest.	Introduction of non-native fish and extensive fishing. Reed destruction.

Islam Headworks	Game reserve		
Lal-Sohanra	National park (IUCN Category II)	Great Indian Bustard (ardeotis nigriceps)	Flora of Cholistan desert. Permanent swamp. Tamarisks and reed grass

Fig. 3.5 Wetlands



***Extent and Location of Areas Prone to Water logging and Salinization*:** The issue has been discussed above and is identified as a key environmental problem in section 3.2.1.5, 'Environmental Hotspots.'

***Vegetation by Type and Loss of Biodiversity*:** The two canal commands form part of the largest irrigated system in the world. Remnants of three type of forests are to be found in the Indus plains: a) tropical thorn forest consisting of *kikar, wan, farash, jand, ber*; b) riverine forests along the areas of active flood plain and meander flood plains (*belas*) and; c) irrigated plantations. Changa Manga forest near Lahore is a prominent example of this, spreading over more than 13,500/- acres. Irrigated plantations were meant to provide alternative sources of fuel wood for the trees denuded during the British road construction era. Other artificial plantations in the LBDC are at Khanewal (11,500 acres) and Chichawatni (11,500 acres). The forest department undertakes linear plantation along the canals and drains for soil stabilization and excess water transpiration. While, *kikar* and *shisham* are indigenous species, experimentation with eucalyptus, poplar and mesquite has yielded mixed results, with soil deterioration, species-suppression and pest infestation being some of the emerging problems. The forestry department has also launched a few community initiatives, ranging from vegetable inter-cultivation on contracted plots to compact and linear plantations.

Natural vegetation is not confined to tree species. The uncultivated lands of the Indus Plains are normally clothed with a sparse to dense growth of low shrubs and grasses, some xerophytic or ephemeral, others tolerant of severe salinity or water logging. They provide some of the best grazing grounds and give sustenance to a dense animal population.

However, agro-ecosystems have almost entirely replaced 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 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, waterlogging, salination, intensification of production and increased use of pesticides. All reduce the productivity of agricultural lands, reduce the capacity of the land to sustain soil microorganisms, invertebrates and higher trophic levels and indirectly place greater demand on natural biodiversity resources. Intensification also reduces floral and faunal diversity in crops and field margins. However, there is no documented evidence of crop genetic diversity loss due to the increased use of uniform cultivars.

The transformation of the Indus river basin from a natural to an agro-ecosystem has either eliminated completely of reduced substantially the following animal species in the two canal commands:

***Table 3.9*:** Extinct/Endangered Fauna

Birds	Mammals	Reptiles	Mammals (water based)	Invertebrates
Great Indian bustard. Sand grouse. Black and gray partridges	Hog deer, black buck, nilgai, wolf, common leopard, toad (bufo stomaticus), lizards: calotes versicolor, uromastix, harwickii, agama agilis	Marsh crocodile	Fresh water turtles,	Krait, cobra, khapra, Russel's viper. Non-poisonous pest feeders (mice and rats), spalerosophis diadema and ptyas mucosus.

The maps below provide baseline information on floral and faunal characteristics of the two canal commands.

Fig 3.6 *Vegetation*

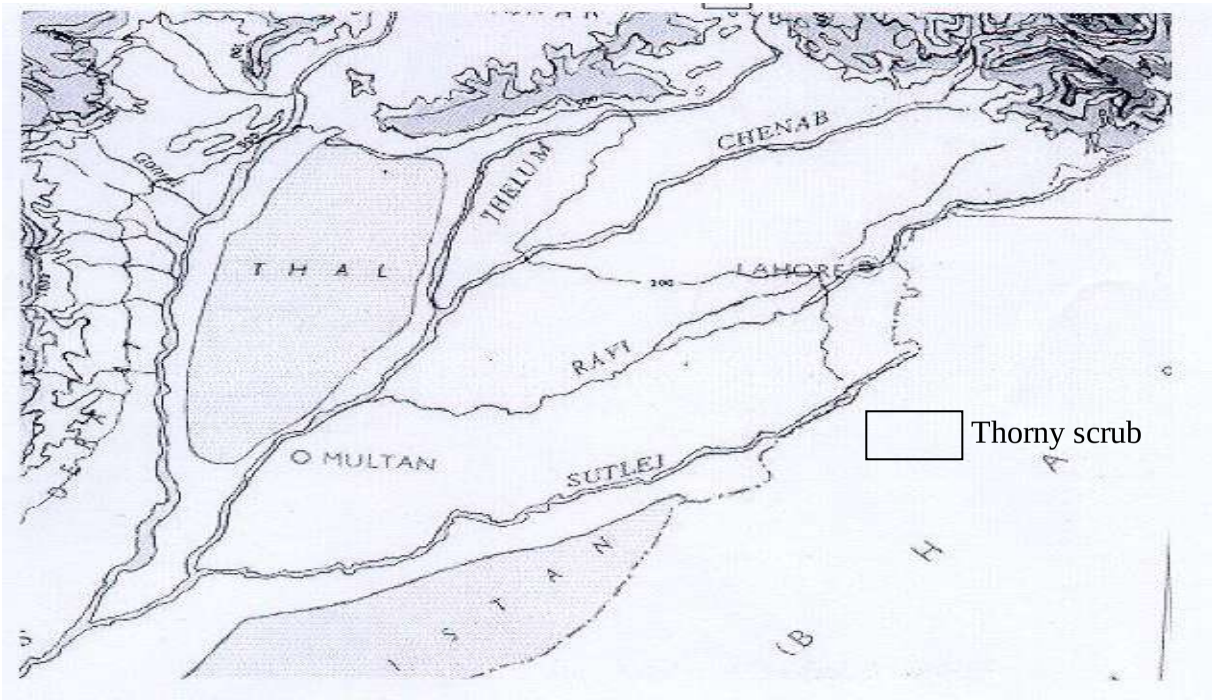


Fig.-3.7 Land Use

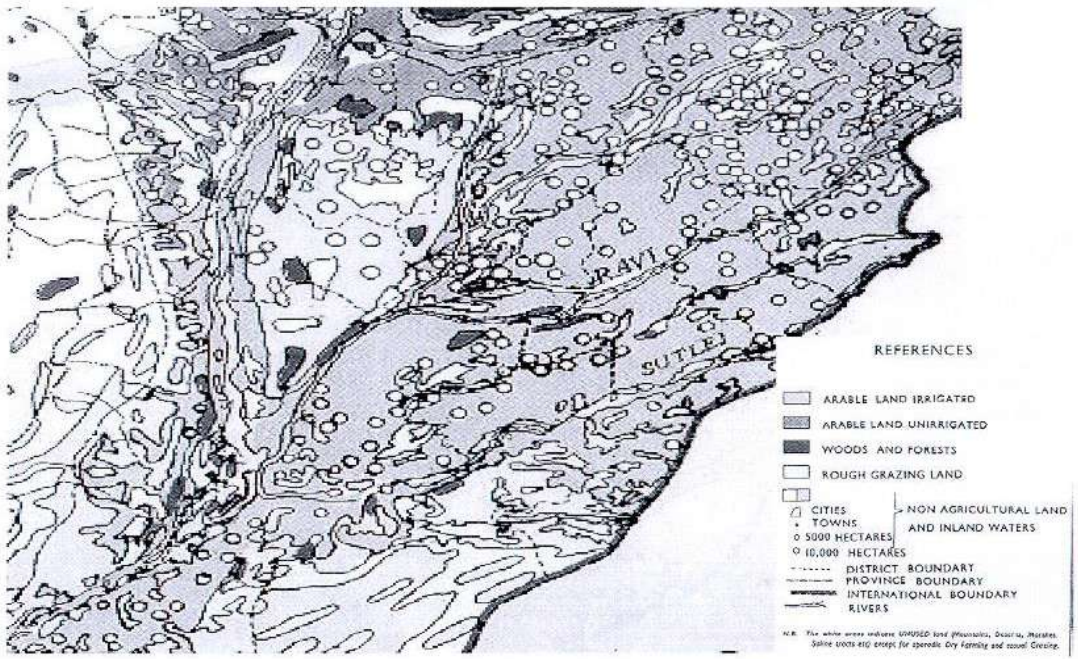


Fig. 3.8 Wildlife

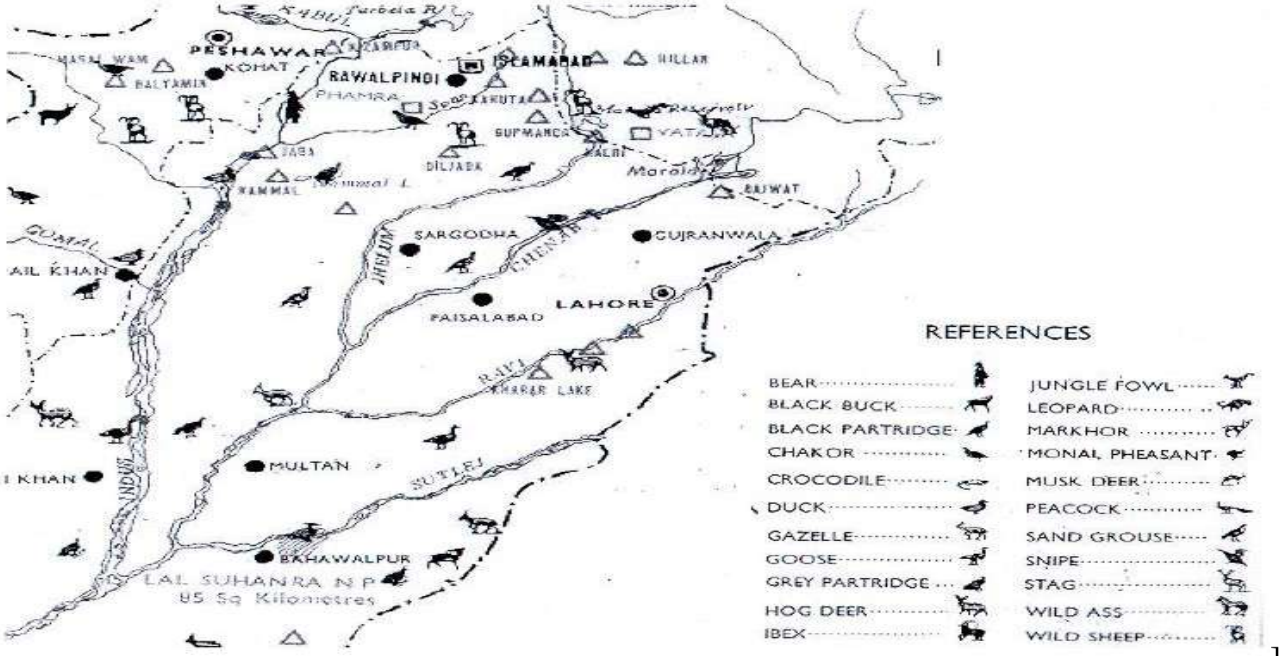


Fig. 3.9 Fisheries

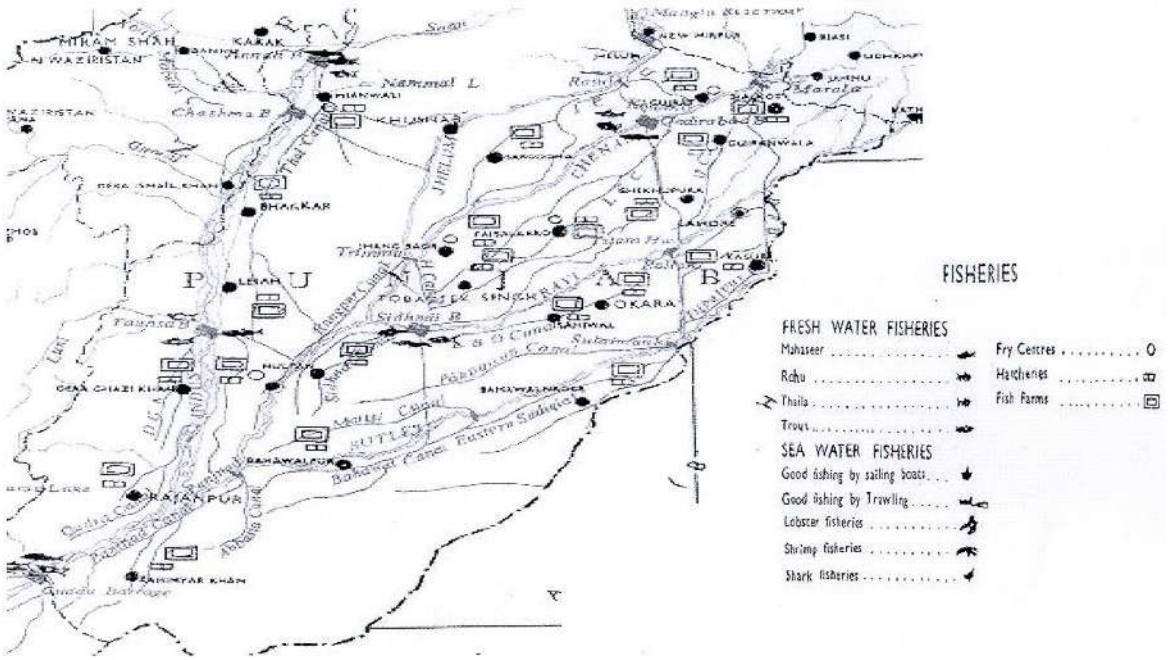
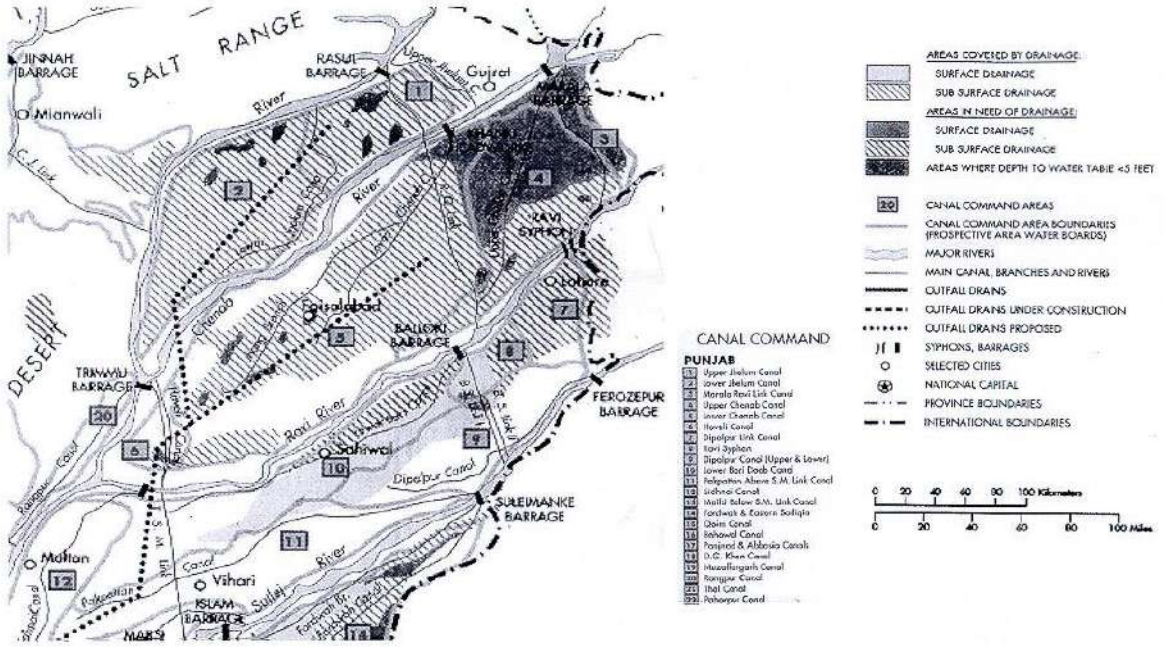


Fig. 3.10 Drainage Situation



3.1.1.4 Environmental Hotspots in the Area

The nature and extent of environmental degradation and its causes are reviewed at some length above. Water logging, salinity, biological and chemical water contamination are some of the generic concerns. Water quality concerns are sourced in industrial and urban pollution and the widespread use of agro-chemicals. Water logging and salinity tend to reflect structural problems. In other words, this twin threat is associated with a degrading irrigation infrastructure and inadequate, poorly constructed and badly managed drainage systems. The ensuing environmental and related problems are well documented; they include declining soil productivity, biodiversity loss, deforestation, habitat destruction, health problems etc. There is a diffuse nature to these problems (see box), which makes it difficult to pinpoint 'environmental hotspots' as such. Nevertheless, a limited and somewhat crude attempt has been made identify such areas. The identification is guided by:

- Large towns and cities, which are the source of urban and industrial pollution spreading into the proximate and more distant rural areas and which, in turn, suffer the effects of agro-chemical contamination
- Wetlands and forests which are being affected by water pollution
- Wildlife and marine resources threatened by water contamination
- Salinity/sodicity concentrations

These facets are superimposed upon each other to identify a few environmentally critical areas. These are encircled in red. Although the exercise has limited operational value, this aspect can be improved by using the information as a guide to more detailed micro-level studies during project implementation.

The drainage and salinity maps are both informative and help in identifying 'environmental hotspots.'

Fig. 3.11 Salinity Distribution

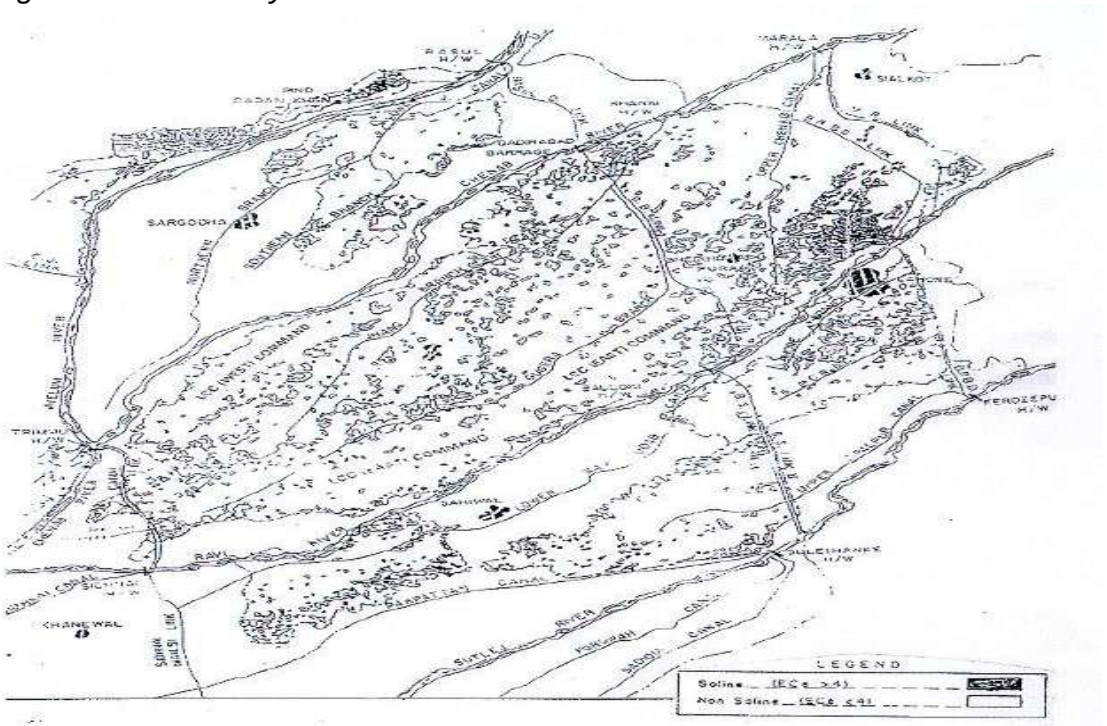
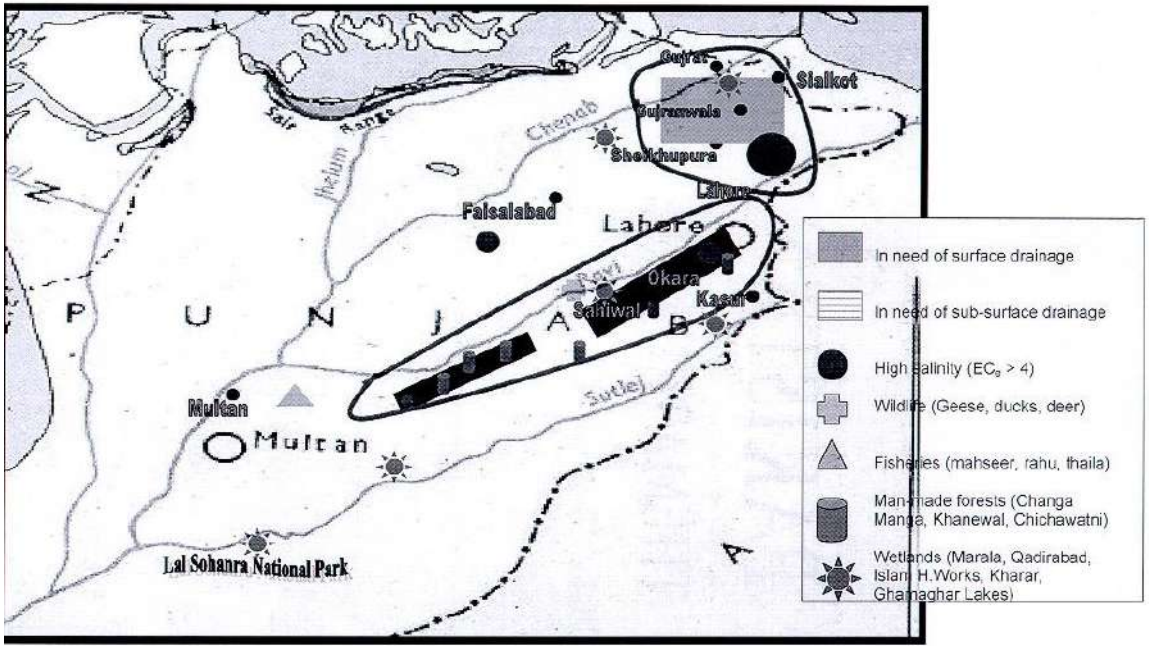


Fig. 3.12 Environmental Hotspots



Fungal Rot in *Shisham* Trees in the Punjab (Sarah Humayun, The News, November 26, 2000)

Shisham (dalbergia sassoo) has become one of the constant features of the Punjab plains and is mostly found on well-drained alluvial soils, along water channels, roads, rail tracks and fields. At the turn of the last century, it was artificially cultivated at Changa Manga, Chichawatni and Khanewal, to meet the fuel and track-laying requirements of the Indian Railways.

Recently, farmers all over the Punjab have been reporting the demise of the *shisham* tree in large numbers. The Pakistan Forestry Research Institute, Faisalabad, estimated in 1998 that up to 20% of the *shisham* trees were infected. The specific cause is root fungal infections and decay, and the tree's progressive withering. The broader cause, much fuzzier and harder to pin down, could range between storerooms full of agro-chemicals waiting to be used, the effluents being expelled into water bodies and the cultivation of hybrid wheat and cotton varieties with their full complement of fertilizers, pesticides and weedicides.

The decline of the *shisham* is attributed to "changes in ecoedaphic factors" … environmental changes, which have induced virulence in pathogens and pests. Four different kinds of fungi are at work on the roots of *shisham* – pytophora, fusarium, ganoderma and rhizocphonia. Two sources of transmission have been identified: transplants being taken from plantation nurseries and; water, inferring from the high rate of attrition along moving water bodies.

Presently, a study is underway to investigate the organisms involved in the malady as well as the abiotic factors contributing to the disease i.e. nitrogen and potash contents, soil pH, rhizophere temperature of the soil and environment, along with soil structure. The effects of fungicides, insecticides and weedicides in the soil and industrial pollution in the rivers add canals will also be examined.

3.1.1.5 Refinement of Baseline Information

While the scanned, enlarged maps provide a fix on environmental characteristics in the two canal commands, they lack precision and some maps are dated. An accurate environmental impact assessment of project activities will require more accurate information, and at much higher resolution levels. The Survey of Pakistan possesses a relatively comprehensive and updated database, GIS facilities and the technical capabilities to generate such maps. They provided a practical demonstration to the consultants on the complexities of geo-referencing, digitalization, layering etc., and, subject to security clearance, offered to provide detailed baseline maps at affordable prices.

Specifically, the project will need environmental information on all the aspects, covered at the canal command level, at the distributary level since distributaries are the foci for all substantive project activities, both of a hard and soft nature. This also reinforces the need for a phased approach to FO formation. The Survey of Pakistan or any other private or donor entity is not likely to have the environmental and social information at the distributary level on tap and it will need to be generated methodically during the course of project implementation.

4

Socioeconomic Baseline

The PISIP, like the On-Farm Water Management-IV, departs from the traditional irrigation projects, by instituting a continuing role for farmers in irrigation management. Government agencies will no longer assume to have a natural monopoly in this activity. The farmers will be involved in the planning, design, implementation and management of the sub-projects within their area once the process of social mobilization of the farmers is completed. A Social Assessment under these circumstances becomes vital to respond to and develop interventions to ensure:

- Socioeconomic and gender equity and minimization of risks for vulnerable sections of the rural population
- The readiness and capability of farmers to assume management transfers of the irrigation system
- That incentives are in place for both the users and agency staff who would be affected by the transfer program
- That institutional capacity at appropriate levels exists to enable participation, resolve conflict, enhance service delivery and monitor results; and
- That the newly established institutions: farmer organizations (FOs), Punjab Irrigation and Drainage Authority (PIDA) and the Area Water Boards (AWBs) are inclusive and represent the interests of the vulnerable groups.

The baseline section (4.1) draws upon information from the feasibility studies[1] of the two canal commands, supplemented with related reports and primary data from field surveys. Section 4.2 reviews the data sources and its quality. Section 4.3 identifies data gaps and uncertainties, which need to be addressed by the project. Section 4.4 presents the approach and methodology for the additional surveys designed to plug the data gaps.

4.1 Socioeconomic Baseline

4.1.1 Social Characterization

4.1.1.1 Population

The estimated population in the LBDC is 4.91 million. The average farm-family size is 8.6 members. An estimated 22% of the population are original inhabitants of the area, 33% are the descendants of the first canal settlers, with the more recent migrants constituting the remaining 45% of the population. The estimated population in the LCCE is 3.77 million, which is distributed district-wise as under:

Hafizabad:	77,000
Sheikhupura:	666,000
Faisalabad:	2,217,000
Toba Tek Singh	810,000

4.1.1.2 Farm Size Distribution

The overall average farm size in the LBDC is about 9 acres. The average farm size of the small farmers operating farms below 12.5 acres is about 4.5 acres. The average for medium size farms (farm area between 12.5 and 25 acres) is about 15.6 acres, while the average in the large farm category (25 acres and above) is about 48.6 acres. Close to 80 percent of the farms (about 150 thousand) in the canal command are in the small farm category. This is followed by 13.6 percent of the farms (25.5 thousand) in the

1 Draft Final Report: Punjab Irrigation Systems Improvement Project: Volume I (LBDC) and Volume II (LCCE); Pakistan Drainage Consultants, October 1999

medium size category. About 6.4% (12 thousand farms) are in the large farm category. The total coverage in percentage terms is, respectively, 41.7%, 23.8%, and 34.5%. This points to a markedly skewed agrarian structure: small farmers dominate numerately but own proportionately less area. During the field work farmers reported that 80 percent of the farm households own less than two hectares (5 acres) and 98 percent of the farm households are owner operators.

This land distribution pattern in the LCCE, obtained from the Agriculture Census (1990) for Sheikhupura, Faisalabad and Toba Tek Singh districts, closely replicates that in the LBDC. The overall average farm size in the LCCE is about 8.3 acres. Small medium and large farmers, on average, own 5, 16 and 42.5 acres, respectively. About 82 percent of the farms (163 thousand) in the canal command are in the small farm size category, followed by 13 percent of the farms (24 thousand) in the medium size category and about 10 thousand farms (5 percent) in the large farm category. The ownership pattern is similarly skewed: in percentage terms the coverage is 48%, 24%, and 28%, respectively.

Strong evidence of polarization is to be found in the two canal commands. The smallest farms have increased rapidly in number. The commensurate increase in area indicates that the average farm size (between 4-5 acres) has remained constant. It appears that this is the bare minimum subsistence level and that farmers prefer to seek off-farm occupation rather than permitting further – and uneconomical - sub-division. The medium size farms have declined as a proportion of total farm numbers and there is a small but perceptible decline in the average farm size. This appears to be an outcome of subdivision through inheritance. The declining proportion of large farms is basically a statistical artifact, reflecting the growing number of small farms. The key finding is that there is only a small areal reduction: in other words, large farmers have been both resuming and consolidating their holdings.

4.1.1.3 Land Tenure

Self-cultivation is the dominant ownership pattern in the LBDC. Owner-operators cultivate about 60% of the farms (112,000); sharecroppers who also farm their own land cultivate about 15% (29,100) and pure tenant–based cultivation accounts for about 25% (46,200).

The farmers have traditionally observed two types of crop sharing. In one case, crop produce is shared equally between the owner and tenant. Inputs are also shared in the same proportions. The tenant carries out land preparation and interculture operations, while the owner pays taxes and land revenue. This arrangement is prevalent in 98% of the project area. This is commonly referred to as sharecropping. A less common system is where the tenant gets about 12% of the farm produce in exchange for providing the manual labor for farm operations. The sharecropping arrangements generally follow the area norms, although, some coercive variations also exist. The land tenure arrangements follow the tenancy laws.

Land leasing has declined noticeably. Compared to 20 years ago, about 40% more farms and over 80% of this area are now operated by pure owners. The more recent field survey shows an even higher percentage, indicating that the trend is continuing. Concomitantly, rented-in land has declined by almost a half (from 32% to 16% of the total.) Pure tenants, as a category, have remained constant as a proportion of the whole, although the area they are farming has declined, from an average 15 acres in 1970 to about 8 acres in 1990. In general sharecropping is being rapidly replaced by cash tenancy arrangements; crop tenants have seen their command area fall from 72% in 1970 to 53% presently, while cash tenancy holdings have increased from 27% to 46% over the same period. Cash tenants tend to be more affluent, with access to outside financial resources.

About one-third farms of the farms are fragmented (two to three fragments per farm). Generally fragments are located on

different watercourses (mostly adjacent), which means farmers have a stake in more than one watercourse. Fragmentation has diverse causes, including, land availability in parcels at the time of original allotment, sale and purchase over time, inheritance, etc. Consolidation at the small farmer level has proven to be socially and legally complex. Fragmentation often gives rise to disputes over water allocations.

Land tenure data for the LCCE is not available. However, the broad trends are conjectured to replicate those in the LBDC.

4.1.2 Poverty and Sustainable Livelihoods

Both poverty levels and income earning opportunities for poor people are assessed. This is a more comprehensive approach as it invokes both the traditionally defined poverty norms, as well as the coping strategies of the poor. In this particular context, this refers to both the occupational distribution and income earning opportunities, based on the perceptions of the poor on what they view as the most onerous aspects of poverty. The traditional poverty criteria considered here includes the head count – the minimum income level required to ensure a prescribed calorie intake for a family -- and adequate service provision (health, education, water supply).

The following analysis is based upon: a) the feasibility studies, which include poverty information based on RRAs carried out in six villages in each of the two canal commands; b) interviews with poor households in the sampled villages (37 households in the LCCE and 12 households in the LBDC and: c) data generated from a survey of 8 villages during the course of the study.

4.1.2.1 Land and Employment

The income distribution patterns are tabulated as under:

***Table4.1*:** Income Distribution in the Sampled Villages

Income Group	LCCE		LBDC	
	%age of households	*Average per capita income($)*	*%age of households*	*Average per capita income ($)*
Very Poor	24.25	55.68	34.98	45.10
Poor	19.85	97.8	24.39	75.41
Average	47.11	144.2	30.69	144.49
Better off	8.79	480.6	10.02	488.49

The World Bank estimates the poverty line to be US$145. By these criteria, the first three income groups can be defined as poor. A number of inferences emerge when this information is juxtaposed with land holding data. First, the poor are preponderantly small farmers and tenants, although, reflecting the emerging trends mentioned earlier, owner-operators have become the majority category. However, not all the poor are farmers. The data on the poorest of the poor, defined as "very poor" and "poor" in the classification above reveals the following occupational breakdown:

***Table 4.2*:** Occupational Breakdown

Occupation	%age (LCCE)*
Farmers	45.67
Servants	13.13
On-farm labor	11.19
Off-farm labor	9.78
Tenants, farm sharing	9.78
Others	10.45

Note: The sample size in the LBDC (12 families) is too small to attempt any generalizations about occupational characteristics. Presumably, the profile is similar to that in the LCCE.

Small farmers and others engaged in farm related activities (on-farm labor, tenants) also engage in animal husbandry – own buffaloes, cattle, goats and sheep – as this constitutes an important source of income and nutrition (milk, meat, manure, work).

Respondents were asked to identify and rank the conditions they felt were most associated with poverty. The lack of arable land, jobs and high dependency were considered the three primary contributors to poverty, with the primacy of the land-poverty association being evident clearly. . Also, both men and women showed an unanimity of responses.

***Table 4.3-A*:** Poverty Characteristics (LCCE)

Characteristics	Combined Group Scoring (%age)		
	Men	Women	Total
Limited cultivable land	55	49	104
Landlessness	52	49	101
Labor as the only income source	30	33	63
High dependency ratio	21	23	44
Unemployment	16	26	42
Indebtedness	19	22	41
Widowhood	14	26	40

***Table 4.3-B*:** Poverty Characteristics (LBDC)

Characteristics	Combined Group Scoring (5age)		
	Men	Women	Total
Limited cultivable land	52	47	99
Landlessness	54	48	102
Labor as the only income source	23	22	45
High dependency ratio	29	34	63
Unemployment	14	27	41
Indebtedness	23	16	39
Widowhood	12	26	28

The data from the sample of eight villages is presented in consolidated form. It combines income and occupational status with poverty perceptions. The three annual income brackets considered are $90-$70, $70-$50 and below $50. All three are well below the poverty line. Defined in these terms, the proportion of poor households in the eight villages ranged from 23% to 80%, with most clustered in the 40%-60% median range.

***Table 4.4*:** Income, Occupations and Poverty Perceptions of Households

Occupation/Income	$90-$70	$70-$50	Below $50	Ranking of Poverty Perceptions
Landowner	30%-40%			1. Low incomes/lack of income sources
Owner-cum-tenant		5%-7%		
Crop tenant		9%-10%		2. Large families
Cash tenant		11%-12%		3. Irrigation access
Service		7%-10%		4. Small land holding size
Teachers, health workers (LHVs, nurses) mill workers, government service				5. Marketing access 6. Poor extension 7. Lack of permanent jobs 8. Culturally driven over-consumption
Other			20%-25%	
Farm and other labor, overseas migrant, retailers – predominantly labor				

In the poverty ranking low incomes are generic categories, which encompass all the other poverty sources. Large families are next in the order with land related constraints being bunched together after that.

4.1.2.2 Social Services and Public Infrastructure

Not surprisingly the lack of social services was not cited as a major contributor of poverty. It would be facile to put this down to a lack of perception about the links between health, education and productivity. In fact, as it turns out, access to social services in the LCCE is higher than the national average in most cases. The exceptions are drinking water and sewerage, where coverage is abysmal.

***Table 4.5*:** Access to Social Services

Services and Infrastructure	%age Household Access	
	LCCE	LBDC
Primary School – Boys	65.2	61.4
Primary School – Girls	47.1	43.1
Middle School – Girls	15.2	NA
High School – Boys	37.2	29.8
High School – Girls	29.1	21.6
Health Center	85.2	75.5
Veterinary Center	70.4	71.0
Village Road	100.0	100.0

Continued…..

Domestic Electrification	95	90
Public Hand pumps	11.5	9.7
Piped Water Supply	0.0	7.9
Sewerage system	8.5	9.5
Agricultural Market	60.3	74.0
Post-Telegraph Office	86.1	81.2
Telephone/PCO	41.6	48.5
Police Post/Station	65.2	71.2

4.1.2.3 Implications for FO Formation

The general and specific manifestations of poverty are likely to have important implications for the farmers' willingness and ability to participate in irrigation management. Recapping these are:

- Between 80%-85% of farms in the two canal commands fall in the small farmer category (under 12.5 acres) and with an average holding size ranging from 4-5 acres.
- In this category self-cultivation is rapidly becoming the dominant ownership pattern
- However, pure tenant farming is still widespread, with the average size of tenant-operated farms having fallen over time.
- Cash tenancy is gradually replacing crop tenancy
- The agrarian structure is skewed. About 5% of the large farmers (with holdings over 25 acres) own more than 30% of the cultivable land.
- There is increasing evidence of polarization. Medium size farms are becoming smaller through the inheritance process, and shifting into the small farm category. In this category, the average size has remained constant over time, evidence that minimum cultivable holdings are being retained. Large farmers are resuming and consolidating land.
- Among the poorest of the poor, there is a preponderance of farming and/or related activities. In other words, farming forms the core of rural livelihoods

The implications for FO formation are as follows:

- Small farmers have an incentive to mobilize as this will provide them with the collective strength to resist economic

(water theft) and rights violations by large farmers in collusion with irrigation department staff.

- The preponderance of small farmers is conducive to equitable and broad-based representation in the FOs.
- The poverty equivalence of small farmers with disempowered and landless groups can potentially ensure a place for the latter in the constituted FOs.
- Growing owner cultivation will ease management problems for the FOs, especially with regard to water allocations

However, the attendant risks are just as great:

- Small farmer based innovations carry less weight with the irrigation department, especially when it views such innovations as a threat to its privileges – indeed to its very existence – and may try to subvert the process
- Large farmers will attempt to dominate the FO's to their own advantage
- Ethnic/*biradri* differences will create strife among FO members, although it has to be convincingly demonstrated that such differences override economic considerations

4.1.3 Assessment of Cooperation/Conflict Among Farmers – Social and Stakeholder Analysis

The population in the LBDC area is far from homogeneous, reflecting the successive influx of peoples from a variety of social and geographic origins, both prior to and after the introduction of canal irrigation. The indigenous settlers are located in the riverine lands stretching south from the *Ravi* to the main canal. These settlers are constituted in social groups called *quoms*, which have co-existed for at least two centuries in discrete settlements and whose dispersed pattern is still largely determined by the location of the traditional patrilineal lands *(patties*). A far greater degree of cultural and ethnic heterogeneity prevails in the area south of the main canal, reflecting successive waves of settlements. The first settlers were the allottees benefiting from the pre-independence canal construction. The second wave consisted of post-Partition colonists; these were *rajputs*, *arains*,

jats and gujars from Indian Gurdaspur, Hoshiarpur and Ferozpur. Subsequently, there were layers of state sponsored settlements, namely, the 12-conditions scheme in the Khanewal left bank area, the tube well scheme instituted in the same area, Tarbela dam affectee scheme and army allottees with their contracted sharecroppers

While indigenous farmer groups generally dominate the left bank, the right bank is a mosaic of *biradaris*. Fragile stability best describes the state of co-existence between these biradries. Social problems tend to be of an inter *biradri* nature, while land and water problems cut across *biradri* lines. Conflict resolution devolves either upon the '*panchayat*' consisting of village elders and upon the state judicial system

In an agrarian society the ethnic composition has a direct bearing on access and control to resources, but this is defined in very broad terms. The *jats, arains, rajputs, and syed biradris* have been farmers for generations. The *kammi* (worker) biradris are defined as *nai* (barber), *mochi* (cobbler), *jaulaha* (weaver), *dhabba* (tailor), *machi/mashki* (water carrier, baker), *kumhar* (artisan), *mistri* (mason) and *musallis* (sweeper). The *gujjars* are traditionally associated with tending livestock. Within the farming community, land tenure, access to and control over irrigation flows along feudal lines. In other words, the size of the holding determines the extent of power and influence over land and water resources and this cuts across *biradris* within the farming community. Evolving conditions have added a slight twist to this configuration. A more appropriate term would be 'feudal mindset' as this expands the universe to include small farmers with the right connections and contractors, who have rented in large tracts of land on a cash-tenancy basis.

In land disputes, the large landowners and the well connected tend to prevail, with little recourse to traditional or state judicial recourse, as established social and cultural norms weigh in against them. Land disputes amongst small to medium farmers are resolved by the village elder if the antagonists are from the same village and by the *panchayat* if they reside in different villages, although a *panchayat*

ruling may be invoked if the dispute cuts across *biradri*s in the same village. The response to illegal water appropriations is also similar. Large farmers are the winners in this case as well, regardless of whether the appropriations are covert or sanctified by the irrigation department. The only difference is when two villages are pitted against each other, in which case the *panchayat* will be called upon to settle the dispute. State judicial recourse has become more prevalent as rural norms and traditions disintegrate and the *panchayats* are viewed as a measure of last resort.

During the fieldwork, it was observed that surveyed villages tended to be *biradri* centered, although *jats* and *arains* were widely dispersed. *Biradri* based convergence on political and social grounds is diminishing – although more so the former. This is encouraging for FO formation.

Water conflicts are more common between villages, and between farmers and the Punjab Irrigation Department (PIDA), than among farmers of the same village; in particular, tail-end farmers feel consistently discriminated against. All the farmer groups, except two, were confident that FO would be able to check tampering of outlets, and water thefts if given the mandate and the powers/authority to do so. They were convinced that illegal appropriations were not possible without the backing of PID staff and that if they were withdrawn, such incidents would diminish. Collective social pressure would curb excesses by feudals and the politically influential.

The population in the LCCE is similarly heterogeneous. Also, the villages tend to be less *biradr*i centered. Notwithstanding, *jat* and *arain* are the two major *biradries* in Faisalabad district, while *dogars* dominate in Sheikhupura district. In addition to the two conflict resolution mechanisms mentioned, prominent religious figures are also called in to mediate disputes.

Biradaries are important in social and political affiliations but were not felt to be a source of resource conflicts. In particular, all the farmer groups indicated that such segregation would not affect the sustainability of FOs and issues related to water management. On

water related conflicts, the respondents preferred to talk about them individually than in the group sessions. They indicated that outlet tempering, water pumping and can breaching were common practices, especially at the head reach of the distributary. The disregard of complaints by the PID, especially when political figures were involved, was cited as evidence of widespread collusion for profit.

4.1.4 Grassroots Organizational Analysis – The Potential for Participatory Irrigation Management

4.1.4.1 Existing Institutions

No NGO or community organization of note exists in the LBDC. Some of the watercourses have defunct WUAs. On distributaries where the OFWM department is trying to establish FOs the defunct WUAs, are being revitalized and new WUAs constituted on watercourses where they do not exist. More recently, the Punjab Rural Support Program (PRSP) organized a few communities into multipurpose CBOs. While PRSP's primary focus is no micro finance, it is also organizing WUAs as building blocks for the FOs.

An Area Water Board (AWB) has been established on the LCCE, a pioneering effort in the Punjab. The AWB membership consists equally of department officials and nominated representatives from the farmer community – these tend to be influential/large farmers. The Superintending Engineer of the LCCE has also been designated General Manager of the AWB. The AWB has designated FOs at each of the distributaries on field staff recommendations. The intent is to get these FOs themselves registered with the AWB, prior to transfer of management to them.

4.1.4.2 Familiarity with and Perceptions About the Proposed Irrigation Reforms

This section is based on surveys carried out in the two canal commands.

There was uncertainty about the proposed institutional innovations among farmers and most of it seemed to be colored by departmental prejudices. Examples of this misinformation are: the irrigation system would be handed over to expatriate investors; water rates would increase precipitately/would be charged on an hourly basis; meters would be installed on outlets (*mogahs*); executive members of the FO would get more water. The LCCE-AWB established FOs unilaterally on a large number of distributaries, essentially complying with PIDA's instructions, but without the benefit of farmer participation or consultation. This has been rectified to some extent, as subsequently FOs are being formed in a more consultative manner but social mobilization and participation still is, substantively, lacking. Similarly, farmer members of the AWB are inducted through nominations and most farmers are unaware of their existence – or even of the AWB itself.

Not surprisingly, the operational PID staff (SDOs, XENs) is skeptical about the whole process. This reflects, partly, their lack of involvement in it and, partly, the fear of the loss of jobs and prerogatives. They also feel farmers are incapable of handling the technical aspects of irrigation management.

By contrast, farmers were unreservedly enthusiastic about the proposed management transfers, not least because they felt unhappy with the performance of PID. Regarding the process, only on large distributaries did farmers feel a sense of inadequacy and supported joint (farmer-PID) management, although they were emphatic that the PID should, eventually, be phased out. The majority of the groups favored comprehensive and upfront transfer, which included rights and responsibilities, such as: a) the right to hire and fire staff (reflecting their disgruntlement with the PID operational staff and the revenue *patwari);* b) right-sizing the outlets (*mogahs*); O&M; collecting and distributing *abiana* (water rates) and; enforcing fines and penalties for water theft and outlet tampering. The farmers were confident that they could check these misdemeanors, provided they were given the authority/powers and the support of the local administration.

Farmers felt their involvement would ensure equitable water distribution, namely, the tail reaches would not be deprived of water. Alternately, farmers without water would not have to pay *abiana* as they currently were doing. They were confident they could assess and collect *abiana*, although some expressed a need for technical training and guidance. All the farmer groups knew, approximately, how much *abiana* was collected annually from their village/watercourse and there were strongly worded sentiments to the effect that 'not a single *paisa* was spent on the O&M of the distributary.' If necessary, they were prepared to pay even higher rates, provided they were given the collective right to spend it.

Eight of the nine surveyed groups supported an open general body meeting, to review and nominate candidates for the FO executive body. A consensus process was preferred to elections, the concern being that elections could degenerate into political infighting and party alignments. No specific criteria or qualifications were specified for the members. However, farmers generally recommended nominating individuals, who were experienced, dedicated and possessed the requisite educational, economic and moral attributes. The suggested tenure for the members was 2-3 years, subject to removal or renewal by a two-thirds majority of the general body.

In response to equity concerns, such as representation of tail end and small and landless farmers in the executive body, the spread of responses was as follows:

- The chairman should not own more than 5 acres
- Fix a quota for tail-end farmers
- Let the FO be an open forum with no quota for anybody and let farmers discuss and decide.

The initial focus of the FO should be on water management. Once the FO had reached maturity, only then should it get involved in areas such as health, education, sanitation and agriculture-related activities (credit, inputs).

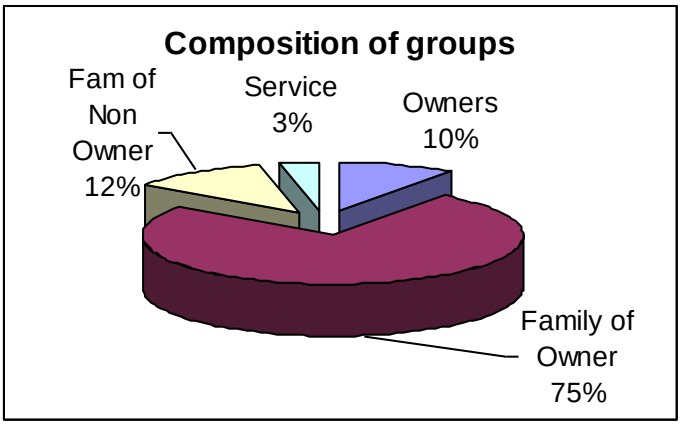
4.1.4.3 Gender Issues Related to Farming and Irrigation

While women are central to many farming activities – in addition to their household chores - their contributions are understated consistently. Regrettably, despite their overwhelming emotional and economic contribution in family affairs, in decision-making affairs they remain subordinate to men. This incongruence is surprising, even more so when women, increasingly, are becoming an integral part of the rural decision making process in neighboring countries. The distilled findings of the surveys carried out separately among men and women in the two canal commands are reported below.

The consensus amongst the farmers was that women should not be involved in irrigation management, nor should they be represented in the FOs, even when it was a multi-faceted one. Instead, the male family members should bring their concerns to the attention of the FOs. Even in property matters the men felt that they – or the *biradri* – could look after their interests.

***Women's Responses*:** Focus group discussions were carried out with women representing villages on seven distributaries in the LCCE. The group composition is indicated in the pie chart.

Fig.4.1



Adult literacy rate among women is between 10-15%. Almost 60% of the women are engaged in farm activities, directly or indirectly (sowing, harvesting, cotton picking, stripping sugarcane, carrying food for males working in the fields etc.). Very few (2%) are in service. Women, traditionally do not irrigate fields. On being queried, they responded that traditionally it was a male activity, required hard labor, and often the *warabandi* came at night when they could not go out.

Women who own land either rent it out, or their male family members farm it and represent them in departmental matters concerning irrigation or revenue. Women are not included in the voting lists for WUAs, as this list consists of only water users registered with the PID and not land owners.

In the brackish water zones, women use canal water for drinking, cooking, bathing and washing. The underground water is only used for cleaning the house. In the slightly saline and sweet water zones, in-house hand and motor pumps are very common. Wastewater disposal is a major problem and there is definite potential for involving women in water management at the household level.

Decision making at both the village and household level resides primarily with men. Women are consulted on household issues such as the children's education, marriage and problems with relatives. Consultations regarding village level affairs – conflicts between *biradries* – do occur but are less common. Farm related issues are also discussed in a few households.

***Table 4.6*:** Decision Making and Consultation

Name of Village	Independent household level decisions	Consultations regarding household affairs	Independent village level decisions	Consultations regarding village level decisions
Chak 293 GB		Education, marriage, problems with relatives		Conflicts between castes, problems/conflicts within *biradri*
Chak 297 GB	Cooking food children's problems	Family matters, problems with relatives	Conflicts/problems amongst women	General problems of the village, Conflicts among biradaries
Chak 125 GB	Cooking, shopping for household items	Family affairs, family incomes		Biradary disputes, farm problems including those concerning canal water use
Chak 237 GB	Children's education, cooking	Children's problems, problems with relatives		Biradry disputes,. problems related to agriculture, including water
Chak 159 GB		Family, children and relatives problems		Conflicts between biradries and groups
Chak 27 GB	Shopping for household items	Family matters		Village disputes

Women and Irrigation: Women are well aware of the importance and problems of irrigation. When asked whether irrigation water related problems were discussed in the house, majority of all the groups responded in the affirmative. However, in very rich and very poor households consultations on irrigation water do not occur. Five out of seven groups indicated that they were involved in some sort of collective activities, mostly savings (committee). The majority of the groups expressed a need for a more active role in decision making at the household and village level. None of the groups wanted to be a part of the farmer managed irrigation system (FMIS). The reasons for this are tabulated below:

***Table 4.7*:** Reasons for Non-participation in Irrigation Management

Name of Village	Reasons for not participating
Chak 293 GB	Traditional barriers; women can not sit together with males, Low literacy among women
Chak 277 GB	Problems related to irrigation are too serious to be solved by women. Lack of expertise
Chak 125 RB	Irrigation is a male activity
Chak 237 GB	Men will not allow women to participate. Lack of trust in their abilities
Chak 159 GB	Men will not allow them to participate
Chak 214 GB	Women are ignorant about the system and its management. Lack of education and exposure
Chak 27 GB	Male dominant society. Even if we sit in the FO the participation would not be meaningful.

Most groups hoped A majority of the women in different groups hoped that the new system would solve the long lasting problems related to irrigation water and would increase their income.

***Table 4.8*:** Perceived Benefits of Farmer-Managed Irrigation Systems

Name of Village	Perceived benefits of the farmer managed irrigation system
Chak 293 GB	FMIS may remove all the problems related to water and the excesses of the irrigation dept and, if managed properly, would increase income through better yield
Chak 277 GB	FMIS would increase yields (earnings) and improve the standard of living
Chak 237 GB	It would remove all the problems created by the Irrigation Dept. and increase the supply of water
Chak 159 GB	If managed successfully, the FMIS would increase incomes
Chak 27 GB	FMIS would ensure better distribution of water. Poor farmers would get their rights.

4.3 Review of the Data Sources and its Quality

The data related to population, cropping patterns and cropped area, canal withdrawals, number of farmers on a watercourse, their land holdings and associated water share, population and uses water requirements by non-farm users, tube wells and its utilization rate, extent of salinization and water logging, etc. are collected by different agencies. They include the revenue, agriculture, livestock, irrigation departments and WAPDA. The available data needs to be aggregated at the distributary level.

4.3 Additional Baseline/Benchmark Surveys and Data Gaps

A meaningful database needs to be created and should include the following variables.

- Land use pattern by distributary
- Cropping pattern by distributary
- Data on delivery efficiencies, in terms of availability at root zone, for each distributary.
- Data on the water table by distributary and minors.

- Water availability (at the head) by source for each distributary.
- Data on tube well at its withdrawals and extent of over mining (water balance).
- Soil types and soil capability maps by distributaries.
- Weather data with rate of evapotranspiration (ET) and crop water requirements.
- Distributary wise usage by agricultural and non-agricultural usage.
- Data on present distributary wise O&M expenditure and recoveries.
- Data on ground level fluctuations by distributary command areas
- General relief map of the area with low lying area identified and with its drainage paths
- Withdrawal and allocation to competing sources on each distributary.

4.4 Suggested Approach and Methodology for the Surveys

Among other things, the FOs should plan and initiate the benchmark surveys, contracting them out to research institutions and other survey specialists. The quantitative and qualitative indicators/data can be monitored to gauge the performance of the institutional arrangements assessed in terms of incomes, equity and sustainability.

The data should include a complete census of the following:

1. List of watercourse with CCA, number of shareholders with area, and water share, grouped into immediate family.
2 Watercourse wise land use, area under different crops by season, cropping pattern, and land use.

5

Social Environmental and Institutional Screening

Table 5.1: Screening Matrix

Project Components	Project Activity/Potential Field Action	Impacted Region/Stake-holders	Impacts – Institutional, Social, Environmental	Mitigation Proposed	Key Outcomes as a Basis for Developing Indicators/ Monitoring Frequency*	Risks
1. Establishing/ Making Operational – PIDA, AWBs	PIDA Change and finalize legal framework and regulations for the operations of PIDA, AWBs and FOs	Impacted Region All canal commands in the Punjab Province Stakeholders	Positive Impacts Government's fiscal liabilities reduced (subsidies phased out, payroll substantially reduced)	A comprehensive /retrenchment compensation program prepared and underwritten by the Bank	PIDA Act being implemented PIDA, AWBs fully staffed and operational CDSG/PSU and M&E Units established and operational	Resistance within PIDA and AWBs to internalizing new organizational values and culture

	Establish an AWB on the LBDC and LCCE Establish the CDSG/PSU and the UM&E units within PIDA, with a view to transforming PIDA and AWBs into autonomous, service oriented, financially viable public utilities. Formulate and implement a publicity campaign for farmers Undertake training needs assessment for farmers and PIDA/AWB staff Based on the needs assessment, develop training modules in the following areas:	Farmers, PIDA, AWB Irrigation and Revenue department staff	Negative Impacts Irrigation staff retrenched Possible governance of AWBs by a few influential people and biased water allocation		PIDA provides financial, revenue and legal advice and technical support to FOs on a time-defined basis Training on organizational, social, financial/revenue, technical and environmental aspects provided Management transfers to constituted FOs under the PIDA Act (1998) implemented PIDA and AWBs transformed into autonomous, service oriented, financially viable public utilities at the end of the transition period (7 years) A viable revenue sharing arrangement between PIDA, AWBs and the FOs established	AWBs nominate farmer representatives on their boards, rather than through consultations with FOs, thus prejudicing fair arbitration. FO formation is not process based; instead paper FOs created Co-management arrangements replace upfront transfers Water not provided to farmers as per agreements

	Process change (organizational) Social mobilization Revenue/financial Technical (O&M, communications) Environmental management (plantation, water quality) Implement training post FO formation Transfer management at the tertiary irrigation level to FOs in the project designated canal commands (LCCE, LBDC) AWB Supply water to farmers on commercial basis Make operational communication system in				AWB commercial operations fully underway at the end of the transition period Impartial and representative tribunals established within the AWBs Possible inefficient functioning of AWBs after the completion of the project. Lack of coordination between AWB officials, PIDA officials and FOs	

	conjunction with PIDA and farmers Activate tribunal within AWB to arbitrate inter and intra FO conflicts					
2. Fostering the Establishment and Development of Farmer Organizations (FOs) at the Distributary/Minor Level	Institute FO formation. The process for each FO will entail: A baseline socioeconomic and environmental survey Social mobilization Training Equitable representation to include: Tenants, sharecroppers, small farmers Head, mid and tail reach of each distributary/minor Women (provided a viable role for them in irrigation management can be	Impacted Region LCCE, LBDC Stakeholders FOs, NGOs, OFWM Department	Positive Impacts Precedents and synergisms created for establishing FOs outside the project canal commands Employment generated for FO contract employees Poor farmers, tenants and sharecroppers empowered Water distributed equitably Water theft and willful damage to		Structured process adhered to in FO formation Viable and sustainable approaches to FO formation identified Institutional arrangements to replicate successful approaches finalized Viable and sustainable FOs formed in the LBDC and LCCE Established FOs become proactive in FO formation Environmental activities integrated in irrigation system management Women consulted and given decision making	FOs subverted by large farmers/vested interests Possible inefficient functioning of FOs after the completion of the project.

	demonstrated) Adopt a phased approach: Phase 1 consists of competitive contracts with PIDA, open to both NGOS and OFWM. The aim is to test and establish viable and sustainable approaches to FO formation Phase 2 consists of institutional arrangements with OFWM to implement these approaches on a larger scale. The CDSG/PSU to maintain close oversight of the process. Involve functional FOs in the formation process		irrigation infrastructure reduced/eliminated Economic and health benefits generated via community based environmental management Negative Impacts Possible friction/social tension between FOs in different locations in trying to access water		powers in water quality and health issues Water panchayats become functional	

	Establish community courts at the community level (water panchayats) Establish social-environmental interface Farmers plant trees, scrub, grasses on distributary embankments and bridle paths Farmers and women monitor and take remedial measures with regard to: Irrigation water quality for drinking purposes Waste water for vegetable cultivation					

3. Improving	Repair Qadirabad	Impacted	Positive Impacts	Establish	Regular and increased	Unwillingness

Irrigation Infrastructure for the LCCE AND LBDC Commands	Barrage Improve/rehabilitate main and branch canals Improve/rehabilitate distributaries/minors Improve/rehabilitate watercourses Concurrent Project Activities in the Two Canal Commands National Drainage Program OFWM Punjab Private Sector Groundwater Development SCARP Transition Punjab Forest Sector Development Project	Regions LCCE, LBDC Stakeholders Contractors, PIDA, AWB, Irrigation officials Farmers	Rated Category B. No adverse social and environmental impacts Water logging and salinity reduced Reduced risk of malaria Increase in agricultural productivity and incomes Also, environmental mitigation due to concurrent project activities synergizes positive environmental and economic impacts Negative Impacts Dredge accumulation Drainage effluent	environmental baselines Conduct more detailed EIAs assessing impacts of water quality on agricultural production and human health Undertake dredge disposal. Communities take responsibility at the tertiary irrigation level Initiate pilot activities to recycle drainage effluent within canal command Intensify adaptive	supply of water ensured Farmers contribute to tertiary level rehabilitation (distributaries/minors/water courses), leading to water use efficiency improvements Water-use efficiency also improved by market-driven and conjunctive use of groundwater in the private sector Shallow vertical and surface drainage under the NDP represents a more sustainable solution to water logging and salinity problems	by farmers to manage SCARP tube wells risks resurgence of water logging and salinity problems

			disposal downstream through rivers Possible failure of structures during rehabilitation, possibility of localized flooding	research and extension on salt resistant crops Increased use of pesticides and fertilizers. Institute integrated pest management		
Overarching Considerations	PISIP cannot be considered a stand-alone activity. As shown above, it is synergistically linked with a number of concurrent activities under different projects. By the same token, a number of overarching considerations are likely to affect PISIP project outcomes and, therefore, require appropriate interventions. 1. Inter-sectoral competition for water. Such competition accentuates the need for more efficient water use, initially dictated by environmental considerations. 2. Water quality and soil deterioration due to: Industrial and household runoff Pesticide and fertilizer use Upstream impacts on the project area and, in turn, the downstream effects of activities in the project area combine to make this a regional concern. In addition, there is an inter-sector dimension to it as well. Efforts to deal with the problem require more detailed investigations (studies, research), as well as inter-agency cooperation (EPA, WASA, agricultural departments, agricultural universities) to monitor such impacts with a view to mitigating them.					
4. Rehabilitating the Telecommunication and		The entire canal commands impacted	Farmer trained in operating the system	Tailoring the system to the		The system may break down or be difficult to

Information System		beneficially by better water distribution		capabilities of farmers		manage
5. Instituting an Effective Monitoring an Evaluation system	Covered under Project Component 1	See Project Component 1	Positive Impacts Accountability in the FO formation process Cycle of continuous assessment and feedback established Institutionalization of a monitoring role within PIDA		Cross-project coordination Uniformity of FO functions assured FOs subject to uniform screening criteria	The monitoring system fails to establish/retain an independent identity Some FO functions (tertiary level drainage management) crosses individual FO jurisdictions
6. Technical Assistance and Training for Efficient Project Implementation	Training Modules Developed and Refined for Awareness creation Social Mobilization Environmental Coordination and Management Irrigation and Drainage	Impacted Region LCCE, LBDC Stakeholders PIDA, Abs, FOs, Irrigation	Positive Impacts Process change facilitated with a view to: Making PIDA service oriented; ensuring the commercial viability of AWBs; ensuring the social, technical and financial		Training Implemented, Assessed, Evaluated and Revised	

	Management Application of Technical Innovations (e.g. lining of canals/distributaries /minors, modern communications systems) Financial/Revenue Management	Department, OFWM, NGOs	viability of FOs			

Note: * Based on the outcomes detailed indicators and monitoring frequency will be determined by the M&E Unit

6

Project Environmental Impacts – Additional Activities to Sustain Environmental Benefits

6.1 The Context

A stand-alone analysis of the potential environmental impacts of project activities is likely to weigh on the side of benefits, a conclusion predisposed by the category-B rating of the PISIP project. However, a regional analysis captures overarching environmental effects, not easily visible in a localized analysis. The risk is that such effects may neutralize envisaged project benefits. Thus, additional interventions may be required, which were not originally conceived. This could take the form of lateral linkages between projects, policy and program coordination between departments and community participation in environmental management.

A corollary to this is that a with-and-without project analysis becomes a bit redundant in view of the regionally inclusive nature of the project. Additionally, there exists a non-reversible policy decision to commercialize and devolve irrigation management. In other words, while counterfactuals can be established, the policy fait accompli makes a with- and-without analysis redundant. Instead, the study compares the environmental impacts of an integrated approach to environmental management, with those arising out of the originally designed project activities.

Some of the environmental concerns which require policy, program and project coordination are:

- Inter-sector water competition
- Water quality issues; the growing and diffused nature of water and soil pollution and the attendant biodiversity loss
- Water-logging and salinity

Possible interventions are interagency coordination for policy formulation, water quality monitoring and treatment; program/project linkages focusing on improving conjunctive water-use and linking irrigation and drainage activities and; mobilizing farmer communities and women for environmental management and mitigation

Consequently, the project may need to develop coping strategies which address extend its original parameters, yet remain within the specified financial limits. Clearly, the environmental issues are complex and many of them cannot be addressed by the project. Nonetheless, a holistic assessment is precedent to identifying feasible levels of intervention.

A related issue is the state of environmental information concerning the project area. The environmental baseline provided contains information gaps. The role of women in irrigation/environmental management is still unclear. Studies on water pollution; its nature, determinants and impacts have to be undertaken. All this demonstrates that environmental management and mitigation has an iterative aspect to it, with the degree of effectiveness underpinned by clarity of insight.

6.2 Project Environmental Impacts

The PISIP is rated as Category “B”. This is in accordance with Bank environmental project screening criteria, as the project is a time-slice operation, involving rehabilitation of existing irrigation systems. The infrastructure development works will primarily entail improvements and rehabilitation of existing irrigation infrastructure. Hence, it would not be subject to the

adverse environmental effects associated with new development, such as resettlement, depletion of land and water resources, loss of wildlife habitat (wetlands and biodiversity).

In fact, there are more potential environmental benefits than risks associated with the project. First, physical irrigation system improvements are likely to lower the incidence of water logging and salinity as a result of reduced seepage from the canals, distributaries, minors and watercourses. Second, the institutional reforms, aimed at commercializing water distribution and transferring irrigation system management to the AWBs and FOs will ensure better O&M of the rehabilitated irrigation infrastructure and improved on-farm water conservation practices. Third, reduced seepage also means fewer adjacent water bodies and ponds, which tend to become breeding grounds for malarial vectors. There has been a resurgence of malaria in the country ever since USAID malaria control projects came to a close in the mid-nineties, which the project will contribute to mitigating.[2] Also, the preventive aspect of such mitigation is consistent with the findings of post-USAID project evaluations, which demonstrated that prevention was more effective than curative measures.

Environmental risks pertain largely to dredge accumulation and disposal during system rehabilitation.

However, as the identified benefits are largely derivative -- a result of project activities aimed at securing other objectives -- additional interventions are required to make them sustainable. Also, non-project related developments could pose environmental problems within the project area. Finally, parallel project activities have the potential to synergize environmental benefits, originally sourced in the project. In order to maximize such benefits and mitigate negative impacts, environmental issues need to be mainstreamed in the project, regardless of origin. This will require institutional

[2] Malaria Control – II: Post-project Evaluation, USAID, 1995

modifications, enhanced scope for farmer participation and a greater involvement of women in project activities.

6.3 The Nature of Linkages

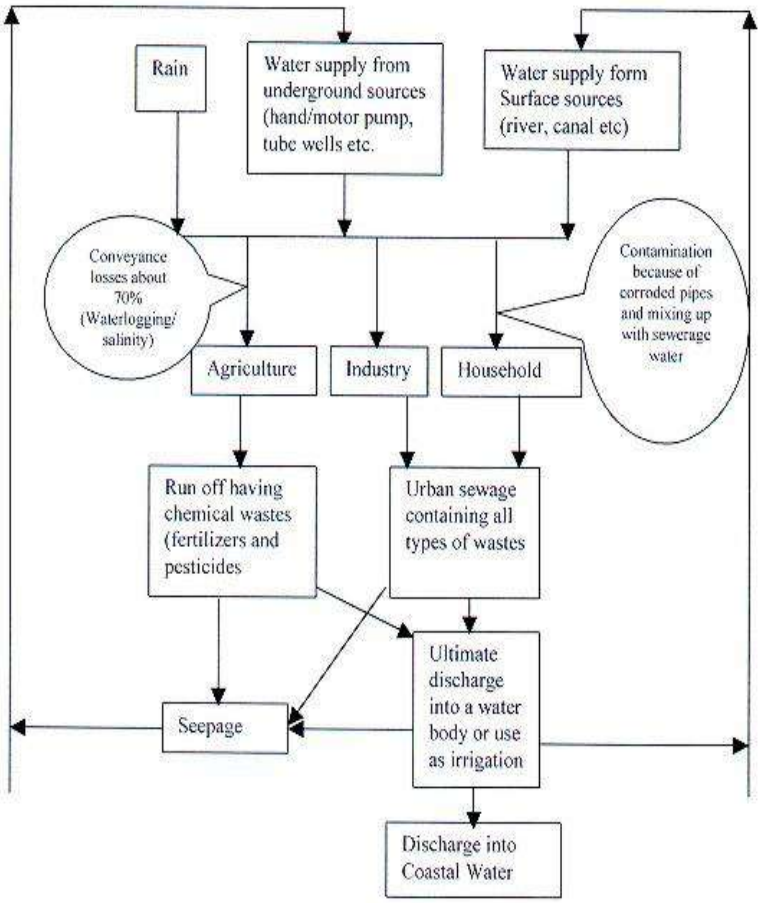
The TORs require a regional social and environmental assessment (RSEA) of project impacts. This assessment is precedent to 'mainstreaming' environmental concerns within the project. The term is applied here to encompass three broad types of linkages.

6.3.1 Overarching Aspects: Water Quality Deterioration

A simple water contamination cycle is presented below:

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 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. (For details see Khan and Naqvi: 1998).

Fig 6.1: A Water Contamination Cycle



While water pollution has many sources, touches a number of sectors and has regional ramifications, the problem has only just begun to be documented. Detailed data on total wastewater discharge is available only for some major cities in the Punjab (for data on Lahore, see chapter 3).

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 182-222 mg/liter (Shuja: 1998:2) 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 the supply-disposal-supply cycle. At each successive step, the pollutant loads increases in the form 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 lain sewerage pipes as a result of pressure fluctuations. In slums, poor localities and villages the standard water supply sources are community stand 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[3]

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.

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3 The World Bank. Nd. *A Review of Environmental health Impacts in Developing Countries Cities.* Urban Management Program Discussion Paper Number 6.

The use of chemical fertilizers, pesticides, insecticides, and fungicides has increased tremendously over the years[4]. The run-off from irrigation feeds into surface water and also seeps into sub-soil water as crops utilize not 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 to be biologically and/or chemically contaminated[5]. Over the years, there has been a change in the pollutant composition towards chemical sources.

The problem is inherently complex and requires extensive monitoring and close inter-departmental and cross-provincial coordination. However, this is easier said than done. The boxed information provides a flavor of what urban water authorities in medium to large cities in the Punjab are up against and, consequently, how far the project can expect to engage them in mitigation activities.

Water Quality Issues in Faisalabad

Faisalabad is an unplanned city with no separation between residential and industrial areas, which causes industrial and household effluents to intermingle. Effluent disposal is built around natural drainage and old existing channels, which eventually discharge into the river Chenab. The soil in and around Faisalabad tends to be plastic, limiting seepage but creating overflow problems. The drainage system is extremely dilapidated. Sullage and storm water drains are dysfunctional and pipe corrosion results in seepage into the freshwater system. In addition, poor communities tend to pump water out of gutters for household use. There are no price or regulatory provisions for in-house or end-of-pipe treatment of industrial effluents. The lack of interdepartmental coordination exacerbates problems. For instance, road construction has not been

4 The consumption of fertilizer has increased about 123% between 1980-81 and 1996-97. (Agricultural Statistics of Pakistan. Page 130)

5 Sustainable Development Policy Institute. 1995. *Nature, Power, and People: Citizen's Report on Sustainable Development 1995.* Islamabad.

dovetailed with the WASA Master Plan, resulting in the creation of troughs, which have become depositories of stagnant water. The present preoccupation is with development rather than consolidation. A classic example of this is that water supply to the new townships continues to be routed through the old city network and which there is no plan to rehabilitate, regardless of the additional demands that it has to sustain.

The emphasis on development schemes, neglect of rehabilitation, limited O&M funding, low cost recovery and high establishment allocations are a familiar municipal syndrome. One of its manifestations is the inability to perceive problems beyond the city confines, a problem aggravated by the vertical orientation of departments. Thus wastewater is sold under contract to outlying farmers and drains into the Chenab. However, there are no regular arrangements to test or treat this water. Any interventions, worth the name are sporadic and donor driven. For instance, JICA has financed the construction of oxidation ponds for wastewater treatment. This is unpopular with farmers who prefer to buy water untreated, while the high value of residential land makes such investment expensive.

The intrusion of urban wastewater into the canal irrigation and river systems is a problem that is likely to become more severe in future as residential and industrial expansion continues apace and municipal budgets shrink in real terms. Clearly, interventions at this level are beyond the pale of the project. However, there is scope for promoting interdepartmental coordination, advocacy and awareness campaigns and the institution of water quality and health monitoring systems.

6.3.2 Lateral Linkages

The planning and implementation of irrigation and related activities in the two canal commands has followed a fairly random pattern. The practice has been to proceed sub-sectorally. Clearly, this is not the best way to generate synergies between related activities (irrigation, drainage, groundwater development, on-farm water management etc.) or to mitigate environmental concerns. For instance, it neglects critical issues of sequencing. In particular, a number of environmental and health problems (soil

and water salinization, wetland degradation, mosquito infestation, etc.) could have been averted had a more integrated approach been adopted.[6] However, the various sub-sectoral projects in the two canal commands include all the key components. The challenge is to strengthen linkages between the related activities with a view to improving efficiency, ensuring equity and achieving sustainable environmental benefits. The projects are described below, especially with a view towards identifying commonalities and links.

6.3.2.1 National Drainage Program (NDP)

The prognosis regarding the extant drainage system is grim. "The consequence of operating a vast, inefficient, and interconnected irrigation system for decades first without drainage, and then later inter-woven with an inefficient, inadequate and discontinuous drainage system has been the gradual rising of the water-table and associated salinity" (Bank: 1997: 3). In the absence of adequate outlets and the mobilization of saline groundwater, effluents have accumulated and continue to be recycled within the contiguous irrigation network, raising water tables and increasing salinity. In addition, much of the drainage infrastructure has degraded due to lack of regular maintenance.

The NDP aims to rectify inadequacies in the drainage system with a view to technical, environmental and institutional sustainability.

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[6] The elements of such an approach followed in an adjoining country are the following: pick a river basin in a focus state; initiate extensive reforms in overall water planning (state water plan); establish a state water planning office with a data and analysis support center - to help develop long-terms inter-sectoral basin plans, allocations, and coordination mechanisms across sectors and agencies; initiate reforms in the irrigation department which would trigger physical investments restricted to a smaller area with an attempt at coordinating irrigation systems improvement, drainage improvement and on-farm water management, water user associations , etc. and then expand this approach to other areas (branches, sub-basins, etc.) and eventually other river basins and states.

Its elements, part of a National Surface Drainage system aimed at draining effluents to the sea, are the following:

- Phase out deep government tube wells in the fresh groundwater areas
- Replace existing SCARP tube wells in saline groundwater areas (SGW) with tile drains wherever possible, with beneficiaries assuming responsibility for O&M.
- Install tile drains where possible for new drainage development in SGW areas, provided there are safe options for disposal of the drainage and beneficiaries agree to be involved in the construction and O&M of the facilities
- Encourage construction of tertiary (on-farm) drains by the beneficiaries
- Direct investment in main and secondary surface drains to areas where crop damage as a result of storm runoff can be reduced, groundwater tables are rising and sufficient irrigation supplies are available to cultivate reclaimed land and where disposal drains are required for saline effluent of subsurface drainage facilities
- Undertake major drainage schemes in conjunction with preventive measures at source, i.e., improvement of irrigation management at main and secondary levels and reduction of water losses at watercourse and field levels

These activities are to be embedded within a context of institutional change. The three key institutional initiatives are the following:

- Provincial Irrigation and Drainage Authorities, with responsibility for the intra-provincial aspects of the system from barrages to canal headworks, and from main drains that cross canal commands and major drainage basins to inter-provincial drains operated and maintained by WAPDA
- Self-accounting Area Water Boards (AWBs) initially set up as pilots around selected canal commands to take over and manage the irrigation and drainage system from canal headworks to distibutaries/minors operated by FOs, and

from the branch drains operated by FOs to main drains operated by PIDA

- FOs owned and controlled by farmers would also be encouraged through a series of pilots in each AWB to take over and manage the irrigation drainage system at the tertiary level – below the distributaries/minors and sub drains feeding into branch drains operated by AWBs.

6.3.2.2 Punjab Private Sector Groundwater Development Project (PPSGDP)

The PPSGDP is partly an outcome of the difficulties arising out of farmer reluctance to take over the SCARP tube wells phased out under the NDP. Partly, it is intended to compensate for lost pumping capacity as SCARP tube wells become dysfunctional. The project is highly participatory in nature and consists of the following elements:

- Forming water user associations and community tube well groups for improved water management
- Taking over or modifying the SCARP tube wells for community tube well operations
- Installing community tube wells to compensate for lost pumping capacity
- Watercourse improvements
- Undertaking repairs to distributaries, minors, and structures
- Monitoring groundwater balance

6.3.2.3 On-Farm Water Management Project – IV

Building upon different pilot projects undertaken in the country, the project aims to broaden and deepen the recent reform initiatives started under the NDP, by enhancing farmers' participation in irrigation management. Its key objectives are to: a) increase agricultural production and farmers income, especially of poor farmers, through increased scope and productivity of Pakistan's irrigation and drainage systems and b) redefine the government's role in establishing self-sustaining efficient irrigation and drainage systems through enhanced farmers'

participation at the secondary level of irrigation water distribution systems.

The key project activities are as follows:

- Through the community development and support program, develop farmer organizations at the distributary/minor level capable of participating in management and the operation and maintenance of the irrigation system on a sustainable basis
- Provide assistance to improve distributary/minor canal system in areas where FOs/WUAs have started participating in the irrigation system.
- Renovate about 10,000 watercourses on the basis of participatory planning and implementation
- Provide for rehabilitation/improvements of the canals leading to areas managed by FOs/WUAs, to ensure adequate and stable water supplies to the FOs/WUAs

6.3.3 Social-Environment Interface

An important aspect of the RSEA approach lies in its recognition of the potential interface between social and environmental activities. The surveys in the two canal commands revealed how farmers and women could engage in environmental mitigation and conservation:

- Plantation of vegetation/trees/grasses which could provide both environmentally-related benefits (erosion control, N-fixing, stabilizing slopes, etc.) and social/livestock benefits (fuel, fodder, food, income-generating materials)
- Gender focus: Social/health impacts of water quality, or the water quality impacts of social issues (washing, livestock intrusions). Women can be potentially engaged in environmental and health issues surrounding water quality: siting of drinking ponds, wastewater disposal, water treatment, re-designing water containers, hand washing, health advocacy
- Women's role in irrigation management: keeping livestock out of irrigation channels, washing clothes in canals and distributaries

- Waste water cultivation: its benefits (nutrient rich) and health impacts (bore worms, water pollution through seepage)
- Farmer involvement in irrigation/drainage management at the tertiary level for sustainable environmental benefits (reduced water logging and salinity)
- Farmer involvement in monitoring ground water balance
- Disposal/use of excavated earth in a constructive manner, such as embankment lining, paths, crop diversification, etc.

The survey findings are synthesized in the next section.

6.3.3.1 Environmental Awareness – Survey Findings (LCCE)

Environmental awareness among farmers is tardy, compared to relatively more pressing social issues. Regarding biological erosion control, most farmers felt that tree plantation was beneficial along the main and branch canals but that distributaries were too small to accommodate them. Opinion was divided on whether the natural vegetative growth (*sarkandas*) stabilized the distributaries; some felt it strengthened the banks, others that it consumed too much water and constricted the channels. A local farmer-doctor suggested planting *isapghol* (Metamucil source), as it was easy to grow, consumed little water and yielded economic returns. Most farmers were in favor of traditional canal lining to prevent erosion. In general, while less aware of its environmental value, farmers were cognizant of the economic benefits. (fuel wood, fodder, revenue generation from timber sales for distributary maintenance and material for silt trapping). There was evidence of vandalized old trees (government property) along the inspection roads. The ownership-protection nexus needs to be encouraged through a socialization process and should become a part of the FO mandate.

None of the farmer group mentioned quality of canal water or industrial chemical pollution as a problem for them as none of the

distributary or canal passes through any major city. In virtually all the villages, where water from watercourses is used for drinking, wastewater is used for cultivation. In some villages wastewater goes directly into the watercourse. In others, individuals who have dug ponds/shallow wells close to their farms where wastewater is collected and then pumped up to irrigate fields use it. Farmers, generally, are not aware of the harmful affects of human waste (excreta), rather they think wastewater is good for crop yield and where they use waste water as a fertilizer substitute. In a kind of inverted environmental logic farmers expressed relief that, resultantly, they did not need to set aside land for a 'jauhar/chappar' (open pond). Clearly, awareness creation about contamination, where it originates from and its adverse health impacts is necessary. A few farmers were aware that use of urban wastewater for cultivation is harmful because of its chemical contents.

In brackish ground-water zones, canal water is being used for drinking. The perception was that such water is of good quality. On a more positive note farmers are aware of salinity problems and, in some areas, monitor the mixing of both surface and ground water in order to dilute such salinity. There is a general concern, especially in the brackish water areas, about the slowly deteriorating quality of soil resulting from the use of tube well water.

6.3.3.2 Environmental Awareness – Survey Findings (LBDC)

Water logging and salinity were not felt to be major problems in the area. The major environmental concern, which about half of the farmer groups highlighted, was the increasing pollution load in the canal water. Farmers identified the sources of this pollution as industry in Lahore and Okara and municipal waste from Sahiwal, which is discharged in the LBDC. The condition of the river Beas, which flows very low during winter, is even worse. All aquatic life has disappeared, and cattle do not drink the water. Nonetheless, due to shortage of water, farmers are forced to use it for cultivation, causing disease and other adverse health effects.

Wastewater is use for cultivation in the majority of villages. For farmers it is a urea susbstitute and, hence, low cost. Farmers are less aware of the adverse health effects of disposing human excreta into the irrigation system, except that it makes the canal water undrinkable.

All the farmer groups are aware of biological measures to maintain irrigation system. Trees provide wood for 'killa bushi' (natural dyke buildup) and revenue for O&M. Grass planting along distributaries would invite cattle damage and conceal rat holes.

The main competing demand for the irrigation water in LBDC is municipal use and for forest management. The releases in the distributaries located in the lower reaches of the branch systems are generally less than the designed discharge. Farmers reported that during summer season, the rotation plan reduces the water availability. During this period some illegal diversion occurs through siphons and breaching the distributary. These breaches, due to poor maintenance also, result in accentuated shortages at critical water demand periods. The farmers reported that the water availability in the system has decreased overtime due to increased pressure from land allocated to resettled people displaced from Mangla, Tarbela, and Islamabad, new allottees, special allowances admitted to garden and fish-pond farmers, increased demand for drinking water supply schemes, and other non-agricultural/industrial uses.

Out of the five distributaries that we visited, surface drains serve three. But the physical conditions of the drains left much to be desired, as they were choked with weed, shrubs and grasses. The conditions of the unlined distributaries were not much different to the surface drains. Because of the lack of regular maintenance, even the lined parts were in poor condition.

6.4 Mainstreaming Environmental Concerns

The conceptual sea change in the institutional arrangements for irrigation system management is a feature of all the major

projects, either planned or being implemented in the two canal commands. It involves redefining government in a regulatory role, distributing water commercially under autonomous arrangements and enhancing farmers' participation with a view towards self-sustaining and efficient irrigation and drainage systems. The strategic focus is one of fully involving communities, NGOs and the private sector. Clearly, the task is a challenging one, and as it is being undertaken across all the projects, the need for improved inter-project coordination is self-evident.

The environmental benefits residing in such coordination are both direct and indirect. The direct benefits are: a) irrigation system improvement could be synchronized with drainage measures; b) project specific community projects (drainage beneficiary groups, community tube well groups, participatory irrigation system management groups) could be brought under functionally integrated farmer organizations and; c) conjunctive use of surface and groundwater could be better managed and monitored.

Indirectly, the institutional reform process also offers opportunities for devising inter-departmental coordination and conflict resolution mechanisms within PIDA, and for strengthening partnerships between farmers, NGOs, government departments and the private sector. Subsuming traditional inter, intra and cross-sector rivalries under the new institutional arrangements would ensure efficiency gains, in turn generating environmental benefits. In addition, vertical linkages, represented by PIDA facilitation, training and oversight of farmer organizations offers prospects for strengthening the social-environmental interface with a view to sustainable environmental management.

In the context of overarching, lateral and vertical linkages, the following initiatives should be taken under the PISIP project – keeping in mind its financial and logistical constraints, as well as the inherent difficulties underlying process change. Overall, there is a need to have a broad integrated framework for environmental and social issues, but to target what can logically and realistically

be mainstreamed into an irrigation systems improvement project. Primarily, the project can be an excellent opportunity for raising awareness and building capacity on the neglected environmental and social fronts in a number of activities:

- Investigation of water quality monitoring arrangements
- Assessment of water quality impacts (health, agricultural productivity, biodiversity) to feed into other projects, such as the Lahore Urban Development project as well as the project FOs.
- Creation of an environmental monitoring cell within the CDSG. These cells should eventually be replicated in the AWBs (mandate, structure and required skills to be determined during project implementation). Training of farmers and officials of PIDA/AWB in environmental monitoring
- Identification of the key policies and institutions with a potential role in environmental monitoring and mitigation. Among others, these would include the following:
    - The Environmental Protection Act (1997)
    - Provincial EPAs
    - Provincial PDA
    - Provincial industry departments
    - PIDA
    - Agriculture departments
    - Fisheries departments
    - Forestry and Wildlife departments
    - WAPDA
    - WASAs
    - Municipal corporations and development authorities
    - PHEDs
    - Private sector, farmers, NGOs, ag. universities

- Examination of the institutional/legislative and legal precedents for regulating industrial and municipal discharges into 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.

- Recommendations for the development of RSEA capacity to aid information-based decision-making aimed at mainstreaming environmental issues. This would include:
- Information management (development of appropriate GIS/ management information systems).
- Training and awareness creation
- Monitoring and evaluation capability
- Consultation processes for multi-sector decision-making and conflict resolution
- Environmental baselines
- Assessment and propagation of new technologies: salt-resistant crops, fodder and grasses in these areas; recycling of drainage effluents; biological control measures; irrigation with saline water; alternatives for pesticide and fertilizer dependant crops

7
Institutional and Policy Issues

This chapter outlines the major institutional and policy concerns in mainstreaming the environmental considerations, and the assessment of institutional and policy aspects related to the process of participatory irrigation management transfer.

7.1. Environmental Aspects

The departments and institutions involved in addressing and coordinating environmental concerns include: WAPDA, PIDs, PIDA, AWB, FOs, Municipal and Town Committees, WASAs, PHEDs, EPA, EIA, and private sector (farmers, NGOs, industrial concerns), etc. At present the coordination between these agencies is non-existent or minimal. Ideally the relevant acts and rules and regulations framed by respective agencies should have clearly described the rights and responsibilities with respect to environmental concerns. The level and interaction and coordination need to be strengthened through regular consultative mechanism. For example, the PIDA/AWB should clearly specify the standards that are acceptable to them to allow the effluent discharge into the irrigation and drainage system in the relevant jurisdiction. This requires a detailed study of the respective department functioning and the skills available to safeguard the environmental degradation being caused due to lack of coordination and absence of clear responsibilities. The draft final report will address this aspect in detail. The draft final report will also assess the staffing pattern, skills-mix, training and capacity building requirements, level of coordination and minimum information flow requirement, and a format for regular

consultative process to monitor the environment related parameters, and to implement the decisions and responsibilities. The report will also assess the need for changes in the regulatory and legal process, and any policy considerations required. (For the environmental institutional coverage see also Chapter 6)

7.2 Institutional and Policy Concerns in the Irrigation Management Transfer Process

The existing institutional arrangements to manage the largest and contiguous irrigation system in the world is more than hundred years old. The irrigation department that was seen as a commercial department was actually managed as a bureaucratic-cum-decentralized outfit. It combined administrative and technical management with an important role of conflict resolution amongst the end users. Overtime, due to various factors, such as poor administration, leakage in the system, lack of accountability, political interference, and deferred maintenance, etc., the administration of the system has weakened over time.

In various time periods, various donors and funding agencies provided financial and technical support to the irrigation sector to rehabilitate and improve the management of irrigation system. One of the policy measure suggested was to rationalize the irrigation (user) charges commensurate with the O&M expenditure. This did not happen due to lack of political will.

In line with the policies recommended by the international lending agencies, namely World bank, IMF, and ADB, two major reforms were initiated to a) reduce the budgetary gap, and b) to improve the management of the system. This meant a transition from state run (and subsidized) system to commercialization and privatization of (farmer managed) irrigation system. The institutional and policy reforms have been formulated to reduce the role of public sector (state managed system). It is envisaged that it will not only reduce the public expenditure, but will also increase the role of private sector (mainly the beneficiaries) who would manage and operate the system.

The institutional reforms included limiting the role of the traditional irrigation department to that of a regulatory authority, and creation of independent autonomous Provincial Irrigation and Drainage Authorities (PIDAs). The PIDAs would sell the provincial allocations to Area Water Boards (AWBs) constituted for each canal system. The AWBs in turn will supply the irrigation water to the end users, at the distributary level, organized as Farmer Organization (FOs). The FOs are apex organizations of water users associations (WUAs) at the tertiary level i.e. watercourses. The AWBs are responsible for the O&M of the main canal system, while the FOs are responsible for the secondary level of the system, that is, the distributaries and minors. The end users continue to maintain the tertiary system that is the watercourses. The FOs are also responsible to assess and collect the irrigation charges from the end users and buy the irrigation supplies from the AWB on cost basis.

Against a backdrop of a long history of state managed irrigation system, the success of participatory irrigation management (PIM) is quite a formidable challenge. The situation is complicated with the overriding laws, inadequacy of enabling laws and rules of business, lack of experience of the newly created institutions, absence of adequate enabling laws, apprehensions by various quarters on the social feasibility of the implementation arrangements, and vested interests that may lose the opportunities of control of the scarce resource and the discontinuation of the rents. Following is a review of the factors that may impede and slow down the transition to the new proposed institutional arrangements.

7.2.1 Overriding and Enabling Laws

The Canal and Drainage Act of 1973 is still the dominant and overriding irrigation law. The Act legally ties water allocation to specific piece of land and combines the land and water sale as synonymous. This is further strengthened by Land Reforms Act of 1972 that makes landowners responsible for water rates/charges. The other legal acts and laws include: Canal and Drainage Act, 1873; The Punjab Minor Canal ACt, 1905; Soils Reclamation

ACt, 1952, the Cooperative Farming Act, 1976; Land Revenue Act, 1967; and The On-Farm Water Management and Water Resources Association Ordinance, 1981.

The PIDA Act does not clearly recognizes the FOs as legal entities. Even the transferring responsibility to assess and collect water charges and to ascertain the portion to be retained by the FOs for O&M is not clearly defined as a law and are *adhoc* as deemed fit by the AWB/PIDA. The FOs are being created to be governed by Rules and Regulations framed by the PIDA., and hence their position as legal entities is still a question.

The PIDA is transitioning the transfer through framing rules and regulations. Since the powers of the PIDA Act is subordinate to other Acts in the country. To enable the AWBs and FOs to function as legal independent entities, the relevant Acts of PIDA need amendments.

This would require that the institutional reforms process should bring in necessary amendments in the PIDA Act that would strengthen the status of FOs as legal entity and provide flexibility in allowing water trading, where possible and environmentally friendly, and de-link the jointures of land with water ownership. Under OFWM IV, there are efforts to standardize the (joint management) arrangements between FOs and AWB. There is no protection to FOs that they will be liable to pay for inefficiencies in AWB and or PIDA with respect to wasteful expenditure especially for over-staffing. The PIDA Act is silent on the rationalizing process for ascertaining the legitimate O&M expenditure of the main system.

For the transfer of management to FOs in the LCCE AWB, the PIDA has taken some adhoc arrangements. To ensure permanency and legal cover, the PIDA has two options, either revise the PIDA Act and get this enacted, or request the government (competent authority) to promulgate an ordinance for a limited period subject to ratification by the provincial assembly.

One of the ambiguity that may arrive from PIDA Act in the presence of Canal and Drainage Act and Land Revenue Act is that the farmers are liable to pay an 'owners' rate' (value added/benefit drawn due to irrigation) in addition to the occupiers rate (as user charges). The 'owner's rate' is same as Land Revenue to be collected under Land Revenue Act . This original *Abiana* charges were in fact a composite charge reflecting the owner's rate and occupiers rate. This implies that the state can demand from the beneficiaries of the irrigation users additional charges as owner's rate. This would be unfair to charge the farmers differently and may be twice. This anomaly also needs to be clarified.

During the field work, farmers have indicated that many disputes (example section 20,68 and 68A of the Drainage and Canal ACt, 1873) can not be resolved at FO or AWB or PIDA level as they generally end up in the civil courts under the Arbitration ACt, 1940. Such cases will lead to friction at the FO level and would hamper the participatory principle of management. The PIDA Act should repeal and modify such provisions to simplify the redressal process with appropriate legal coverage. Most legal civil disputes, especially related with irrigation, are resorted and procrastinated through stay orders. This needs to be looked into while amending the PIDA Act.

There are certain laws mentioned in the Drainage and Canal Act that empowers the delegations to the Canal Officers who are part of the state machinery. After theses officers are employed by the PIDA their authority and empower met ceases. Therefore the PIDA Acts need to insure the appropriate legal authority.

It is imperative that the PIDA Acts should be amended, modified, and empowered to ensure that there is no legal vacuum and lacuna that may restraint the transitions, ensure the effectively of PIDA as an effective entity to perform in public interest, and retain the participatory objectives of the institutional changes.

7.2.2 Institutional Capacity

The present institutional capacity to manage the transition at the required pace is hampered by the absence of designated personnel. The present staff though have cleared understanding and mind-set for the transfer, also feel frustrated by the pace of the implementation arrangements. Nonetheless, the staff at the PIDA and AWB needs to be sensitized for social engineering aspects in general, and gender specific concerns in particular.

The wholesale formation or identification of FOs in the LCCE AWB is an approach that has been short-circuited to prove the speed of implementation. There is no felt desire for an awareness campaign from the AWB to widely educate the farmers about the transition process, its implication and responsibilities. This reflects absence of appreciation for the community mobilization process. The FOs should represent the larger share holders in the system and should represent all the segment of the society within a distrbutary command. The whole objective of the transition will be defeated if the FOs are not able to manage the system efficiently in terms of technical, financial, environment related, and socially equitable standards. The two organizations that have shown interest in assisting PIDA/AWB in organizing communities into FO are IIMI and OFWM department. IIMI (and to some extent OFWM department) has experience of forming Apex/FO organization. Their capacities in terms however are limited to cover all the target FOs in the AWB. PRSP assisted by NRSP is experimenting the idea to assess their capacity . They have indicated that they do not want to take up the responsibility unless they are sure of the implications, appropriate staff needed and training required to the designated staff, and the realistic costs. The PRSP assisted by NRSP would be able to extend technical assistance to the FOs not limited to irrigation management but also in extension services to increase the farm productivity, and activities beyond just the participatory irrigation management.. None of the NGOs that have shown interest to assist AWB to organize FOs have previous experience for organizing the communities around the common interest of irrigation water.

7.2.3 Training Needs

UNDP, through the assistance of Japanese Government, had commissioned a study to provide training to the staff of PIDA, AWB, and FOs etc. to assess the training needs. A review of the same will be made in consultation with the PIDA and AWB to identify if additional training needs are needed.

7.2.4 Time Frame for the Proposed Reforms

Based on consultation with the PIDA and AWB, a detailed time frame will be finalized to be operationalized by the PIDA and AWBs.

8

Lessons from Previous and Ongoing Projects and Studies

Three projects have been or are being implemented concurrently in the region, which includes the two canal commands where the PISIP is to be implemented. These are: the National Drainage Program (NDP); b) the On-Farm Water Management Project (OFWM-IV)-and; c) the Punjab Private Sector Groundwater Development Project (PPSGDP) – a continuation of the SCARP Transition Project. The planned On-Farm Water Management Project-IV, a national project in its earlier versions, has been recast as four provincial projects in its fourth phase.

8.1 Lessons From National Projects

Experiences in implementing project activities, which can inform the PISIP have been identified. Social, environmental, institutional, legal and organizational aspects are addressed.

8.1.1 On-Farm Water Management – IV

Lessons learned from Bank involvement in the irrigation and drainage sector in other countries, such as Mexico, Argentina, the Dominican Republic, Chile, Philippines and Turkey and in the earlier national project phases point to a number of elements as key to project and post-project sustainability. Specifically:

- Watercourse renovation should cover the entire command areas of distributaries and minors
- Donor assistance should be tied to up-front contributions by farmers towards the capital cost of infrastructure improvements and construction. This will enhance their sense of ownership in the system.
- Water users associations (WUAs) should undertake repair and maintenance of the farm level structures;
- A holistic approach to irrigation system management is likely to generate economic, social and environmental synergies. Thus farmer organizations (FOs) should be organized from the WUA level up, and entrusted with water distribution, collection of water charges and O&M. Also, the FOs should be multi-tasked, entrusted with complementary irrigation (secondary and on-farm), groundwater and drainage (on-farm and upto sub-drain level) responsibilities

8.1.2 Punjab Private Sector Groundwater Development Project (PPSGDP)

This project, too, focuses on a systemic approach to groundwater development. FOs, formed around community tubewells (CTWs), should be involved in the entire continuum of activities -- planning, supplying water to members, collecting revenue and carrying out O&M. It links project assistance for civil works to upfront capital contributions and the successful functioning of FOs for at least one year

The recommended approach to FO formation emphasizes organizational and functional soundness. Thus, trained social organizers and village activists should be responsible for organizing the FOs, training should be imparted in managing financial accounts, revenue management, water delivery and O&M, monitoring and evaluation.

Departmental hindrance to the reforms should be addressed through the establishment of an autonomous project management unit (PMU)) and training and redeployment of surplus

The PPGDP also recognizes the need for lateral linkages between watercourse renovations, drainage improvements and conjunctive use of irrigation and groundwater.

8.1.3 National Drainage Program

The NDP replicates social, environmental and institutional experiences from the other two projects and refines them further.

The NDP favors a phased approach to FO formation. Initially, the existing FO pilots would be expanded gradually and modified to incorporate the lessons of experience or research. The number would be expanded more rapidly on the basis of one or more successful models that would emerge from the pilots. Like the other two projects it, too, stresses the need to involve farmers in design, implementation, O&M and have them bear up-front construction costs partially. In the same vein, the parties have agreed mutually to incremental financing commitments for irrigation and drainage. Specifically, project investments would be scaled back or canceled altogether if the pace of reforms is deemed slow due to lack of government commitment, implementation constraints, or resistance/lack of commitment by WAPDA, PIDAs, or AWBs to real change.

Going a step further, the NDP proposes Social Assessments (SA) of all investments and FOs established under the project to provide frameworks incorporating participation, gender, poverty focus and social analysis into the design and delivery of project interventions to beneficiaries, particularly poor and women beneficiaries and project-affected persons. Second, it promotes IEC stressing a high degree of public participation and disclosure of project information to the public and the stakeholders in particular. Third, it recommends that land acquisition, resettlement and rehabilitation associated with project interventions are implemented in accordance with the Framework for Land Acquisition and Resettlement.

The NDP also addresses environmental impacts, mitigation and monitoring aspects systematically and in depth. Initial

Environmental Scoping (IES) and EIAs are to be prepared for all investment projects. These would form the basis for environmental and wetland management plans. Subsequently, environmental monitoring and audits would be carried out. The program supports a wide breadth of interventions, ranging from the diversion of saline effluent away from freshwater lakes and rivers to encouraging beneficiary groups to adopt biological measures to reduce the drainable surplus.

Institutional initiatives under the OFWM-IV and the PPSGDP have been articulated in greater detail. Improvements spelled out in the PIDA Acts are: a) providing for more autonomy for PIDA and the AWBs; b) providing for the establishment of a separate or quasi-autonomous agency to regulate and adjudicate the decentralized irrigation and drainage institutions and infrastructure; c) providing for fuller and faster financial self-sustainability of PIDAs and AWBs and; d) providing for faster financial self-sustainability of farmer organizations.

To help the new entities achieve significant cost-reductions and improve productivity, the provinces would impose hiring freezes on all PIDAs and AWBs, reassign redundant staff to other organizations, and offer them incentives for early retirement.

8.2 Project Complementarities and Overlaps

The project complementarities and overlaps are in evidence strongly. Each project addresses aspects of irrigation, drainage and groundwater development. The Bank's recent focus on farmer-based irrigation management and commercial water distribution are common underlying themes. Also, the organization structure for each project emphasizes inter-department and cross-sector coordination. The table identifies common areas of focus suggesting the need for greater inter-project integration and institutional coordination:

Table 8.1 Common and Complementary Activities and Initiatives

	PISIP	NDP	OFWM-IV	PPSGDP
1. Common and Complementary Activities				
Improvement of irrigation facilities (canal, distributary, watercourse)				
Watercourse renovation				
Drainage				
Groundwater monitoring				
2. Legal, Regulatory and Institutional Initiatives				
Water User Associations/Farmer Organizations				
PIDA				
AWB				
PMU with multi-functional responsibilities and cross-department/sector representation			CDSG1	PMU2
Federal Steering Committee				
Provincial Policy Committee				
Regulatory Framework				
NGO Participation				
Private sector contracting				

Notes: Community Development Support Group
Project Monitoring Unit
There is ongoing discussion on whether a separate regulatory framework should govern groundwater monitoring and enforcement or whether it should be folded into the PIDA Act.

The absence of coordination can lead to confusion. For instance, the NDP recommends transfer of existing fresh groundwater (FGW) tubewells to and, where necessary, their replacement by the private sector, and expansion of the network of FGW tubewells through installation of new tubewells by the private sector. On the other hand, the PPSGDP premise is that replacing SCARP, FGW tubewells with private tubewells invites anarchy, builds excess capacity leading to over-capitalization and excessive O&M costs; danger of over-exploitation of groundwater, inequity in water supply, as well as improper conjunctive use of canal and groundwater.

The elements identified above suggest the need for a spatially rather than functionally defined approach. This is the case in India

where the approach is to pick a river basin in a focus state; initiate extensive reforms in overall water planning (state water plan); establish a state water planning office with a data and analysis support center - to help develop long-terms inter-sectoral basin plans, allocations, and coordination mechanisms across sectors and agencies; initiate reforms in the irrigation department which would trigger physical investments restricted to a smaller area with an attempt at coordinating irrigation systems improvement, drainage improvement and on-farm water management, water user associations , etc. and then expand this approach to other areas (branches, sub-basins, etc.) and eventually other river basins and states.

8.3 Lessons from International Projects

The experiences of similar irrigation/drainage/groundwater development projects are illustrative and should not be seen as replicable models. The positive experiences are meant to inform and guide similar initiatives in Pakistan. By the same token allowances should be made for land-tenure relationships, political constraints, cultural dissimilarities and institutional capabilities.

Table 8.2 FO Characteristics

	Elected FO members	Accountability to farmers	Single purpose	Financially Autonomous	Women involved
Turkey	N	P	Y	Y	N
Mexico		Y		Y	N
Philippines		Y	N	Y	Y
India	Y	P	Y	P	N
Sri Lanka	Y				Y
Indonesia	Y	Y	Y	P	Y

Notes: Y – Yes
N – No
P.—Partially

Table 8.3 Enabling Conditions

	Political Will	Administration	Condition Of System	Legal Framework
Turkey	Strong	Strong	Good	
Mexico	Strong			Solid
India	Weak	Weak	OK	Weak
Sri Lanka	Weak	Weak	OK	Weak/unclear
Indonesia	Strong	Not very strong	OK	Solid/Clear

Table 8.3 Outcomes

	Collection of water charges	Decision making	Irrigation services	Disputes	O&M Require-ments	Sense of owner-ship	Yield	Equity
Turkey	Improved	Farmers	Improved	Less	Less (labor by farmers)	Strong		
Mexico	Improved		Improved					
Philippines	Improved		Improved		Reduced			
India	No change	No change	Improved/reliable	Less	Less		Increased	
Sri L	Improved		Improved		Less		No change	
Indonesia		Shared: PID+farm-ers	Improved	Less	Less	Increased	Increased	Improved

Sources:

World Bank. 1996. *Proceedings of the Second International Seminar on Participatory Irrigation Management.* Antalya. Turkey. The Economic Development Institute of the World Bank

Participatory Irrigation Management in Andra Pradesh, India: Current Issues and Need for Monitoring and Evaluation. Notes from a visit by Douglas L. Vermillion, December 9, -22, 1999.

Brewer, Jeffrey D. 1996. *Present Status of Participatory Irrigation Management in Sri Lanka.* http://www.inpim.org

Jairath, Jasveen. 1999. *Participatory Irrigation Management: Experiments in Andhra Pradesh.* http://www. Epw.org. in

Bruns, Bryan. 1196. *Participatory Irrigation Management in Indonesia: Lessons from Experience and Issues for the Future.* http://www.cm.ksc.co.th

9

Monitoring and Evaluation Strategy

9.1 Monitoring Framework

The monitoring and evaluation strategy should be governed by the generic project objectives of equity, efficiency and environmental sustainability. By the same token, monitoring and evaluation should entail full stakeholder participation, from the development of indicators to assessment of performance. In this context, the indicators presented below should be viewed as a part of an interative process, continuously reviewed and modified as stakeholder participation increases.

The modalities for an umbrella framework to monitor farmer-managed irrigation systems, is presented below. Its purpose is to assess the effectiveness and sustainability of FOs and, based on such assessment, to recommend transfer, or otherwise of management responsibilities to the constituted FOs. The framework takes into account the integrative aspect of the project as well as its social, environmental and institutional dimensions. However, an assessment of institutional effectiveness is implied in this framework; direct indicators to measure institutional performance are indicated below.

The enactment of Provincial Irrigation and Drainage Authority Acts in the four provinces has established a legal framework for wide-ranging institutional reforms in the irrigation sector. The reforms also include constitution of farmer organizations at the

distributary level, with a view towards devolved and participatory irrigation management. The acts have, subsequently, been fine-tuned to accommodate the emerging ground realities.[7]

FO formation is mandated across a number of World Bank and Asian Development Bank funded projects engaged in irrigation/groundwater/drainage rehabilitation and management.[8] Pilot initiatives have already been launched in an attempt to develop sustainable and cost-effective approaches towards irrigation management. The task is difficult as it entails potential conflicts with vested interests, involves many players and is premised upon trust and consensus. However, despite the many social and political complexities, there is robust evidence of success in other countries, with farmers' willingness to organize around water being a key-contributing factor.[9]

Clearly replication of such innovations on a large scale in Pakistan will be a formidable task and needs to be monitored and supported at every stage; from inception to transfer to post-transfer operations. However, existing constraints also need to be recognized. The devolution process has barely gained momentum. While the legal initiatives are in place, farmers are unaware of their envisaged role, institutional mechanisms are not in place and NGOs need to be identified and sensitized.

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7 For instance, a provision has been made to accommodate both consensus and elections in the formation of FO executive bodies. Also, if deemed suitable, management can be transferred to FOs regardless of whether Area Water Boards have been constituted on the canal command.

8 The projects, variously in the implementation, pipeline and planning phases are:
National Drainage Program (WB/ADB)
Left Bank Outfall Drain (WB and other donors)
On-Farm Water Management - III & IV (WB)
SCARP Transition – II (WB)
Punjab Private Sector Groundwater Development (WB)
Balochistan Community Irrigation and Agriculture Project (WB)
Punjab Irrigation System Improvement Project (WB – forthcoming)
Punjab Farmer Managed Irrigation project (ADB)

9 For instance, Columbia, Mexico, Turkey, the Philippines

Therefore, a phased approach is recommended. Such an approach is less forcing and likely to encourage the spontaneous and voluntary participation of farmers and NGOs via demonstration effects. Space is also created for appropriate mechanisms and programs to evolve for inter-departmental coordination, awareness creation and training – both among farmers and department staff. Essentially, FO formation should proceed with a view to making them viable institutions rather then just paper entities, which invites risk of process failure and reinforces entrenched mindsets against innovation.

Clearly, simultaneous transfers on a large scale will not be possible. A corollary of this in other countries has been joint management arrangements, where the irrigation department determines the pace of transition. An inherent risk in this is that management transfer may never take place fully, particularly when it entails loss of power and privilege. Thus, transfers should be upfront, with technical, legal and financial services being provided through contractual arrangements.

9.1.1 Umbrella Monitoring and Evaluation Unit (UM&EU)

With the above in mind, it is intended to establish an Umbrella Monitoring and Evaluation Unit (UM&EU) with cross-project responsibilities. The unit should be activated immediately, eventually becoming part of the Project Development Support Group (CDSG), housed in the Punjab Irrigation and Drainage Authority (PIDA). One of its key tasks will be to assess the social, technical and financial competence of the FOs, based on a combination of pre-established criteria and collective judgment. Subsequently, the UM&EU will make a recommendation to PIDA on whether to sanction or with hold transfer of management. FOs recommended for such transfers will be supported in their operations by the CDSG for a period of one year. Details regarding the structure and responsibilities of the UM&EU are as follows:

9.1.1.1 Structure

The UM&EU will consist of a two-tiered structure. The lower tier, referred to as Monitoring and Evaluation Units (M&E Units), will comprise teams of mid-level professionals specializing in institutional economics, social anthropology, civil engineering, land revenue matters, irrigation and agricultural economics, gender issues and legal affairs. The upper tier, referred to as the Project Advisory Committee (PAC), will consist of senior professionals and experts from the government, the private sector, policy research organizations[10] and NGOs. It will have an independent status but will liaise closely with PIDA and convene periodically to review and endorse the recommendations of the M&E Units, before these are submitted to PIDA for implementation.

9.1.1.2 Responsibilities

The M&E Units will:

- Establish criteria for FO approval
- Determine the social, technical and financial viability of constituted FOs, based on established criteria and their collective judgment
- Ensure review and endorsement of their recommendations, regarding transfer of management, by the ISC
- Submit approved recommendations to PIDA for implementation
- Design training modules for the irrigation department and OFWM staff for immediate implementation
- Identify training needs of FOs that do not meet the criteria for transfer
- Assess and develop a roster of agencies/NGOs with social mobilization expertise

Post-transfer responsibilities would include:

10 For instance, PIDE, AERC, IDS, PERI, SDSC etc.

- Monitoring efficacy and implementation of legal agreements between PIDA and FOs
- Monitoring representation of FOs in PIDA and AWBs, as well as other means of judicial recourse for the FOs
- Monitoring violations of equity conditions

9.1.1.3 Responsibilities of the Project Advisory Committee

- Ensure transparency of the transition process
- Review and endorse recommendations of the monitoring units
- Ensure that FOs are adequately represented in the AWBs and PIDA
- Mediate and resolve conflicts between departments
- Review and suggest amendments in the PIDA, AWB and FO Acts, Laws and Bye-laws
- Act upon other recommendations of the M&E units

9.1.2 FO Approval Criteria

While approval criteria should not be unduly stringent, making allowance for the fact that FOs will continue to obtain post-transfer support services from the PDSG, minimum conditions for effectiveness and sustainability need to be met. These are as follows:

- ***Equity***[11]
  - Representation of sharecroppers, tenants and small/poor farmers (in both the general and executive bodies)
  - Representation of non-farmers/landless users of the irrigation system
  - Proportionate representation of small, medium and large farmers in the general and executive bodies (if there are more small farmers on the

[11] The viability of a gender role in irrigation management is presently being assessed.

distributary, they will have proportionately larger representation on the FO)
- Established and functioning judicial appeal mechanisms

- ***Organization***
  - Completion of detailed socioeconomic baseline surveys prior to FO formation
  - Training in social mobilization skills
  - FOs built up from the level of water users associations (WUAs) organized around watercourses
  - Entire length of the distributary represented in the FO (length will also determine the structure, i.e. number of tiers)
  - FOs initially developed around irrigation and drainage management
  - Executive body membership by rotation (either by consensus or election)

- ***Finance and Revenue***
  - Designated members trained in financial (accounts) and revenue management (*abiana*), land records)
  - Contractual arrangements formalized
  - Arrangements for farmer contributions formalized

- ***Technical***
  - Training in O&M (irrigation and drainage), instrument reading and communications provided
  - Contractual arrangements formalized
  - Training in participatory M&E

- ***Social-Environmental Interface***
  - Training in biological stabilization (community plantation -- trees, fodder, grasses)
  - Awareness of social and economic benefits

- Awareness of water quality and health issues (potable water, waste-water vegetable cultivation)

9.1.3 Monitoring Indicators

The matrix form presentation of indicators is visually convenient and also provides a sense of their cross-sectional importance. While the indicators have been distinguished by their physical and performance characteristics, a further subdivision by their input and output attributes and an objectively verifiable quantification will be undertaken. The indicators were developed based on discussions with PID, PIDA, AWB staff and in consultation with farmers who are actual or potential members of FOs and WUAs

Table 9.1 Monitoring Indicators

Indicators	***Physical (Asset Condition)***	***Performance***	**Social**	***Institutional***	***Environmental***	***Financial***
Condition of Irrigation System						
Berms	*		*			
L-Section	*		*			
Breaches	*		*			
Mogah Size	*		*			
Embankments	*		*			
Inspection paths	*		*			
Goods inspection paths	*		*			
Diversion structures	*					
Communication apparatus	*		*			
Khal (w/c)	*		*			
Nakka (w/c)	*		*			
Gradient	*		*		*	
Tree plantations	*		*		*	
Condition of tile and surface drains						
Delivery efficiencies (overall & mogahs: measured by: flume, flow meter or divergence between design and actual size)		*	*			
Cropping intensity (across the board, between mogahs)		*	*			
Litigation and number of disputes over water (theft - intra w/c, across mogahs)		*	*	*		
Redressal of disputes and at various levels (panchayat, AWB, courts)		*	*	*		

Indicators	***Physical (Asset Condition)***	***Performance***	***Social***	**Institutional**	***Environmental***	***Financial***
Cost Recovery						
Overall cost of O&M		*	*			*
Assessment and collection of abiana (single and double)		*	*			*
Drainage cess (surface and deep vertical)		*	*			*
		*	*			*
Remission of abiana		*	*			*
Number and %age of defaults						
FOs						
Technical and revenue staff contracted (assessment on a curve)		*	*			*
FOs constitution equitable (representation of small farmers, sharecroppers/ten-ants, landless, gender representation, ethnic/biradri balance)		*	*			
Rotational representation in FO executive bodies, AWB, PIDA		*	*			
Compliance with FO rules and regulations (timely elections, general body		*	*			*

meetings, maintenance and access to records)		*	*			*
Maintenance of accounts		*	*			*
Group Dominance (Collusion)						
PIDA						
Fully staffed		*		*		*
No. of contract staff hired		*		*		*
Fully funded (budget allocations)		*		*		*
Financial sustainability (revenue collection)		*		*		*
PIDA and AWB staff trained (social and environmental awareness)		*		*	*	*
CDSG established (with constituent units)		*	*	*		
No of FOs formed and functional		*	*	*		
No of trainings imparted to FOs, other farmers and (social, environmental, technical)		*		*	*	
PIDA performs coordination role (inter-project, inter-agency, inter-sector)		*		*	*	
Incentive package/golden		*		*		*

handshake in place and being implemented for PIDA staff						
AWBs AWB fully staffed No. of contract staff hired Revenues being generated Water being distributed on commercial basis		 * * * *		 * * * *		 * * * *
OFWM No. of trainings imparted (social and environmental awareness) No. of FOs mobilized and registered Financial sustainability established (Govt. funding, contracting) Service delivery/extension services provided to farmers		 * * * *	 * *	 * * * *	 * 	 *
Environmental Awareness and Mitigation FOs implement biological control measures (trees, fodder plantation) Women involved in water quality monitoring,		 * 	 *		 * 	

management and mitigation (health, livestock, washing, technical – household, drinking water and sewerage)		*	*		*	
Monitoring wastewater use for vegetable cultivation		*	*		*	
No of research studies conducted		*	*	*	*	*
Drainage improvement undertaken (new construction, rehabilitation)	*		*	*	*	
Intersector coordination for water quality monitoring underway		*		*	*	
Farmers monitoring groundwater balance		*	*		*	

10
Consultation

This chapter reports on and synthesizes the results of the study team's meetings with stakeholders, field trips and participation in various workshops. The stakeholders include government departments, NGO's and farmers. Stakeholder perspectives are presented on the feasibility and approaches to FO formation, the institutional (legal, regulatory and organizational) implications, environmental concerns and mitigation, gender involvement and equity and efficiency issues.

Suggestions for future consultation with stakeholders are detailed in Chapter 6, "Project Environmental Impact and analysis of Alternatives," Chapter 9, "Monitoring Strategy," and Chapter 12, "Project Roadmap

10.1 Visit to Hakra 4-R, Haroonabad – An Iimi Supported for Initiative, October 1999

The purpose of this visit was to elicit feedback from farmers regarding participatory irrigation management, their role in environmental remediation and gender involvement.

10.1.1 Farmer Organizations

A disparity of views has hindered progress on institutional reforms and transfer of management to the farmers. Presented are two contrasting views, based on discussions with PIDA on the one hand, and with the FO (HAKRA-4 distributory) and IIMI staff on the other.

10.1.1.1 PIDA Views

PIDA is optimistic about setting up 350 FOs on the two canal commands over the 5-year project period. It has been quite active in establishing:

- Rules and regulations for FOs
- A committee to operationalize moribund WUAs
- Election regulations for FOs (1st draft)
- Registration of FOs (1st draft)
- Business regulations for FOs (1st draft)
- Fund regulation and reporting (1st draft)

More rapid progress has been stymied by snags in the legal and institutional reform consultancy and by NRSP's inability to submit its technical proposal on social mobilization and FO formation.

10.1.1.2 Hakra 4 FO/IIMI Views

It takes time for a grouping of farmers to establish mutual trust, subsume class and ethnic differences, farm size disparities and tenure relations. Attempting to establish 350 FOs in 5 years is likely to invite anarchy, and risks negation of the institutional reform process by conservative elements in the Irrigation Department and PIDA, tuned into power and prerogatives.

The PIDA regulations are rigid about the FO structure, whereas the need is for such FOs to evolve according to their individual circumstances. For instance, PIDA tends to push its election regulations when experience has shown consensus to be more conducive to group harmony; in contrast, elections encourage factional splits.

It is desirable for FOs to coalesce originally around a single issue, namely water, as distinct from the NRSP's relatively more diffused and multi-pronged approach. As the HAQRA-4 FO became empowered it showed a willingness – and capability – to diversify into other areas, such as micro credit, adult literacy and fertilizer distribution.

On the PIDA Act itself, the Punjab version has been found unsatisfactory by a legal consultant engaged by IIMI to assess all the provincial acts. Among other things it leaves too much to subsequent byelaws, rules and regulations, whereas many of these should be enshrined in the Act itself, as is the case with the Sindh Act. The concern was that such delegation would increase PIDA's discretionary powers.

10.1.1.3 Questions Arising from the Discussions

- Is there a need to fine-tune the laws and regulations upfront and make them more flexible and community sensitive? Perhaps the process should be more participatory than it has been.
- Why is one specifically tied to the two project areas? Why not piggyback on existing success stories, or efforts underway. A quick search disclosed 5 initiatives: Haroonabad (IIMI); PIEDAR (Kabirwala); HALCROW (Sheikhupura); OFWM (Bahawalnagar); OFWM (Bahawalpur). With a little effort, more could be found closer to the project-designated canal commands. The HAQRA-4 FO expressed concern that it was being assigned responsibilities but no rights. This not only undermines the credibility of the government, but also creates fissures within the organization itself. To restore such credibility, and as a bridging activity, the project could consider leveraging water management transfers to functional FOs under the existing dispensation (that is before AWBs are formally constituted) outside the project canal commands. This would create positive demonstration/ripple effects for the project to capitalize upon.
- Are there grounds for setting up an independent monitoring entity? Its objective would be to assess the capability of FOs to take over management responsibilities. A mix of socially active NGOs and irrigation oriented research institutes are recommended, such as PIEDAR, NRSP and IIMI.

10.1.2 Environmental Issues

10.1.2.1 Water Quality Deterioration

The focus of the TORs is on assessing the environmental impacts of irrigation system rehabilitation. In addition, they mandate a regional assessment to include downstream and upstream effects. However, there may be a need to address a more generic concern. A pernicious aspect of water pollution is drawing increasing attention. The urban and industrial effluents from major cities, such as Lahore and Faisalabad, are being diffused far downstream through rivers and canals. Irrigation water is the main source of drinking water in many small towns (especially where ground water is brackish). Thus, through no fault of their own, downstream residents are exposed to adverse health effects thanks to both biological and chemical contamination. Of course, local practices (washing clothes in irrigation channels, livestock intrusions) exacerbate the problem. Further, there is an increasing trend for municipal bodies to contract wastewater for vegetable 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.

Thus, an environmental impact assessment, which concerns itself exclusively with the effects of irrigation rehabilitation, may be inadequate. Previous environmental studies suggest that such impacts are likely to be beneficial. However, this may be a trivial finding. For instance, preliminary health studies by IIMI indicate that malaria is not a severe problem, partly because of earlier USAID projects, which controlled its incidence quite effectively. On the other hand, water quality deterioration is an abiding concern, which the project may like to address, illustratively in the following ways:

- Fostering inter-department linkages and coordination to address industrial and municipal effluents at source in the major cities. Direct interventions are beyond the scope of the project.

- Direct interventions in the small towns, in the form of wastewater treatment plants/pilot projects/technical assistance.

10.1.3 Gender Issues

The initial impression is that the scope for a gender role in irrigation is limited. While women are actively involved in vegetable cultivation (household), crop planting/transplanting and harvesting, a cross-cutting cultural bar prevents them from being involved in repairing or maintaining irrigation channels. By the same token, there would be no reason to involve them in early FO activities, which would be irrigation oriented at the outset. The scope for such integration – and empowerment – would come later when the FO diversifies into more women focused activities (literacy, health, credit).

Conceivably, women can be involved in water quality preservation (keeping livestock out of the channels, limiting their washing activities, cleaning water tanks). But this just perpetuates their existing drudgery rather than giving them decision-making powers.

10.1.4 Observations

Clearly, while all the components of the institutional reform process are in place, a more credible approach needs to be developed. At present, project objectives appear to be a bit out of sync with ground realities. Formulating realistic/viable laws and regulations, objective oversight of FO capabilities, and linking disbursement with credible decentralization and devolution can create the appropriate synergies. Underpinning all these aspects is the need to have more modest targets. Bringing farmers and irrigation authorities together may prove to be an extraordinarily difficult task, given the prevailing attitudes. Also, irrigation rehabilitation needs to be dovetailed with drainage activities, which is another argument for being selective.

Finally, the early investigations indicate that secondary data covering the project area is sketchy and information will have to be generated first hand. Given the time constraints, spatial cut-offs may be necessary. If this were agreeable to the Bank, the team would develop a set of criteria for FO/area selection (ethnic homogeneity, small and uniform holdings, limited degradation, overlap with OFWM and NDP activities etc.). Criteria pertaining to FO formation would be tested in the field.

10.2 Meeting with the General Manager, Pida, Lahore, November 11, 1999

The study team members held a meeting with Mr. Menasha Hussein (G.M. Transition) and Mr. Anwar Ahmed, Deputy Director, Operations, at the PIDA office, Lahore, to discuss social issues to be addressed by the RSEA.

The MD told us that progress on the institutional reforms and transfer of management to farmers is very slow (the PIDA is considering involving NRSP for the social mobilization and IIMI for the technical capacity building of the constituted farmer organizations.) One reason for this is that the legal and institutional reforms consultants are not on board. Also, the NRSP has not submitted the technical proposal to PIDA. Nonetheless, PIDA has made progress in the following areas:

- Establishment of a committee to operationalize defunct FOs
- Election regulations for FOs (1st draft)
- Registration of FOs (1st draft)
- Business regulations for FOs (1st draft)
- Fund regulation and reporting (1st draft)

However, the rules and regulations were incomplete. For instance, procedurally, joint management agreements were not in place still; Article 4-C of Canal Act allowed establishing canal committees with oversight and reporting functions but no rights; financial rules delegating assessment and collection powers had

not been approved; FO byelaws had not been reviewed and finalized; FOs had not been sanctioned powers to punish

10.2.1 PIDA's FO Model

PIDA planned to establish about 350 FOs, 150 on the LBDC and 200 on LCCE and transfer management to them. There are no criteria for site selection or where to start. However, the AWB for the LCCE has been established.

The outlet is the basic unit for a FO. If an outlet serves 20 farmers (land holding is not a criteria), they will elect one representative on the basis of one-person one vote. If there were 50 outlets on the distributary, the 50 reps would make an FO and would elect an executive body of 8 members (2 from the upper reach, 3 from the middle section and 3 from the tail end). Its office bearers will be the President, General Secretary and Finance Secretary. The representative of the outlet would be responsible for the *abiana* assessment. The PIDA would institute checking teams to verify the assessment and curb misreporting.

10.3 Meeting with the National Rural Support Program (Nrsp), Rashid Bajwa, Managing Director, December 20, 1999

The NRSP recommends that FOs should be organized around the basic unit i.e. WUAs (at the watercourse level). It feels that unless viable, sustainable and representative WUAs are formed, any higher-level organization built upon them will be fragile. NRSP is in the process of establishing an FO on one distributary in the LCCE, with a view to assessing the approach, unit cost and time required for the FO to mature. The initial indications are that the process would be costly but would lead to sustainable FOs.

NRSP could provide extended operational and advisory support to the FOs. This could take the form of either a project support unit, or a dedicated sole purpose NGO. NRSP had established previously such units for the World Bank funded Ghazi Barotha Hydel Power Project and for the revitalization of the Balochistan

Rural Support Program. As its expertise lay in social mobilization, IIMI could be brought on board for the technical and revenue aspects.

NRSP expressed a preference for multi-purpose FOs, involving them concurrently in credit, agri-extension, health, literacy, economic enterprises and input and output marketing. It cautioned also that tinkering with the established norms of irrigation management should be thought over carefully

10.4 Study Team Report, Lcce, December 13 – 17, 1999)

The study team met Mr. Anwarul Haq, deputy-managing director, PIDA. He shared some of the PIDA FO regulations with us, withholding others as they were in the draft stage. He indicated they were still awaiting the proposal from NRSP-IIMI to provide the community mobilization and training services. The team then proceeded to Faisalabad and paid a protocol visit to Mian Abdul Ghaffar, Chief Engineer Faisalabad Zone (covering Lower Chenab Canal East and Lower Chenab Canal West command areas). He appraised us about the transition process and about the role of the army in the annual silt clearing operation.

10.4.1 Area Water Board

The meeting with the Mr. Ziaullah Waraich Superintending Engineer/Chief Executive of the LCCE-AWB and his three Executive Engineers was informative, providing some focus for future interactions with both PIDA/AWB management and farmers. He arranged a meeting in his office with four of the eight members of the AWB. The irrigation department handpicked the members supposedly, on their reputation for being honest and knowledgeable. The selections are based on the recommendations of the civil administration of the area, and field staff of the irrigation department. The members of the AWB indicated they had been briefed on the roles/ responsibilities of PIDA, AWB, and FOs. To date they had one (inception) meeting. They are waiting for the transition when the FOs become operational and are still

not very clear regarding the rules of business, their roles and responsibilities.

10.4.2 Institutional Options and Relative Costs

The CE of the AWB further informed that they had constituted FOs on all the 96 distributaries in the LCCE. The distributary level irrigation staff identified FO members. Clearly, this is primarily to fulfill its project mandate, as the selection and social mobilization process does not even meet minimum criteria. No formal selection criteria were used in identifying the FO members. No consultations had taken place with the farmers; in particular, WUAs had not been involved in the process. Also, the AWB has designated FOs on some distributaries where others have been established already by the OFWM

Under NDP financing, the OFWM-IV has already facilitated 4 FOs in the Lower Canal Command East (LCCE) to different stages of maturity, with more being targeted annually. A precondition is revitalization of dormant WUAs. Concurrent activities are watercourse improvement and drainage rehabilitation (drains under 15 cusec capacity). There appears to be a coordination problem, with the latter activity also being carried out by the ID. The ID plans to form its own drainage beneficiary groups (DBGs) through which it will rehabilitate low capacity drains. Coordination efforts include the need to deal with the cross-border jurisdiction that such rehabilitation will entail.

In the field we met with three FOs, two established by the OFWM and the third, a hybrid (OFWM-ID). The OFWM has four field teams in the LCCE. Each team has about 10 professional staff and about 5 support staff. They are targeting two FOs per field team in a year. The process through which they have organized these FOs is apparently quite impressive. They have organized WUAs on each watercourse through a series of consultations. Similarly, they have organized FOs on these distributaries. The documentation of the process is systematic and suggests active involvement of all the stakeholders.

The OFWM department's field teams have both water management specialists and an agronomist on the teams. They also intend to provide technical support to FOs in on-farm drainage and construction and rehabilitation of drains that are less than 15 cusecs. Based on back of the envelope calculations, the estimated annual cost of each field team is about Rs.8, 500,000/- per annum (establishment and operating cost). Assuming each team would establish two FOs in a year, this works out to, approximately, Rs.4, 50,000/-. By comparison, NRSP costs are much higher at Rs.25, 00,000/-.

The cost-effectiveness of the OFWM may reflect sub-standard performance. Cited concerns are its history of establishing thousands of defunct WUAs, pilferage of public money and a tendency to favor farmers with political clout. Besides, the OFWM has little technical, financial and legal expertise. A specialized Project NGO will be better placed to bring area specialists on board from international institutions, NGOs and the private sector.

10.4.2.1 NRSP

NRSP, in collaboration with IIMI are developing a proposal to provide community mobilization services to the AWB. The NRSP will focus on institutional development while IIMI will provide technical training to FO members in technical management (such as calibration of diversion structures and water outlets, irrigation agronomy, conjunctive use where needed, monitoring of the physical performance etc). NRSP is engaged, presently, in establishing an FO on one distributary on the LCCE, with a view to determining costs and time entailed. NRSP will work through the Punjab Rural Support Program (PRSP), which has an office in Faisalabad. The possibility of PRSP becoming a key player in the FO formation process under the project is being looked into.

10.4.3 Farmer Responses

The farmers were receptive, as demonstrated by the fairly enthusiastic feedback during the pre-test of the three-hour plus

questionnaire. However, it was a set-piece situation with active participation by the executive body members and passive endorsement by the WUA representatives and farmers. Following is a distillation of the discussions

10.4.3.1 Entry Point

Water appears a viable entry point with the FOs keen to take over management responsibilities. Farmer complaints are: a) the PID field staff (XENs, SDOs) collude with large/influential farmers in appropriating water illegally (breaching distributaries/minors, pumping, outlet tampering etc.); b) there is NO maintenance as opposed to the deferred/limited (cost-constrained) maintenance claimed by the ID -- we saw ample evidence of this in one distributary, resulting in reduced discharge well below the design capacity and; c) collusion with the irrigation patwari in acreage/crop assessment and water allocation. From the discussions it appeared that farmers consider water a decisive organizing factor, taking up other activities sequentially. In fact, imitating the IIMI (Haqra-4) experience, one of the FOs had taken up fertilizer distribution to sustain its momentum in anticipation of transferred management. The farmers indicated that collective action/censure would deter illegal activities, which was not possible when they were not organized.

Opposed to the notion of water as a single entry point is NRSP's multi-purpose approach -- even while it recognizes the importance of water. Clearly, the gender focus increases if this approach is adopted. Once again farmers were a bit uncomfortable answering questions about their women-folk and were fairly adamant that women had no role in water management. There is a need to get around this reluctance to talk, both by recasting the questionnaire and approaching the women directly. Incidentally, we did see women washing clothes inside the distributaries and minors and tending buffaloes on the canal banks

10.4.3.2 Elements of the Approach

***Elections versus Nominations*:** Both elections and selection/nominations appear to work, with both modalities having been adopted successfully. Consequently, PIDA should be flexible in its regulations. We were informed by PIDA that they were simplifying their rules to facilitate transfer of management to the Haqra-4 FO and that this would be done inside of a month. If true, this means the constitution of an AWB is not a prerequisite to FO formation and transfer, and would allow the Bank to support successful FOs outside the two canal commands. However, one must concede a large credibility gap with respect to PIDA's intentions.

Although based on limited evidence, we are offering a somewhat different perspective on equity. With inter-generational fragmentation, large land holdings appear to be reducing. While this is offset by the increasing tendency to take land in under contract, the link between landholding size and influence is becoming relatively more tenuous. Other emerging factors that determine influence are connections, community service, and reputation for honesty. While not discounting the traditional, politically driven, 'chaudhry' culture, it could be posited that there is greater emphasis on accountability. Companion findings are that the bulk of farmers are owner-occupiers with few remaining tenants/sharecroppers. Also, small landowners (1-3 acres) either tend to contract out or sell their land because the holdings are no longer economically viable, or where they remain they supplement their incomes through off-farm employment. We emphasize that these are very preliminary findings, that they are area specific, and that more investigations are both necessary and planned.

FO Structure, Rights and Responsibilities: The IIMI approach (Haqra-4) approach is to build on WUAs, segment the large distributaries under water user organizations (WUO) and constitute a representative water user federation (WEF) at the apex level. PIDA's preference is for a two-tier approach, namely, WUAs and FOs, representing different segments of the

distributary, with resolution of intra-distributary conflicts taking place at the AWB (farmer members) level.

Some farmers showed an interest in co-management, a la the Andhra Pradesh approach. Reasons cited were: a) the inability of the FOs to handle the technical aspects (maintenance of L-section and gradient, calibration of outlets and other diversions, biological erosion control etc.) and; b) maintenance of land records/cropping patterns. These functions required continued retention of ID staff (SDOs, XENs, irrigation 'patwaris') under increased FO oversight. Co-management was seen as a possible transition arrangement to be replaced eventually by outright transfer as FO capabilities improved. Residual deficiencies at the assessment and technical levels could be addressed through contractual arrangements with the private sector/retired experts.

However, other farmers feared that ID participation would abort effective devolution and transfer and those they preferred to go for upfront contractual arrangements. An abiding problem is that eliminating the irrigation 'patwari's' role could lead to a loss of the national cropping data base -- its inaccuracy notwithstanding. The farmers also indicated, rather heroically, that their per unit O&M cost would be much less than the approved yardsticks of the department,

Both FOs (executive body) and the AWB (president) preferred that magisterial powers (to impose fines, penalties and jail sentences) be delegated to them. Equally, there was concern that such powers would be misused. A determination will have to be made whether such bodies should be limited to adjudication (panchayat) responsibilities or invested with powers to punish.

Water Pricing and Availability: Availability of water rather than pricing appeared to be the key concern. Provided water was uniformly available and adequate, farmers would be prepared to pay a higher price for it. A preference was expressed for capacity pricing (flat rates), rather than the present crop-based pricing.

Poverty Alleviation: Views diverged regarding representation of small farmers/sharecroppers in the FOs. One view was that they would continue to be ignored; however, they would derive indirect benefits from incremental water being shared across the board. Another view was that there be a fixed quota for poor farmers. A progressive executive body member recommended that farmers with 5 acres or less should have as much as 50% of executive body representation, and that 33% of the remaining seats should go to farmers in the tail reaches.

Pre-Roadmap to FO Formation: The following options are presented, prior to articulating one or more roadmaps to FO formation.

- Establish a limited number of FOs each year (OFWM, NRSP), or proceed on a broad front (AWB)
- Organize around water or multi-purpose activities or both.
- Promote pilot projects of both the OFWM and NRSP, with a view to parallel expansion in both the canal commands. Turf battles are a concern and there could be funding complications. Additionally, relative costs need to be evaluated.
- NRSP takes the lead role assisted by a project support unit or project NGO (see Husaini's note).
- OFWM takes the lead role. NRSP provides mobilization support and IIMI provides technical back up.
- Establish an independent monitoring entity to determine an FO's institutional and financial viability as well its ability to meet equity/gender criteria
- Establish flexible rules and regulations to accommodate a diversity of conditions and environments. For instance, provision for co-management as well as immediate transfers; no spatial or sequencing restrictions on transfers if conditions are conducive and; limits to the discretionary power of departments

Clearly an in-depth institutional analysis of the key players will need to be conducted to determine levels of social sensitivity,

transparent and competent governance, financial and management capabilities, prior experience etc. In addition to the secondary data available, a checklist is being developed to generate first hand information on these aspects. This will not only help in the assessment of institutional capabilities but will also guide the recommendations for institutional strengthening

10.4.4 Environmental Impact Assessment

10.4.4.1 Drainage

Regional Impacts: Salt transmission downstream occurs mainly through the rivers, which are the depositories of the spillage from trunk/primary drains. However, these rivers also serve as natural barriers to cross-canal command surface flows. Clearly there is a need to establish water monitoring and communication systems. Subsequent interventions aimed at minimizing regional impacts can engender local environmental problems. For instance, evaporation ponds entail seepage in surrounding areas and loss of potentially cultivable land. A partial solution could be to introduce salt-resistant crops, fodder and grasses in these areas. A system for recycling drainage effluents (reverse osmosis) appears an effective solution and could be considered on an experimental basis for possible low-cost adaptation.

Local Impacts: The Faisalabad Drainage Circle of the Faisalabad Irrigation Zone is responsible for the maintenance of 1321 miles of surface drains covering a catchment area of about 6,000 square miles and covering both the LCC East and LCC West. The surface drains are designed for both seepage and storm water disposal. The bulk of the area under LCCE is underlain by saline groundwater and is the site of the earliest SCARP-1 site project, which installed an extensive vertical drainage system in the area. Reportedly, the project was successful in lowering the water table to a considerable degree. The problem is threatening to resurface as a result of government disinvestment in the program and reluctance shown by the private sector to adopt it. Also, farmers have sunk their own private (smaller capacity) tube wells and monitor conjunctive (mixing) use of both surface and ground water carefully. However, due to the brackish nature of the

ground water salt accumulation does occur and continuous leaching is required. While the bulk of the effluent is discharged into the Ravi and Chenab rivers, part of it flows back into the canal system.

Rehabilitation of the highly degraded surface drainage system (due to deferred maintenance) was begun under the National Drainage Program in 1998. Since then, under a three year rolling plan, desiltation, rehabilitation, extension, remodeling and construction activities have started. The primary focus presently is on desiltation and rehabilitation. Additionally, the NDP program plans to transfer the O&M of drains less than 15 cusecs to constituted drainage beneficiary groups (DBGs) as a part of OFWM-4. As mentioned earlier this raises inter-FO coordination issues.

10.4.4.2 Water Quality

The Regional Aspects: The team met with the MD Mr. Shahid Ahmad and the Deputy MD, Mr. Haleem of the Faisalabad Water and Sanitation Authority (WASA). The MD provided maps, data and the budget of WASA. The problems are formidable. A brief background provides the context for future constraints and possibilities, especially in relation to adjoining agricultural areas and downstream environmental impacts.

Faisalabad is an unplanned city with no separation between residential and industrial areas, which causes industrial and household effluents to intermingle. Effluent disposal is built around natural drainage and old existing channels, which eventually discharge into the river Chenab. The soil in and around Faisalabad tends to be plastic, limiting seepage but creating overflow problems. The drainage system is extremely dilapidated. Sullage and storm water drains are dysfunctional and pipe corrosion results in seepage into the freshwater system. In addition, poor communities tend to pump water out of gutters for household use. The lack of interdepartmental coordination exacerbates problems. For instance, road construction has not been dovetailed with the WASA Master Plan, resulting in the

creation of troughs, which have become depositories of stagnant water. The present preoccupation is with development rather than consolidation. A classic example of this is that water supply to the new townships is being routed through the old city network, which there is no plan to rehabilitate.

The emphasis on development schemes, neglect of rehabilitation, limited O&M funds, low cost recovery and high establishment allocations are a familiar municipal syndrome. One of its manifestations is the inability to perceive problems beyond the city confines, a problem aggravated by the vertical orientation of departments. Thus wastewater is sold under contract to outlying farmers and drains into the Chenab. However, there are no regular arrangements to test or treat this water. Any interventions, worth the name are sporadic and donor driven. For instance, JICA has financed the construction of oxidation ponds for wastewater treatment. This is unpopular with farmers who prefer to buy water untreated, while the high value of residential land makes such investment expensive.

The intrusion of urban wastewater into the canal irrigation and river systems is a problem that is likely to become more severe in future as residential and industrial expansion continues apace and municipal budgets shrink in real terms. Clearly, interventions at this level are beyond the pale of the project. However, there is scope for promoting interdepartmental coordination, advocacy and awareness campaigns and the institution of water quality and health monitoring systems.

Social-Environmental Interface: Environmental awareness among farmers is tardy, compared to the relatively more pressing social issues. Admittedly, the questions also need to be configured more carefully. Farmers are aware of the potential of biological erosion control. For instance, one FO expressed concern that the prolific growth of ‘sarkandas’ (weeds) on the distributary banks caused water losses, both through its absorption and due to channel constriction. The need to plant trees, grasses and shrubs on the ridges and along the outer banks was discussed. While less

aware of its environmental value, farmers were cognizant of the economic benefits. (fuel wood, fodder, revenue generation from timber sales for distributary maintenance and material for silt trapping). We also saw vandalized old trees (government property) along the inspection roads. The ownership-protection nexus has to be encouraged through a socialization process and should become a part of the FO mandate.

In brackish ground-water zones, canal water is used for drinking. The perception is that such water is of good quality. In a similar vein, farmers only see benefits in using wastewater for vegetable cultivation (rich in phosphate). We saw one such drain that had been attached to a 'khal' (watercourse), with wastewater being supplied to the farmers in turn. In a kind of inverted environmental logic farmers expressed relief that, resultantly, they did not need to set aside land for a 'jauhar/chappar' (open pond). Clearly, awareness creation about contamination, where it originates from and its adverse health impacts is necessary.

On a more positive note farmers are conscious of salinity problems and closely monitor the mixing of both surface and ground water.

10.4.4.3 Baseline Information

Baseline information about environmental aspects in the LBD and LCCE canal commands is being generated through the use of GIS and LANDSAT imagery. Specifically, the WWF Office in Lahore is collaborating with us in providing maps, which will contain the following information:

- Major rivers, canals, cities, towns and roads
- Water logging and salinity
- Forest cover
- Flood plains/wetlands
- Flora/Fauna
- Protected areas

In addition, the WWF has also provided compiled information, which we are sifting through and which could serve as a possible ground truthing source. We also plan to meet with the provincial EPA and WAPDA's Environmental Section, prior to developing recommendations for the structure that should undertake environmental monitoring activities during project implementation.

10.5 Meeting with Piedar, (Ngo), January 2000

The organizational details for setting up an Umbrella Monitoring and Evaluation Unit were discussed with Syed Ayub Qutub, the Executive Director of PIEDAR. These have been used as inputs for Chapter 9, "Monitoring and Evaluation Strategy."

10.6 Inauguration of the Area Water Board and Orientation Workshop on Institutional Reforms, Pida-Iimi, February 2000, Faisalabad

Major issues that arose from the workshop discussions are the following:

- The government would select Farmer members of the AWB and PIDA. Their mandate would be policy decisions. Implementation and management would remain with the Irrigation Dept. So, only the FOs would be truly representative. Such an arrangement reverts to the traditional, top-down decision-making style. It also creates scope for large farmer-irrigation department collusion.
- The FO would have the authority of an executive engineer (XEN) but the XEN himself would be there to supervise and manage activities. Who would have overriding authority in case differences emerge is to be resolved still.
- PIDA is keen to establish FOs and has given an open hand to OFWM in this regard. In fact, the process has kicked off under the NDP. Concern was expressed

whether this was advisable in the absence of institutional response capabilities and adequate social mobilization.

- At the provincial level PIDA and at the circle level AWB would replace Irrigation Dept but no alternate is identified at the Zone level. It is not clear who would assume the responsibilities of Zonal Chief/Chief Engineer.

10.7 Consultative Workshop on Institutional Reforms in Water Management, February 3, 2001.

The federal Agriculture Minister inaugurated the workshop. In his address he emphasized the need to improve agricultural productivity and highlighted the importance of irrigation in this.

PIDA explained the rationale for the reforms. The system was designed for 75% cropping intensity, as opposed to its present level of about 130-140%. The reforms contained elements of privatization, commercial contracting and participatory irrigation management. Among other things, the objectives were to achieve sustainability and decision-making at the grassroots level. PIDA was to be vested with regulatory authority and given the responsibility to deal with inter- provincial matters relating to irrigation. The AWB would be responsible for distributing water to the FOs on a commercial basis and for conveying drainage effluent through existing drainage structures to the outlets. The FOs would be responsible for the O&M of the distributaries, assessment and collection of abiana, distribution of water, and conflict resolution. They were expected to become self-sustaining institutions within 7 years.

The international findings regarding participatory irrigation management indicated that management costs had gone down for the government but increased for the farmers. However, these findings contained subjective biases. The capacity building of farmers, slow pace of implementation, quality of social mobilization, formula for sharing abiana with AWB, and

developing maintenance standards for the irrigation infrastructure are some of the issues that need to be addressed.

IIMI presented a case study of Hakra 4-R. Progress was noted on both equity and efficiency grounds. In financial terms, the FO had assessed and collected as much of the assessed *abiana* in one month as it took the irrigation department 6 months to collect. Also, collection costs declined from 22% of the total amount collected to 6%. The FO had also settled 150 water disputes without a single, subsequent, appeal. However, concern was expressed that in the new system there is no provision for holding the AWB or PIDA accountable for violating the terms of their agreements with the FOs. To illustrate, PIDA had not released the funds they promised last year.

The WB representative presented the findings of a study on international comparisons of PIM evaluation, which highlighted only the positive aspects of these evaluations.

11
Farmers' Participation Plan

11.1 Overview

The development objectives of the PISIP are to: a) improve agricultural productivity and farm income; b) contribute to poverty eradication and; c) establish a decentralized, efficient, participatory and financially sustainable institutional apparatus for the operation and management of Punjab's irrigation systems. The key performance indicators include: i) enhanced efficiencies and equities in the distribution of irrigation water and its farm level use; b) increased agricultural productivity and higher cropping intensities, particularly at the tails of the watercourses/distributaries; c) formation of commercially oriented AWBs as public utilities and participatory FO and; d) effective transfer of operation, management and maintenance of the irrigation and drainage systems to the respective agencies (AWB and FOs) at different levels, in the LCCE and LBDC commands. From this one can infer that the success or failure of PISIP would mainly depend on the genuine transfer of management and authority to farmers, effective and meaningful participation of farmers in the process of FO and AWB formation and their capacity to maintain, manage and operate the irrigation and drainage systems at different levels.

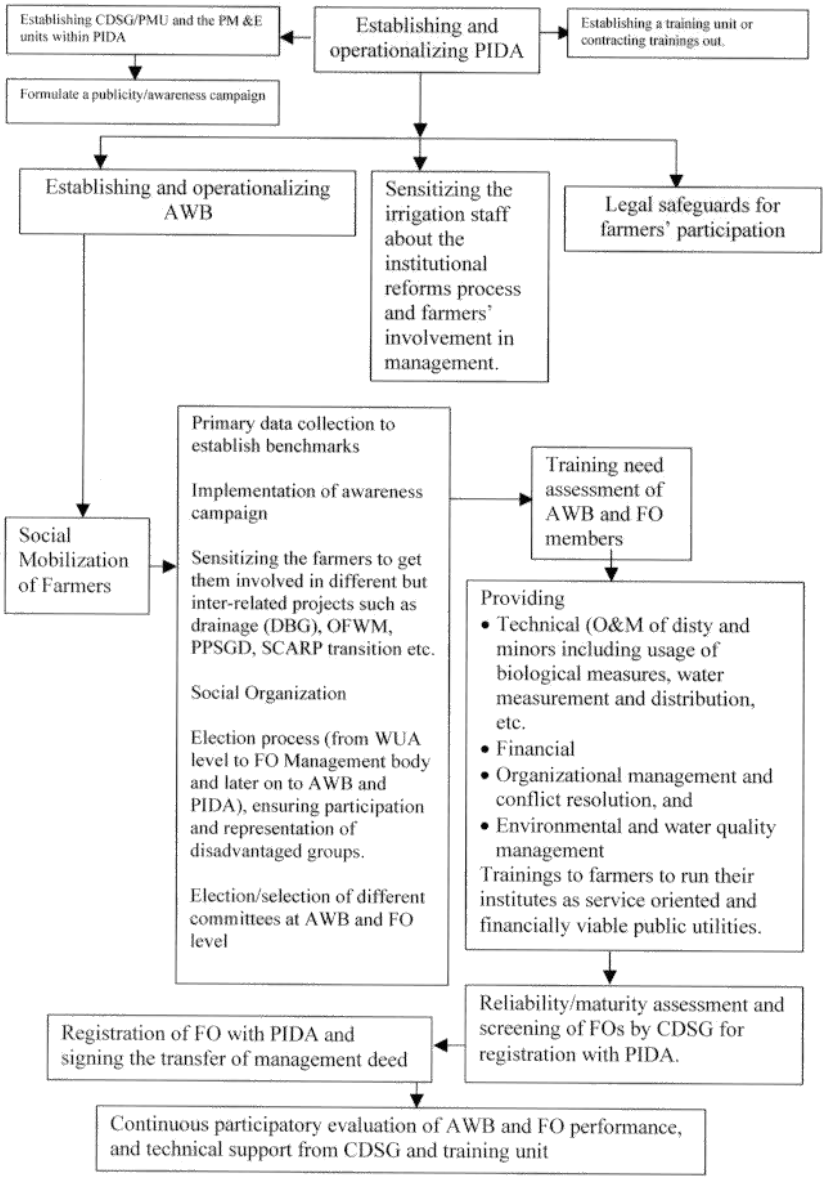
To create an enabling environment for farmers' participation it is important to provide legal safeguards, proper social mobilization, continuous technical assistance, and freedom to exercise the powers and authority entrusted to them.

We very strongly suggest a phased approach and a slow pace in FO formation and transfer of management, so that PIDA can handle and administer the transition process with due care. Initially, there should be enough flexibility to try different approaches and models of community mobilization and FO formation such as PRSP/NRSP model, OFWM approach, IMMI/IWMI model and Helcro model. During the process, best practices and lessons learnt should be compiled which would, ultimately, develop into an approach/guidelines in itself.

During the fieldwork, we discussed different approaches such as upfront transfer, joint (PID-farmer) irrigation management etc. Farmers are not very happy with the idea of joint management as they think that the PID staff is involved in water thefts and bribes. They want the General Body of the FO to have the powers to remove the Management Body, or any of its member, with a two third majority.

Farmers, in general, are very enthusiastic about the process and happy about the change it would bring. They are willing do the spade work and contribute more if the abiana is less then what is required for O&M of distributary and organizational costs of FO.

Fig 11.1 Farmer Participation Plan



11.2 Legal Safeguards

The Water Users' Association Ordinance of 1981 and PIDA Act of 1997 provides the legal framework for establishing Fos at the distributory/minor level, some modification/clarifications/additions to the Punjab Laws are necessary for the formation and operation of FOs.

In the PIDA Act 1997, an autonomous status is given to PIDA, but the functions and responsibilities of AWB and FOs are not defined. Rather is left to the government to decide about their functions.

The act is not very clear on the issue of farmer's participation at different levels of irrigation management. For instance, at the PIDA level, its clear that non-farmer members would not be more than farmer members but no criteria is defined for a farmer to become PIDA member. We have seen in that in the last regime, the overwhelming majority of PIDA farmer members were member of the parliament and the rest big landowners. Similarly, at the AWB and FO level quota or seats are not reserved for small owners. In addition, no mechanism is defined to facilitate the representation of non-farmers in FO. No systematic procedures are defined to ensure that those who are elected as representative of outlet/watercourse reach upto PIDA farmer membership level.

The Act and by-laws should probably be clearer on working/management of PIDA and AWBs. For example, the Act in its article 11.1, states that on coming in force of this act, all the employees of Irrigation Wing of Provincial Irrigation and Power Department would become the employees of the PIDA. In our social assessment we found that farmers are not very happy with the Punjab Irrigation (PID) staff especially the one they deal with on day-to-day basis. Farmers think that PID staff is the root cause of all inequalities, water thefts and other problems. So shifting the whole PID staff to PIDA would not bring a change in the attitude, behaviour, perceptions, and the working environment of the department. It is obvious that PID is not willing to concede its powers to farmers. We have observed this in the case of LCCE-

AWB, where chairman of AWB is not able to exercise any power as, an extra-Act 97 portfolio of Chief Executive has been created and Superintendent Engineer has taken over this post and is managing the whole affair.

Registration and handing over of distributory management is another issues where legal flaws are obvious. There is no time frame within which PIDA is bound to issue a registration certificate to an FO, which is a basic requirement for signing the transfer deed and handing over to management. Secondly, even after receiving the registration certificate from PIDA, PID may delay the transfer of management for unlimited time period.

Inadequate attention is given to make the PIDA, AWB, and FOs, economically viable and commercially oriented. Most of the financial issues are left to the by-laws and the government.

Table 11.1 Legal Safeguards

PIDA Act 1997	Risks	Mitigation
• "The government may establish Area Water Boards and Farmer's Organizations and assign to them such functions as it may deem fit" (Article 14).	• Different governments may assign different functions to AWBs and FOs. PIDA is given no role in assigning functions to AWB and FO. So govts. May bypass PIDA.	• Autonomy and independence of AWB and FO should be ensured in the Act
• "All employees of the Irrigation Wing of the Provincial Irrigation and Power Department ……., on coming in force of this act, become the employees of the Authority" (Article 11.1)	• Farmers are not very happy with this as they think PID staff is the root cause of all inequalities, water thefts and other problems. Secondly, PID staff reporting to SE/Chief Executive of AWB would not be accountable to FO and its members.	• It should be left to the FO and AWB to hire/fire staff under their jurisdiction. A golden handshake scheme may be devised for the present staff.
• In the Act it is stated that a farmer member would be elected as chairperson of AWB and there is not provision for a Chief Executive. But in the case of LCCE-AWB, SE has been nominated as Chief Executive (CE) of the AWB, and made responsible for the management of its affairs.	• If this trend continues the power would always stay with PID and farmer participation would be eyewash.	• The TORs of the AWB chairperson and office bearers should be clearly defined in the act/bylaws and he/she should be made responsible for dealing/managing the AWB affairs.
• The act and by-Laws are completely silent about the representation of non-farmers, women and other marginalized groups in FO and AWB.	• Women and other marginalized segments of the society would be further marginalized for not having any say in water management at any level.	• Special seats should be reserved for non-farmers/owners, women and other disadvantaged groups/communities. This may also help in reducing the segregation between owner and non-owners. A specific percentage of seats in FO/AWB should be allocated for women. Women participation should be ensured especially in those areas where drinking water is taken from canal

• FO By-laws ensure the representation of farmers from all reaches including tail. But representation of small owners is not ensured anywhere.	• As there are small and large owners on all the reaches the process may be hijacked by the large owners and small and poor owners may be ignored.	• Special seats in all the reaches should be allocated for small owners
• Bylaws for registration of FO clearly state that management of a distributory would be transferred to an FO once its registered with PIDA and a written agreement of transfer of management is signed between the FO and PIDA. There is no time limit within which the Registrar would give a registration certificate to FO after receiving the application and agreement would be singed by PIDA with FO	• Farmers fear that PIDA and Irrigation department are causing unnecessary delays in the registration of FO and transfer of management. In LCCE, The process of FO formation (general and management body elections) has been completed on ten distributaries, (thought we have reservations about the process), but non of them is registered or given management. Now farmers are losing heart and enthusiasm.	• Soon after the election process is over FO should be registered and trainings should be provided. The maturity of the FO should be assessed by the CDSG, before an agreement of transfer is signed. IF CDSG approve the management should be transferred.
• According to Bylaws, an FO is responsible for operation and maintenance of distributaries, minors and drains	• It is neglected that drains cut across distributory boundaries. This may lead to conflicting/overlapping responsibilities.	• Modalities and jurisdiction of FO in this regard, should be defined very clearly
• PIDA Regulations emphasis on elections for the general body and Executive Committee of FO	• Farmers think that elections everywhere may lead to conflicts or politicization of the process.	• Fieldwork and experience suggests that consensus to be more conducive to the group harmony. But generally this option should be left to the community where they want to go for consensus or elections.
• PIDA Act and By Laws does not ensure that at any stage of institutional reform process, the FOs would be empowered to elect AWB, amongst FO general body/management body members, or AWBs would be able to	• Selection or nominations by Government or by irrigation department would leave a lot of space for hijacking of AWB and PIDA by influential feudal landlords.	• For meaningful institutional reforms and wider participation of farmers, a vertical participation plan is very important. It would ensure that those who were elected at WUA level only reach the PIDA membership.

elect PIDA farmer members.		• The Act leaves too much to subsequent by laws, rules and regulations. Many of these should be enshrined in the Act itself. Such delegation would increase PIDA's discretionary powers.

11.3 Social Mobilization – Elections Versus Selections

The process of social mobilization is also very crucial for the operations and sustainability of Fos. Strategically imparting comprehensive awareness about the goals, objectives, and activities of the project, the process of institutional reforms, and role, responsibility and authority of FO's Management Body and Chairperson, to all the stakeholders may serve as critical measure in this regard. At the same time efforts should be launched to sensitize the staff of Irrigation Department. Special attention should be given to the lower staff, which feels insecure and threatened by the project activities and is using different tactics to sabotage the process.

Once farmers are well aware of the reforms process and its objectives, discussions regarding the plan, the process of social organization should kick off. Farmers may be organized in the form of WUAs at each watercourse. The WUA should have the responsibility of maintaining the watercourse and the distributory in the range of the outlet, electing/selecting a watercourse representative for the FO's general body, serve as a monitoring team on the performance of the FO, and facilitate the collection of water charges from the water users. Once they are organized and they understand their rights and responsibilities, the process of elections/selection for WUAs and FO should be initiated. In the mean time the authentic voters' lists[12] should be displayed at prominent places in every village so that if anybody has an objective that can be addressed. From the fieldwork and experience of other projects, we suggest that the choice of election or consensus should be left to the communities. A stringent criterion, in this regard, my lead to conflicts. Consensus/elections of FO and the Management Body should take place in the present the representatives of the Irrigation Department, the organization responsible for social mobilization and the relevant member of the

[12] Under the present election rules, the only authentic list is one which is signed by the Executive Engineer of Punjab Irrigation Department.

AWB. Presently, OFWM, who is doing the social mobilization in LCCE, is not even invited at the election ceremony of FO or at the meeting of AWB.

11.4 Training

Parallel to the discussion and election process, a training need assessment exercise should get underway so that by the time the FO and management body is elected, required trainings are designed and scheduled.

11.5 Registration and Transfer of Management

At the successful completion of trainings, the FO should be registered and management, and O&M of distributory should be transferred to FO. The performance of the FO should be constantly monitored by the CDSG and required technical assistance and guidance should be provided by the group.

Table 11.2 Social Mobilization

Activities	Responsible Institution/s
Collection of Primary data through fieldwork for establishing benchmarks	CDSG, NGOs, OFWM,
Awareness	NGOs, OFWM, print and electric media
Discussion with farmers about the process of elections	Social mobilization team, PID,
Training Need Assessment	CDSG and social mobilization team
Trainings	CDSG
Registration of FO	Registrar PIDA
Transfer of Management	PIDA/AWB
Post transfer monitoring and TA	CDSG

12
Project Roadmap

12.1 Overview

The project roadmap attempts to sequence activities with a view to effectively integrating social and environmental concerns into the project. The desired outcomes are widely shared growth, poverty reduction and sustainable natural resource management, outcomes subsumed under the term sustainable human development.[13] The key issues and concerns, which have been addressed separately in previous chapters, are as follows:

- Strategies for the inclusion of vulnerable farmers and other stakeholders (NGOs, CBOs, private sector)
- Assessment of the appropriate management roles for farmers
- Mitigation of environmental concerns
- Assessment of institutional capabilities and responsibilities, particularly with a view to poverty alleviation and environmental mitigation
- Legal and regulatory framework development (PIDA, AWBs, FOs)

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13 Sustainable human development (SHD) is an all-embracing concept that defines and integrates development, sustainability and equity (DSE) in relation to the three central pillars of development – economic, social and environmental. In doing so, it extends the definition of sustainable development, as originally formulated in the Bruntland Commission Report, and stated as, "meeting the needs of the present generation without compromising the needs of future generations."

- Assessment of the major social and environmental impacts of the project
- Monitoring and evaluation plan

The chapter segregation is convenient for highlighting the different but related aspects of the project. However, a management plan is required to bring these aspects together as one integrated whole. This chapter attempts this by defining a clear sequence of activities and is proposed within three broad classifications, namely:

- Project Preconditions
- Project Implementation
- Project Evaluation

12.2 Sequencing Of Activities

12.2.1 Project Preconditions

12.2.1.1 Empower PIDA

PIDA and the constituted AWBs should be empowered. At a minimum, they should be fully staffed and funded, with an adequate budget; a basic set of rules and regulations in place and; with judicial tribunals established within the AWBs.

At present, PIDA is moving fairly rapidly in drafting rules and regulations aimed at devolution of management to FOs and for the formation of AWBs. However, it is not up to speed with funding and staffing. This needs to be addressed immediately to ensure that PIDA can function effectively, especially as it is the focal point for various irrigation projects, similarly tasked with institutional transformation, social empowerment and sustainable environmental management.

While PIDA has brought into its objectives to an extent, the single AWB constituted on the LCCE has a murkier notion of what it should strive for and some of its activities are placing project innovations at risk. For instance, FOs have been designated on all the distributaries within its command without precursory mobilization; also, members on the AWB Board do not represent small farmers, nor has the AWB attempted to disseminate information regarding its role.

12.2.1.2 Retrenchment Plan for PIDA Officials

Irrigation department staff should be informed upfront about their eventual retrenchment and the possible alternatives, ranging from golden handshakes, underwritten by the Bank, to employment opportunities in the private sector, such as contractual service arrangements with FOs. As the institutional and management changes are inevitable there is more advantage to be gained by being transparent about them. In general, changing institutional mindsets is difficult, ideally measured in decades rather than years. With this in mind, specific modalities for starting the process and sustaining it should be identified and functions defined clearly in both time and space.

12.2.1.3 Establish PDSG/M&E Unit/SC under the National Drainage Program

Planned institutional and social initiatives under PISIP have already been replicated in the NDP and the recently completed OFWM-III. However, the social innovations have not made much headway, nor does there exist much sensitivity about environmental impacts, both among communities and at the department level. The inherent complexity of institutional reforms suggests a need for coordination across like-minded projects, as well oversight of the process. With this in mind, it is proposed to establish a Community Development Support Group (CDSG) to coordinate and strengthen the reform process

***Constitution and Functions*:** The CDSG would be housed in PIDA. Two integral components of this group would be: a) an Umbrella Monitoring and Evaluation Unit (UM&E) and; b) a Project Advisory Committee (PAC). As indicated earlier, the PAC would be entrusted with reviewing and backstopping the recommendations of the technical support and M&E units. The group should be activated as soon as possible through a PIDA notification and recruitment of experts begun immediately.

The functions of the group and its constituent elements would be to:

- Undertake detailed studies on social, environmental and institutional aspects
- Undertake training needs assessment
- Design information/instruction brochures and pamphlets
- Implement training
- Develop project coordination and integrating mechanisms
- Provide financial, technical, social and organizational support to PIDA, AWBs and to FOs, post transfer
- Undertake M&E
- Review and backstop recommendations of the group

A concern exists that the PAC could be transformed into a depository for retired officials with limited and biased farmer representation. The following checks are recommended to prevent this: a) the committee should have broad-based membership from the private sector, NGOs, universities etc.; b) 60% of the membership should comprise small farmers, with holdings under 5 acres and; c) a bank representative should be delegated to monitor and resolve conflicts beyond the committee's remit

Detailed studies should be a parallel activity aimed at informing the institutional, social and environmental initiatives planned for PISIP and presently underway under different projects. The exercise should include but not be limited to the following studies:

- Gender and environment management
- Economic-Environmental utility of biological control measures
- Water quality analysis; the regional dimension, need and feasibility of coordination
- Environmental baseline for the project area
- Pricing options and their linkage with O&M
- Water trading
- Institutional Analysis
- Rules, policies, incentives
- Integrating activities and mechanisms
- An Analysis of Farmer Organizations
- Approaches

  - Water-centered (irrigation, groundwater, drainage)
  - Broad-based (micro credit, input distribution, health and education)
  - Joint management
  - Upfront transfers (contract services)

- Functions
- Structure (tiers,
- Gender role
- Electoral college
- Interface of FOs with service delivery
- Monitoring groundwater mining (recharge balance)

12.2.2 Project Implementation

Project implementation includes the planning, design, construction, operation/coordination and monitoring stages of the project. This delineation helps in understanding the linkages between technical, institutional/policy, social and environmental issues. For instance, the hard components of the project (infrastructure rehabilitation, communications) are conditional upon satisfactory social mobilization (FO formation); social mobilization and training is a precondition to operating complex and technologically advanced communication systems; rehabilitation of the irrigation system and its maintenance should also consider viable biological alternatives; inter-agency and inter-project coordination are necessary to sustain project benefits; project monitoring feeds back into project design and operations.

12.2.2.1 Planning

Awareness Creation: There is both an upfront and on-going aspect to awareness creation. At the outset farmers should be alerted to their rights and responsibilities. NGOs, and the OFWM department should distribute an information dissemination strategy consisting notionally of leaflets/pamphlets/brochures. Another additional option could be TV/radio spots and group discussions.

Training Needs Assessment and Training Implementation: The multi-dimensional and participatory nature of the project requires that the various stakeholders (farmers, department staff, NGOs) be both qualified and prepared for their responsibilities in working towards project objectives. The various studies identified above are aimed at providing insights on the economic, social and environmental aspects with a view towards achieving sustainable project outcomes. Based on such insights, training needs assessment should be undertaken. In turn, the studies and the needs assessment should form the basis for developing training modules for the various stakeholders. Among other things, the modules will aim at developing:

- Social awareness among irrigation department staff
- Social mobilization skills of the OFWM department staff
- Interactive/personnel skills (with a view to inter-departmental coordination)
- EIA skills among PIDA, AWB, OFWM staff and farmers
- Legal and regulatory competence of department staff and farmers
- Organizational, technical and financial capabilities of farmers
- Social-environmental interface at the FO level
- Farmer-service interface (input delivery and extension services)
- The training modules will be implemented by experts/trainers based in or organized by the PDSG. There should be an iterative aspect to the training with the modules being continuously updated with inputs from ongoing studies. The term training encapsulates in-house, regional and international training as well periodic workshops, seminars and conferences.
-

12.2.2.2 Design

FO Formation: FOs will be formed under contractual arrangements with PIDA and subsequently registered. The process is envisaged in two phases. The first phase will encourage the participation of NGOs, established FOs and the OFWM department. A competitive

environment is meant to promote cost-effective as well as sustainable approaches to FO formation. While avoiding typecasting approaches, elements of a common approach should evolve with a view towards institutional sustainability. In other words, as FOs are replicated over a wider area, the OFWM department should become more centrally involved in the process. Specifically, this is dictated by considerations of scale economies, logistics and the obvious fact that irrigation and agriculture are closely linked.

There is an advantage to deliberately slowing down FO formation in the early stages. In the absence of an enabling institutional environment there is the all too familiar risk of paper FOs emerging.[14] In order to preempt this, close monitoring is required at each stage from inception to maturity to post-transfer. The activity milestones are

- Advertisement issued by PIDA for community mobilizers (NGOs, OFWM)[15]
- Standard application forms with attached registration criteria (financial, social, technical) developed by UM&E unit issued by PIDA
- Successful applicants contracted
- Maturity assessment and approval undertaken by M&E units
- Post transfer support (training and technical) provided by PDSG
- FO representation on Board of Members of AWB and PIDA begins to be effected

With a formal approval process in place, a momentum is expected to develop eventually as mindsets change, mechanisms are consolidated and positive ripple effects are created.

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14 With this in mind, the AWB should be advised not to register FOs nominated by them until they have gone through the formal process of mobilization, preparation and assessment

15 Once successfully contracted, payments should be sequenced (40% mobilization, 20% midway and 40% upon successful maturity assessment)

12.2.2.3 Project Operations/Coordination

***Phasing of Operations*:** In the light of the complex and inter-related institutional, social and environmental aspects of this project, perhaps the key recommendation is that its operations be carefully phased. For instance, PIDA/AWB has just established the threshold of legal credibility and needs to be made operationally and financially viable. Second, the credibility gap both amongst and across farmers and irrigation department staff needs to be bridged. Third, potential stakeholders (OFWM, NGOs, CBOs) have to buy into the process; an experimental/pilot stage to the FO formation process is a precondition for an eventually viable and replicable approach. Fourth, inter-sector, inter-agency and inter-project coordination for environmental management is an operationally difficult task; the feasible level of such activities have to be identified; Finally, an accountable and independent monitoring structure has to be established within PIDA.

Therefore, it is recommended that the project proceed extremely cautiously in the first year, targeting no more than 10 FOs in each of two canal commands and picking up the momentum only as substantive milestones are crossed.

Interproject, Interdepartment and Intersector Coordination: *As indicated in the institutional analysis, PIDA should initiate coordination at three levels, each equally important. First, it should strengthen the interface between projects involved in irrigation, drainage and groundwater management to ensure the correct sequencing of activities.*[16] *This interface also extends to inter FO jurisdiction issues arising out of the three activities. Second, it needs to coordinate more closely with the OFWM Department, as it assumes a more central role in FO formation/operations, as well as with the agriculture sector to secure extension services for the FOs. Another aspect of coordination involving many departments and agencies is environmental monitoring with respect to both brown (water quality, salinity) and green (forests, wetlands, biodiversity) issues. Finally, linkages need to be developed with NGOs and the private sector to facilitate provision of social, joint marketing of inputs and outputs, credit and technical services.*

12.2.2.4 Project Construction

Physical Infrastructure Rehabilitation: Physical infrastructure rehabilitation at the tertiary level, under the project, is meant to leverage institutional reform and to create suitable initial conditions for the FOs by transferring fully operational irrigation systems to them. However, only those distributaries should be rehabilitated and transferred where FOs which passed social and technical scrutiny. Second, the activity should be synchronized with parallel drainage activities under the NDP.

Revenue/Subsidy Aspects: The gradual approach to FO formation may delay eliminating government subsidies to the Irrigation Department and in full commercial operations of the AWBs. However, the long-term prognosis is far better compared to the lack of results under mandated increases in OM cost-recovery, which were aborted due to political resistance. In the short to medium term, innovations rooted in various studies (higher abiana rates, area as

16 These are ongoing projects and projects in the pipeline funded by various donor agencies (e.g. NDP, OFWM-IV, PSGWDP, PISIP)

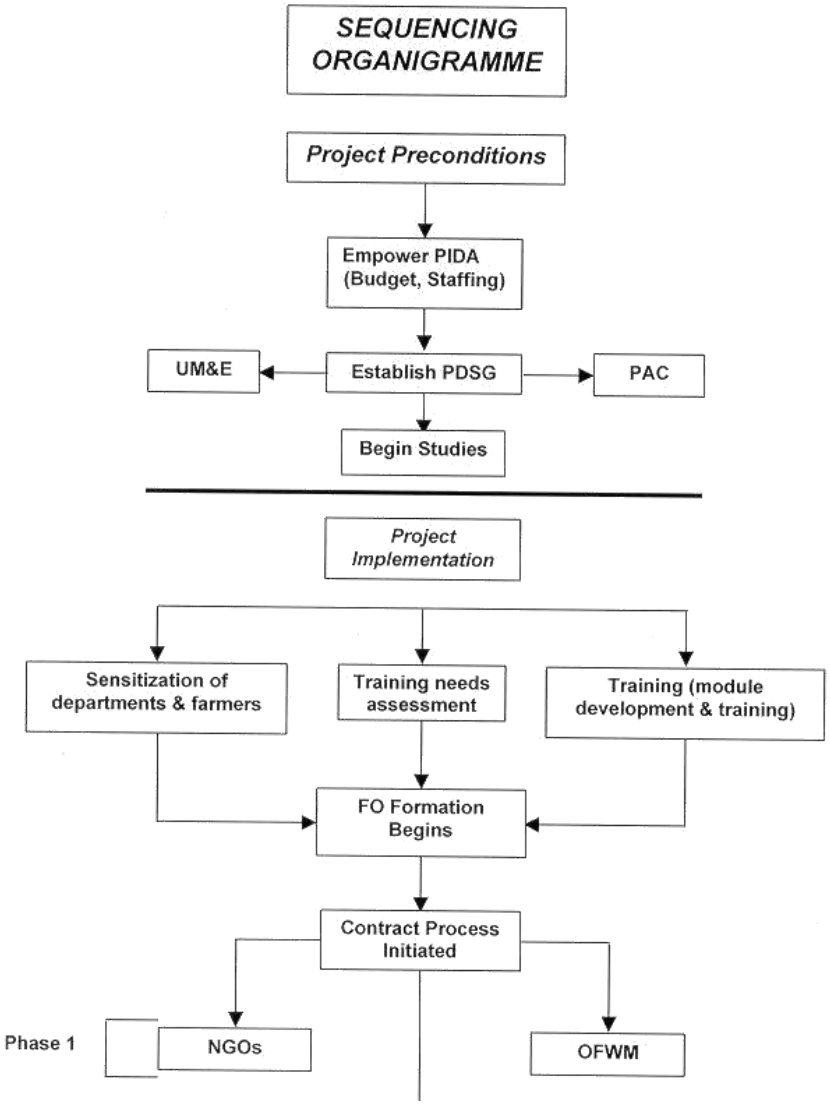
opposed to crop-based pricing, water markets) can be implemented with a view to eventual replication as FO coverage expands.

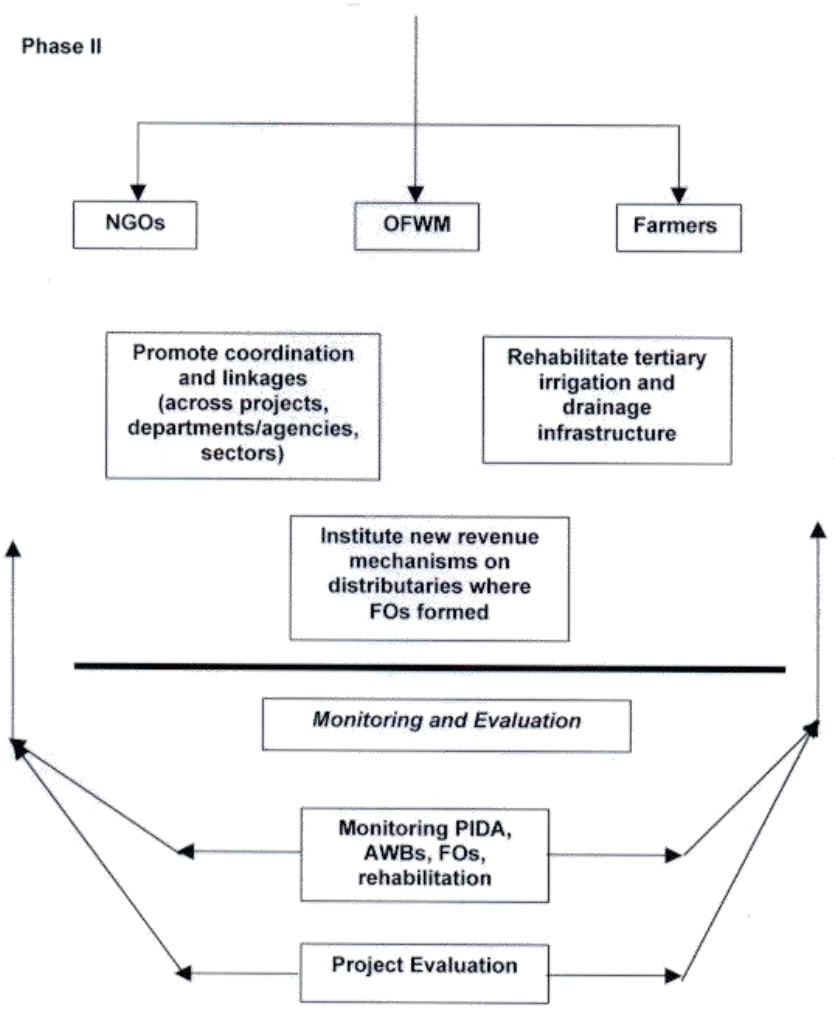
12.2.2.5 Project Monitoring and Evaluation

Monitoring the activities of PIDA, AWB and FOs is expected to be a continuous process with feedback loops. This will be done within the monitoring framework and with respect to the indicators elaborated in chapter 7. Project evaluation has a more discrete aspect; its purpose is to generate lessons regarding strategic project thrusts.

The organigramme presents a sequence of project activities. However, this is very notional and needs to be further refined to account for spatial and temporal overlaps.

Fig 12.1: Sequencing Organigramme




Phase II
NGOs
OFWM
Farmers
Promote coordination and linkages (across projects, departments/agencies, sectors)
Rehabilitate tertiary irrigation and drainage infrastructure
Institute new revenue mechanisms on distributaries where FOs formed
Monitoring and Evaluation
Monitoring PIDA, AWBs, FOs, rehabilitation
Project Evaluation

13

Environmental Management Plan

The Environmental Management Plan includes recommendations for capacity-building, an M&E strategy, guidelines development to integrate environmental objectives and concerns into relevant PIDA, AWB and farmer clients' activities. The proposed activities relate to institutional (staffing, access to expertise, interdepartmental project coordination, training), policy (R&R policy, policy for integrating environmental policies into irrigation rehabilitation including pest management), knowledge base and analytical skill development (information base, GIS, modeling), outreach and participation, wetland management, M&E, additional studies/guidelines to be developed as part of the project (eco-friendly construction, consultation strategy).

13.1 Capacity Building

The table presents suggestions for ensuring that project activities are environmentally sustainable. The proposed interventions are designed to respond to emerging environmental needs and problems and to develop capacity to deal with them.

Table 13.1 *Proposed Environmental Interventions*

Project Components	Project Level Interventions	Extra-project Interventions
SOFT -- Strengthening of PIDA -- Establishment of Area Water Boards -- Community Development and Support Program	 -- Studies -- Awareness Creation -- Training -- Community involvement in environmental management -- Gender involvement (water quality issues)	 -- Inter-agency coordination for water quality monitoring -- Wastewater treatment
HARD -- Improvement of Irrigation Facilities (main and branch canals, distributaries, watercourses) -- Improvement of Link Canals -- Rehabilitation of Barrage -- Telecommunication and Information	 -- Study and implementation of biological stabilization measures in irrigation and supporting infrastructure -- Promoting water use efficiency	 -- Inter-agency and inter-project coordination -- Integrating irrigation, drainage and groundwater management
PROGRAM -- Monitoring and Evaluation -- Project Management -- Technical Assistance, Training and Future project Preparation	 -- Developing environmental indicators -- Monitoring water use efficiency -- Monitoring water quality -- Monitoring biodiversity -- Monitoring health impacts -- Monitoring community and gender participation in environmental management -- Environmental impact assessments -- Identification of needs-based studies	

Proposed environmental studies are detailed in Chapter 9

13.2 Environmental Monitoring Strategy

The monitoring indicators (Chapter 9) were developed in consultation with PID, PIDA, AWB staff and with farmers who are actual or potential members of FOs and WUAs. Environmental monitoring per se has technical, institutional and social imperatives. The first requirement is the development of a detailed environmental baseline, as the baselines provided in the report are merely indicative. They need to be disaggregated to the distributary level, preferably during the early stages of project implementation to ensure that accurate project environmental impact assessments and evaluations can be carried out. It goes without saying that GIS capabilities need to be established within PIDA and technical training imparted to its staff. In addition, farmer representatives should be familiarized with such techniques and be able to interpret the maps to gain a basic understanding of -- and identify more closely with -- the different manifestations of environmental degradation. Chapter 9 also provides a detailed integrated monitoring and evaluation framework.

The Indus Basin Irrigation System Model housed in the World Bank should be used as a basis for carrying out a detailed social cost-benefit analysis of the proposed innovations. The model should be relocated in PIDA and in-house expertise developed to feed and run the model as and when required. Variables that could be modeled, reflecting their social, environmental and institutional underpinnings, are:

- Water quality impacts on groundwater, soil fertility and human health
- Reduced use of pesticides and fertilizers on crop productivity
- Increased “abiana” rates on costs of production
- The impact of stable water supplies on crop production

- The costs and benefits of biological control measures (slope stablilization, fuelwood and fodder)
- The costs of optimizing conjunctive use of surface and groundwater (salinity control)

These suggestions can be refined to include additional parameters relating to the integration of environmental concerns into irrigation management and crop production. An important focus of such integration should be on externality pricing and on converting perverse into environmentally friendly incentives.

13.3 Policy Guidelines

Clearly the project will not be in a position to change policies. However, it should attempt to influence them by undertaking policy research, advocacy and networking on critical environmental issues. This also means building upon and developing synergies with existing policy work. The following areas for policy guideline development, are suggested illustratively:

- Internalizing environmental impacts in water pricing (water logging, salinity)
- Developing an integrated framework for water quality monitoring
- Developing measurement, monitoring and implementation guidelines for conjunctive use of surface and groundwater, salinity assessment, groundwater recharge extraction rates.
- Promoting norms for waste disposal, livestock intrusions, bathing and washing clothes in irrigation channels
- Developing guidelines for monitoring and safe use of waste-water for commercial vegetable cultivation
- Promoting environmentally friendly practices such as community managed tree plantations (windbreaks, lining distributary paths), biological stabilization of slopes

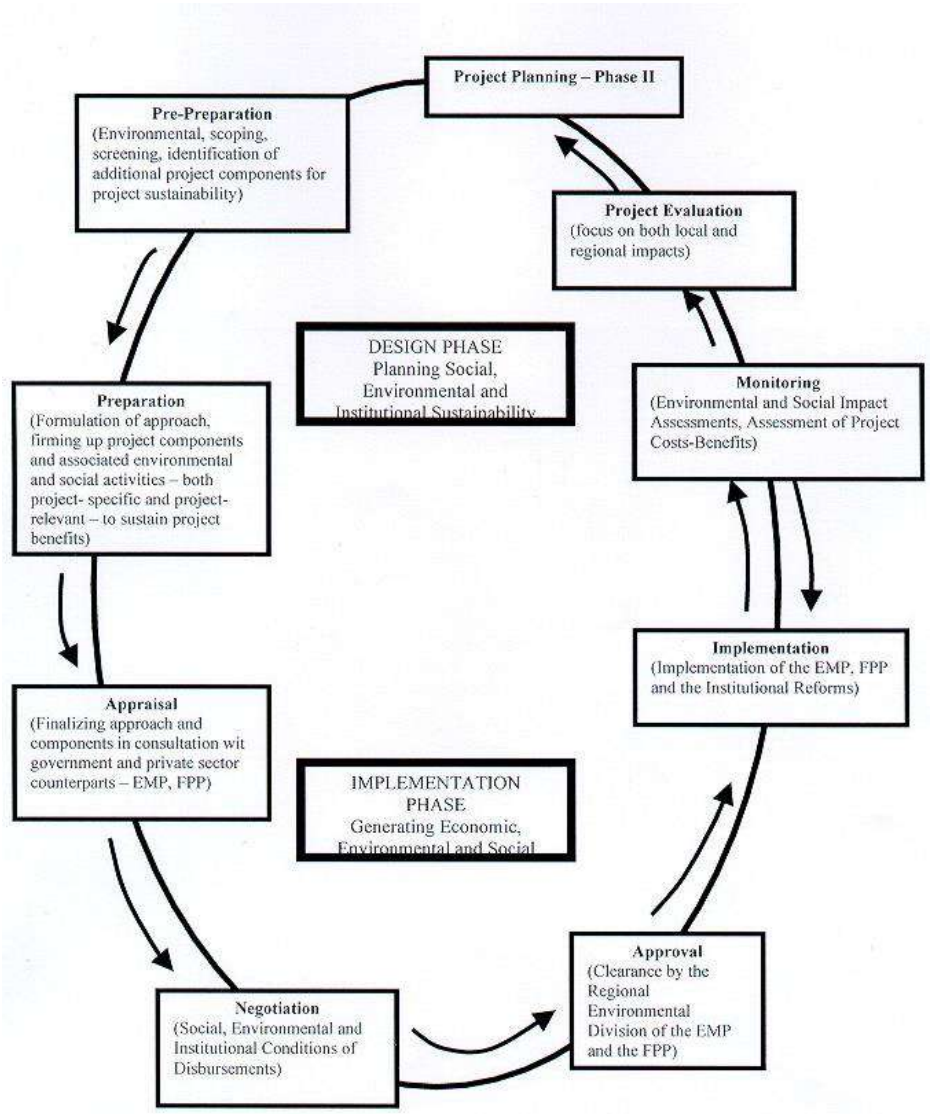
- Developing policy guidelines for wetland management with community participation

Again these are notional suggestions and should be refined further during project preparation.

13.4 Integration Of The Rsea With The Project Cycle

The following schematic presents the integration of the RSEA with the project cycle. It indicates the manner in which environmental mainstreaming should be undertaken within the project cycle.

Fig 13.1 RSEA and the Project Cycle



Annexes

Annex I

Trip Report (LCCE)
(December 13 – 17, 1999)

The team met Mr. Anwarul Haq, deputy managing director, PIDA. Anwar shared some of their FO regulations with us, withholding others as they were in the draft stage. He indicated they were still awaiting the proposal from NRSP-IIMI to provide the community mobilization and training services. The team then proceeded to Faisalabad and paid a protocol visit to Mian Abdul Ghaffar, Chief Engineer Faisalabad Zone (covering Lower Chenab Canal East and Lower Chenab Canal West command areas). He appraised us about the transition process and about the role of the army in the annual silt clearing operation.

1. Farmer Organizations

The meeting with the Mr. Ziaullah Waraich Suprintending Engineer/Chief Executive of the LCCE-AWB and his three Executive Engineers was informative, providing some focus for future interactions with both PIDA/AWB management and farmers. He arranged a meeting in his office with four of the eight members of the AWB. The members were hand-picked by the irrigation department supposedly, on their reputation for being honest and knowledgeable. The selections are based on the recommendations of the civil administration of the area, and field staff of the irrigation department. The members of the AWB indicated they had been briefed on the roles/ responsiblities of PIDA, AWB, and FOs. To date they had one (inception) meeting. They are waiting for the transition when the FO become operational and are still not very clear regarding the rules of business, their roles and responsibilities.

The CE of the AWB further informed that they had constituted FOs on all the 96 distributaries in the LCCE. FO members were identified by the distributary level irrigation staff. No formal selection criteria was used in identifying the FO members. No consultations had taken place with the farmers; in particular, WUAs had not been involved in the process.

In the field we met with three FOs, two established by the OFWM and the third, a hybrid (OFWM-ID). The farmers were receptive, as demonstrated by the fairly enthusiastic feed-back received in implementing the three-hour plus questionnaire. However, it was a set-piece situation with active participation by the executive body members and passive endorsement by the WUA representatives and farmers. Following is a distillation of the discussions

1.1 Entry Point

Water appears a viable entry point with the FOs keen to take over management responsibilities. Farmer complaints are: a) the PID field staff (XENs, SDOs) collude with large/influential farmers in appropriating water illegally (breaching distributaries/minors, pumping, outlet tampering etc.); b) there is NO maintenance as opposed to the deferred/limited (cost-constrained) maintenance claimed by the ID -- we saw ample evidence of this in one distributary, resulting in reduced discharge well below the design capacity and; c) collusion with the irrigation patwari in acreage/crop assessment and water allocation. From the discussions it appeared that farmers consider water a decisive organizing factor, taking up other activities sequentially. In fact, imitating the IIMI (Haqra-4) experience, one of the FOs had taken up fertilizer distribution to sustain its momentum in anticipation of transferred management. The farmers indicated that collective action/censure would deter illegal activities, which was not possible when they were not organized.

Opposed to the notion of water as a single entry point is NRSP's multi-purpose approach -- even while it recognizes the importance of water. Clearly, the gender focus increases if this approach is

adopted. Once again farmers were a bit uncomfortable answering questions about their women-folk and were fairly adamant that women had no role in water management. There is a need to get around this reluctance to talk, both by recasting the questionnaire and approaching the women directly. Incidentally, we did see women washing clothes inside the distributaries and minors and tending buffaloes on the canal banks

1.2 Elements of the Approach

1.2.1 Elections versus Nominations

Both elections and selection/nominations appear to work, with both modalities having been adopted successfully. Consequently, PIDA should be flexible in its regulations. We were informed by PIDA that they were simplifying their rules to facilitate transfer of management to the Haqra-4 FO and that this would be done inside of a month. If true, this means the constitution of an AWB is not a prerequisite to FO formation and transfer, and would allow the Bank to support successful FOs outside the two canal commands. However, one must concede a large credibility gap with respect to PIDA's intentions.

Although based on limited evidence, we are offering a somewhat different perspective on equity. With inter-generational fragmentation, large land holdings appear to be reducing. While this is offset by the increasing tendency to take land in under contract, the link between landholding size and influence is becoming relatively more tenuous. Other emerging factors that determine influence are connections, community service, and reputation for honesty. While not discounting the traditional, politically driven, 'chaudhry' culture, it could be posited that there is greater emphasis on accountability. Companion findings are that the bulk of farmers are owner-occupiers with few remaining tenants/sharecroppers. Also, small landowners (1-3 acres) either tend to contract out or sell their land because the holdings are no longer economically viable, or where they remain they supplement their incomes through off-farm employment. We emphasize that these are very preliminary findings, that they are

area specific, and that more investigations are both necessary and planned.

1.2.2 FO Structure, Rights and Responsibilities

The IIMI approach (Haqra-4) approach is to build on WUAs, segment the large distributaries under water user organizations (WUO) and constitute a representative water user federation (WEF) at the apex level. PIDA's preference is for a two-tier approach, namely, WUAs and FOs, representing different segments of the distributary, with resolution of intra-distributary conflicts taking place at the AWB (farmer members) level.

Some farmers showed an interest in co-management, a la the Andhra Pradesh approach. Reasons cited were: a) the inability of the FOs to handle the technical aspects (maintenance of L-section and gradient, calibration of outlets and other diversions, biological erosion control etc.) and; b) maintenance of land records/cropping patterns. These functions required continued retention of ID staff (SDOs, XENs, irrigation 'patwaris') under increased FO oversight. Co-management was seen as a possible transition arrangement to be replaced eventually by outright transfer as FO capabilities improved. Residual deficiencies at the assessment and technical levels could be addressed through contractual arrangements with the private sector/retired experts. However, other farmers feared that ID participation would abort effective devolution and transfer and that they preferred to go for upfront contractual arrangements. An abiding problem is that eliminating the irrigation 'patwari's' role could lead to a loss of the national cropping data base -- its inaccuracy notwithstanding. The farmers also indicated, rather heroically, that their per unit O&M cost would be much less than the approved yardsticks of the department,

Both FOs (executive body) and the AWB (president) preferred that magisterial powers (to impose fines, penalties and jail sentences) be delegated to them. Equally, there was concern that such powers would be misused. A determination will have to be

made whether such bodies should be limited to adjudication (panchayat) responsibilities or invested with powers to punish.

1.2.3 Water Pricing and Availability

Availability of water rather than pricing appeared to be the key concern. Provided water was uniformly available and adequate, farmers would be prepared to pay a higher price for it. A preference was expressed for capacity pricing (flat rates), rather than the present crop-based pricing.

1.2.4 Poverty Alleviation

There was a divergence of views regarding representation of small farmers/sharecroppers in the FOs. One view was that they would continue to be ignored; however, they would derive indirect benefits from incremental water being shared across the board. Another view was that there be a fixed quota for poor farmers. A progressive executive body member recommended that farmers with 5 acres or less should have as much as 50% of executive body representation, and that 33% of the remaining seats should go to farmers in the tail reaches.

1.3 Institutional Capacity

1.3.1 OFWM (Water Management Coordinator, NDP – Ali Sher Zahid)

Under NDP financing, the OFWM-IV has already facilitated 4 FOs.in the Lower Canal Command East (LCCE) to different stages of maturity, with more being targeted annually. A precondition is revitalization of dormant WUAs. Concurrent activities are watercourse improvement and drainage rehabilitation (drains under 15 cusec capacity). There appears to be a coordination problem, with the latter activity also being carried out by the ID. The ID plans to form its own drainage beneficiary groups (DBGs) through which it will rehabilitate low capacity drains. Coordination efforts include the need to deal with the cross-border jurisdiction that such rehabilitation will entail.

1.3.2 Area Water Board

The AWB has designated FOs on 90 plus distributaries in the LCCE. Clearly, this is primarily to fulfil its project mandate, as the selection and social mobilization process does not even meet minimum criteria. Also, the AWB has designated FOs on distributaries where they have already been established by the OFWM

1.3.3 NRSP

NRSP, in collaboration with IIMI are developing a proposal to provide community mobilization services to the AWB. The NRSP will focus on institutional development while IIMI will provide technical training to FO members in technical management (such as calibration of diversion structures and water outlets, irrigation agronomy, conjunctive use where needed, monitoring of the physical performance etc). NRSP is, presently, engaged in establishing an FO on one distributary on the LCCE, with a view to determining costs and time entailed. Husaini's note provides more details of NRSP's approach and capabilities. NRSP will work through the Punjab Rural Support Program (PRSP), which has an office in Faisalabad. The possibility of PRSP becoming a key player in the FO formation process under the project is being looked into.

1.3.4 Roadmap to FO Formation

The following options are presented, prior to articulating one or more roadmaps to FO formation.

- Establish a limited number of FOs each year (OFWM, NRSP), or proceed on a broad front (AWB)
- Organize around water or multi-purpose activities or both.
- Promote pilot projects of both the OFWM and NRSP, with a view to parallel expansion in both the canal commands. Turf battles are a concern and there could be funding complications. Additionally, relative costs need to be evaluated.
- NRSP takes the lead role assisted by a project support unit or project NGO (see Husaini's note).

- OFWM takes the lead role. NRSP provides mobilization support and IIMI provides technical back-up.
- Establish an independent monitoring entity to determine an FO's institutional and financial viability as well its ability to meet equity/gender criteria
- Establish flexible rules and regulations to accommodate a diversity of conditions and environments. For instance, provision for co-management as well as immediate transfers; no spatial or sequencing restrictions on transfers if conditions are conducive and; limits to the discretionary power of departments

Clearly an in-depth institutional analysis of the key players will need to be conducted to determine levels of social sensitivity, transparent and competent governance, financial and management capabilities, prior experience etc. In addition to the secondary data available, a check-list is being developed to generate first hand information on these aspects. This will not only help in the assessment of institutional capabilities but will also guide the recommendations for institutional strengthening

2. Environmental Impact Assessment

2.1 Drainage

Regional Impacts: Salt transmission downstream occurs mainly through the rivers, which are the depositories of the spillage from trunk/primary drains. However, these rivers also serve as natural barriers to cross-canal command surface flows. Clearly there is a need to establish water monitoring and communication systems. Subsequent interventions aimed at minimizing regional impacts can engender local environmental problems. For instance, evaporation ponds entail seepage in surrounding areas and loss of potentially cultivable land. A partial solution could be to introduce salt-resistant crops, fodder and grasses in these areas. A system for recycling drainage effluents (reverse osmosis?) appears an effective solution and could be considered on an experimental basis for possible low-cost adaptation.

Local Impacts: The Faisalabad Drainage Circle of the Faisalabad Irrigation Zone (SE – Sheikh Javed) is responsible for the maintenance of 1321 miles of surface drains covering a catchment area of about 6,000 square miles and covering both the LCC East and LCC West. The surface drains are designed for both seepage and storm water disposal. The bulk of the area under LCCE is underlain by saline groundwater and is the site of the earliest SCARP-1 site project which installed an extensive vertical drainage system in the area. Reportedly, the project was successful in lowering the watertable to a considerable degree. The problem is threatening to resurface as a result of government disinvestment in the program and reluctance shown by the private sector to adopt it. Also, farmers have sunk their own private (smaller capacity) tubewells and monitor conjunctive (mixing) use of both surface and ground water carefully. However, due to the brackish nature of the ground water salt accumulation does occur and continuous leaching is required. While the bulk of the effluent is discharged into the Ravi and Chenab rivers, part of it flows back into the canal system.

Rehabilitation of the highly degraded surface drainage system (due to deferred maintenance) was begun under the National Drainage Program in 1998. Since then, under a three year rolling plan, desiltation, rehabilitation, extension, remodelling and construction activities have started. The primary focus presently is on desiltation and rehabilitation. Additionally, the NDP program plans to transfer the O&M of drains under 15 cusecs to constituted drainage beneficiary groups (DBGs) as a part of OFWM-4. As mentioned earlier this raises inter-FO coordination issues.

In terms of a broad sweep one could say that in the short-to-medium term, irrigation and drainage system rehabilitation will proceed concurrently and with greater farmer awareness and participation.

2.2 Water Quality

The Regional Aspects: The team met with the MD Mr. Shahid Ahmad and the Deputy MD, Mr. Haleem of the Faisalabad

Water and Sanitation Authority (WASA). The MD provided maps, data and the budget of WASA. The problems are formidable. A brief background provides the context for future constraints and possibilities, especially in relation to adjoining agricultural areas and downstream environmental impacts.

Faisalabad is an unplanned city with no separation between residential and industrial areas, which causes industrial and household effluents to intermingle. Effluent disposal is built around natural drainage and old existing channels, which eventually discharge into the river Chenab. The soil in and around Faisalabad tends to be plastic, limiting seepage but creating overflow problems. The drainage system is extremely dilapidated. Sullage and storm water drains are dysfunctional and pipe corrosion results in seepage into the freshwater system. In addition, poor communities tend to pump water out of gutters for household use. The lack of interdepartmental coordination exacerbates problems. For instance, road construction has not been dovetailed with the WASA Master Plan, resulting in the creation of troughs, which have become depositories of stagnant water. The present preoccupation is with development rather than consolidation. A classic example of this is that water supply to the new townships is being routed through the old city network, which there is no plan to rehabilitate.

The emphasis on development schemes, neglect of rehabilitation, limited O&M funds, low cost recovery and high establishment allocations are a familiar municipal syndrome. One of its manifestations is the inability to perceive problems beyond the city confines, a problem aggravated by the vertical orientation of departments. Thus wastewater is sold under contract to outlying farmers and drains into the Chenab. However, there are no regular arrangements to test or treat this water. Any interventions, worth the name are sporadic and donor driven. For instance, JICA has financed the construction of oxidation ponds for wastewater treatment. This is unpopular with farmers who prefer to buy water untreated, while the high value of residential land makes such investment expensive.

The intrusion of urban wastewater into the canal irrigation and river systems is a problem that is likely to become more severe in future as residential and industrial expansion continues apace and municipal budgets shrink in real terms. Clearly, interventions at this level are beyond the pale of the project. However, there is scope for promoting interdepartmental coordination, advocacy and awareness campaigns and the institution of water quality and health monitoring systems.

2.3 Social-Environmental Interface

Environmental awareness among farmers is tardy, compared to the relatively more pressing social issues. Admittedly, the questions also need to be configured more carefully. (Harsh, would appreciate some feedback on this if possible). Farmers are aware of the potential of biological erosion control. For instance, one FO expressed concern that the prolific growth of 'sarkandas' (weeds) on the distributary banks caused water losses, both through its absorption and due to channel constriction. The need to plant trees, grasses and shrubs on the ridges and along the outer banks was discussed. While less aware of its environmental value, farmers were cognizant of the economic benefits. (fuelwood, fodder, revenue generation from timber sales for distributary maintenance and material for silt-trapping). We also saw vandalized old trees (government property) along the inspection roads. The ownership-protection nexus has to be encouraged through a socialization process and should become a part of the FO mandate.

In brackish ground-water zones, canal water is being used for drinking. The blanket perception is that such water is of good quality. In a similar vein, farmers only see benefits in using waste water for vegetable cultivation (rich in phosphate). We saw one such drain that had been attached to a 'khal' (watercourse), with waste water being supplied to the farmers in turn. In a kind of inverted environmental logic farmers expressed relief that, resultantly, they did not need to set aside land for a 'jauhar/chappar' (open pond). Clearly, awareness creation about

contamination, where it originates from and its adverse health impacts is necessary.

On a more positive note farmers are extremely conscious of salinity problems and closely monitor the mixing of both surface and ground water.

2.3 Baseline Information

Baseline information about environmental aspects in the LBD and LCCE canal commands is being generated through the use of GIS and LANDSAT imagery. Specifically, the WWF Office in Lahore is collaborating with us in providing maps which will contain the following information:

- Major rivers, canals, cities, towns and roads
- Waterlogging and salinity
- Forest cover
- Flood plains/wetlands
- Flora/Fauna
- Protected areas

In addition, the WWF has also provided compiled information, which we are sifting through and which could serve as a possible ground truthing source. We also plan to meet with the provincial EPA and WAPDA's Environmental Section, prior to developing recommendations for the structure that should undertake environmental monitoring activities during project implementation.

Annex II

Survey Report
LCCE Canal Command Area
January 3, 2000 to January 7, 2000

1. **Lagar Distributary of the Upper Gugera Brach of LCCE,**
Village Wakil Wala, Moza Barh, Tehsil and Dist Shekhupura,
January 4, 2000
FO nominated by AWB
Description:
Length: about 10 miles
Tail portion lined but the condition of unlined portion very poor
Designed capacity is 43cs
Present mean flow is about 23cs

2. **Azmat Distributary of Burala Branch of LCCE,**
Village Qadir Bux Abad, Tehsil and Dist Kamalia,
January 5, 2000
FO by OFWM
Description:
Length: about 3.7 kms
All lined
Designed capacity is 9.75cs
Present mean flow is about 7.5cs

3. **Farooq Distributary of the Lower Gugara Branch of LCCE,**
Village Chak 774 GB, Tehsil Samundri Dist. Faisalabad
January 5, 2000.
FO by OFWM
Description:
Length: don't know
Tail portion lined but the condition of unlined portion very poor
Designed capacity is 45cs
Present mean flow : farmers don't know

4. **Khekhi Distributary of the Lower Gugera Branch of LCCE,**
Village Chak 333 GB and 330 GB, Tehsil Toba Tek Singh
January 6, 2000.
FO by AWB
Description:
Length: about 25.29 miles
Tail of the tail is portion lined. Condition of unlined portion is OK (no berms)
Designed capacity is 260cs
Present mean flow is about 282cs

5. **Chakku Distributary of Lower Gugera Branch of LCCE,**
Frida, Jaranwala, Tehsil, and Dist. Faisalabad
January, 7, 2000.
FO nominated by AWB
Description:
Length: about 0.75 miles
All lined
Designed capacity is 3.5cs
Present mean flow is about 3.5cs

Basic information

In most of the LCCE canal command area (CCA), watercourses have *pakki warabandi* and farmers are satisfied with it. There is a consensus among farmers that the present warabandi is a good system of water distribution and there is no need to change it. Only one village (Qadir Bux Abad, Azmat distributary) has *kachi* warabandi but none of the farmers there showed dissatisfaction on that. In on village (Wakil wala, Lager distributary) pakki warabandi is disturbed after the closure of SCARP tube wells because the canal water was supplemented through tube well water. After the closure they require more water from canal.

Environment

The CCA of LCCE largely consists of good quality soil. Only a very small portion at the tail of Khiki (near Shor Kot because of Trimu_Siddnai link canal) and chakku disy (near Jaranwala) are waterlogged where water table is rising. Presently, in these areas, water table is between 0-6 feet. The yield in areas, where water table is rising, is decreasing rapidly. The incidence of malaria is only in those areas where water table is above the ground level – very small areas. So far the government has done nothing to solve this problem.

There is a general concern, especially in the brackish water areas, about the slowly deteriorating quality of soil resulting from the use of tube well water. Farmers told that they have to use underground water through private tube wells, which are mushrooming and are more harmful for being shallow, because of the shortage of canal water. This problem is more severe in tail reaches of all the disys as they suffer from water shortages very often. The problem of water shortage, and rising water table is worsened after the closure of SCARP tube wells. Farmers demanded an increase in water allowance for the brackish water zone and suggested a supply through tube wells to sweet water zone.

Out of the five distys that we visited three are served by surface drains. But the physical conditions of the drains are awful. They are full of weed, shrubs and grasses and their cleaning is immediately required.

The conditions of unlined disys are not much different from the surface drains. Because of the lack of regular maintenance even the lined parts are in poor condition.

None of the farmer group mentioned quality of canal water or industrial chemical pollution as a problem for them as none of the disys or canal passes through any major city.

In all the villages except one (Chak 333), where water from watercourses is used for drinking, wastewater is used for cultivation. In some villages wastewater goes directly into watercourse and get mixed with canal water. In others it is used by some individual who have dug ponds/shallow wells close to their farms where wastewater is collected and then pumped up to irrigate fields. Farmers, generally, are not aware of the harmful affects of human waste (excreta), rather they think wastewater is good for crop yield and where they use waste water they put less fertilizers. However, quite a few of them knew that use of urban wastewater for cultivation, for having chemicals in it, is harmful.

Farmers are aware of the biological control measures in maintaining the canal system. Most of them expressed that the FO would not have to take any such measures as plantation of trees is not possible and not good along the banks of distributary – as they are very small) and only be beneficial along the main and branch canals. They were divided whether the natural growth of grass and *sarkanda* should be allowed along the disy of not. Some were of the opinion that it strengthens the banks while other thought that they consume too much of water. One farmer who is a local doctor too, suggested the plantation of *isapgole* which is easy to grow, does not consume water and is productive too. Most of them were in favor of lining of distys to prevent all types of problems.

Agriculture

In the areas that we visited, more than 70% farms are less than five acres and less than 5% are above 25 acres. More than 85% farms are owner cultivated and very few (less than 5%) are operated by sharecroppers. Major crops in the areas are sugarcane, wheat, rice, vegetables and cotton. Most of the farmers at the head think that their yield is higher than rest of the LCCE CCA where as people on the tail think differently. But there was general consensus that the yields can improve is more canal water is made available to them.

Social conditions

Literacy level in the area is quite high (about 65%) but still most of the people are into full time farming. The proportions of different bradries vary from village to village but Jatt and Arain are the two major bradries in Faisalabad Dist. In shekhupura Dogars are also very prominent. Bradri and political affiliations play an important role in social grouping but non of the farmer groups mentioned any conflict based on this. However, all of them were of the opinion that this segregation would not affect the sustainability of FO and issues related to water management.

There is no standard conflict resolution mechanism in place. Areas where there is one very strong social figure (Qadir Bux Abad), most of the conflict are resolved locally. From our experience it seems that religious background plays very important role to give you the decision-making powers. In other areas conflict are resolved through litigation.

Conflicts on water

The incidents of conflict on water seemed very common but people did not talk about them in group discussions but only when interviewed individually. Most of them mentioned that outlet tempering, water thefts through pipes and cuts are common practices especially at the head reach of distys. Whenever such an incidence has happened, farmers have brought it in PID notice but hardly any action had ever been taken. The examples of any

punishment or fine are even lower when the culprit was a political figure. All the farmer groups were of the opinion that this is all done after the collusion with PID.

Awareness about Farmer Managed Irrigation System

Apart from a few farmers in the two farmers group, which are organized by the OFWM, non of the farmers, even those which have been nominated by AWB as members and chairman of FO, are not aware of the new system. Only one farmer knew about one of the area water board members. This ignorance is also common among the PID staff. The staff of PID (relevant XENs, SDOs and others) is not aware of the member of their Fos and no social mobilization or public consultation took place in the whole process.

From conversation with PID staff, its very obvious that they are very unsympathetic towards the whole process. The lower staff (SDO and below) has not been involved in the process and they feel threatened after the formation of PIDA and Fos. The farmers told us that PID staff is spreading disinformation, such as abiana would be increased, meters would be installed on outlets, executives of the FO – who are going to be the influential ones -- would get more water, if we (PID) can not run the system perfectly how would you (farmers) be able to manage it technically etc, to discourage farmers to participate in new arrangements.

On the other hand, farmers are of the opinion that they must play a significant role in irrigation management. They think that their involvement would promote equitable distribution of water and all the farmers at all reaches would benefit from it. If Fos were able to increase the supply of canal water it would affect the yield and hence economy positively. And even if they could not increase the supply, those who don't receive water would not have to pay abiana as they have to do now. However, they fear that they may face difficulties in managing long distributaries such as Khikhi. Most of the farmers are confident that they can maintain the canal much better than PID if, only, 40% of the total abiana is given to

them. A majority of them was aware of the amount of abiana collected from their village but no one was aware of how much is spent on O&M of distributary. Regarding the assessment and collection of abiana, they suggested that each WUAs should be given the responsibility to assess and collect abiana from the water course, and in case of misreporting, the culprit should be fined 11 times.

The farmers are also confident that they can also check water thefts and outlet tempering provided they are given the required authorities/powers and support of local administration. What they need for all this, in addition to powers, is some technical training and guidance. Some farmers were of the opinion that, initially, instead of the farmer managed irrigation system it should joint (farmer + PID) managed irrigation system and later on, role of PID should be phased out gradually. All the farmers are of the opinion that if the process of FO formation is politicized, as they see from the present nomination for FO, AWB and PIDA, then the whole process is bound to fail. The major criteria for success is the true and honest representation of farmers at all levels that should be sought through consensus and not through election as is done in politics. Secondly, the FO must be given powers to punish and fine against water crimes. The chairperson at each level (WUAs, FO, AWB, PIDA) should be accountable to general body and decision of critical nature must be verified by the majority of general body. The executive body of the FO should be a good combination of Educated, experienced (elders), honest, large, medium and small farmers. The tails reach should be given more representation as it would assure the supply at tail which means supply to all would be guaranteed (equity). An FO should be elected for 3 to 5 years and general body should have the power to remove executive body with 2/3 majority. PIDA and AWB should have minimum interference in the affairs of FO.

The major focus of the FO should be water management. However, once it feels mature enough to take other issues up such as health, education, and agriculture related activities, only then it should get involved in those.

Regarding the gender role in irrigation, non of the farmer group had a very optimistic opinion. According to them women should play more active role in water management at household level but their involvement in irrigation management or in FO would be against the existing social realities and set up. However, they foresee a role for FO to encourage the establishment of vocational centers for women and some micro credit scheme for them One group of farmers (Chak 333GB) was even aware of the Gramin Bank experience in BD, so wanted something for women on those lines.

Annex III

Survey Report
LBDC Canal Command Area
March 6 – 13, 2000

During my visit to LBDC CCA, I had focus group discussion with 9 groups of farmers in different villages. The soil and underground water, generally, is of good quality. However there are pockets of water logging and salinity. Since this area was not covered by SCARP so there are no government tube wells but private tube wells are mushrooming rapidly. As the problem of water logging is not very common, surface drains only exit in waterlogged patches. Physical conditions of distributaries are much better after desiliting and farmers at tail are quite happy. However, a couple of groups, who are at the tail of tail, complained that they were not getting sufficient water even after desilting. Those who own land at head complained that their outlets were too high from the canal bed and they are getting less water then is allocated to them. As none of the farmers knew how to measure the discharge even at the outlet level, so when they complained about reduced supply of water after the desilting campaign and associated it with downsizing of their outlets by PID for bribe, one does not really know whether the outlet is actually down sized or they were drawing more before desilting, resulting from accumulation of silt.

All the villages, that I visited, have Pakki Warabandi and farmers are not in favour of any change in it. Distributaries here, generally, are not included in the canal closure rotation plan however, in summer due to reduced supply of water from dams, PID had to use the rotational plan. Frequency of distributary

breaches depends on need for water. It's more common in summer than in winter.

About 80% of the households own land less in the farm size of less than five acres. Above 98% of the owners cultivate their own land and few go for sharecropping or leasing it out. Major crop in the area are wheat, sugarcane, cotton and rice. The average of yield per acre for wheat is higher (about 25-32 monds/acre) than the nations average of 23 monds/acre). The major constraints to productivity are poverty (lack of capital to invest into agri inputs), inadequate supply of canal water and high rates of private tubes wells (rate vary from Rs. 60 to Rs. 120 per hour) and lack of information about the new varieties and new research in the field of agriculture. In one village the yield was lower because their soil is saline and underground water is brackish.

Literacy ratio varies substantially from village to village. But, generally, literacy ratio among male population is as high as 60-65% and among female population as low as 10-15%. More than 90% of those who live in villages are in full time farming and those who are farming + business or services are shopkeeper or laborers (unskilled or skilled).

In quite a few villages (5/9), OFWM has improved watercourses but WUAs which were formed at that time are no more active. Now OFWM is established/forming new WUAs with a view forming FOs on distys. But, unfortunately, there is no permanent Water Management Coordinator posted in Shahiwal and Coordinator Multan is given this additional responsibility. The person who is in charge in his absence is very enthusiastic and willing to work but does have the skills and capacity for social mobilization. The staff of OFWM is not even very clear about the concept of FO, their rules and regulations, their rights and responsibilities.

The other organization that is working in the area is PRSP. Their main focus is on microcredit and saving. Only in one union council (122/9-L), they have formed WUAs using the same

formula as of OFWM (70:30). The regional general manager (RGM) was not there during my stay but rest of the staff is not aware of concepts like AWB and FO. I did not find any active local/village level CBO or NGO in the area.

There are different bradries in different villages but Jatt and Arain are found everywhere. Social grouping is political and bradry basis and it was more visible in a couple of villages than the others. Social groupings or conflicts on the basis of political affiliation are weakening and reducing. But in case of any severe conflict, majority, as first action, goes to police or court but ultimately most these get resolved outside the court (by village elders or punchayat or some other informal mechanism). Only one village has a punchayat consisting of the head of each bradry. It happens with the conflicts on water though they are less common than others. Water conflicts are more common between villages and between farmers and PID than among farmers of the same village. All the farmer groups, except two, were quite confident that FO would be able to check tempering of outlets, and water thefts if it has to powers/authority and the mandate to do so. They were of the opinion that water theft and outlet tempering is not possible without the backing of PID staff. So if PID staff is removed and powers are given a committee of farmers (Not any individual even if he is the chairman) frequency of such incidents would decrease. However, most of them were aware of the fact that the FO would not able to stop the feudal and politically influential people easily and it would have to take the help of administration.

Nobody in area exactly new about the institutional reforms in the irrigation dept. However, about half of groups have heard from PID that soon irrigation system would be given to ANGRAIZ, water rates would be increased tremendously, meters would be installed on outlets, abiana would be charged in per hour basis and it would have to paid every month like electricity bill.

None of the groups was happy with the management performance of PID. Farmers were very open about corruption in PID and how

one gets more water by bribing the baildar or the overseer. Except one, all groups were of the opinion that farmers should play a role in irrigation management. However, level of role and responsibilities that an FO should take over differed group by group. Some were in favour of just O&M of disty while others wanted to do the hiring firing of staff (most the people don't want to keep the existing staff of PID and Patwari), right sizing the outlets (to increase equity), collection and distribution of abiana and deciding about fines and punishments in case of water theft or water outlet tempering. Most of the groups were confident that they could assess and collect abiana. They put forward following suggestions in this regard:

- Assigning one person on each outlet to assess abiana and then it would be collected by Lamberdar
- Abiana assessed and collected by Lamberdar of each village
- Abiana assessed and collected by the representative of that outlet in the FO

All the farmer groups knew, approximately, how much abiana is collected annually from their village/watercourse and there was a consensus that not even a single penny is spent on the O&M of disty. Farmers are, generally, willing to make voluntary contributions and do the labour themselves if the amount of abiana is less than that is required for O&M of disty. However, they were of the opinion that they can manage the disty with 1/3 of total abiana.

Regarding the process of FO formation and selection of Exe body, 8 out of 9 groups are in favour of an open meeting of the general body, discussing the candidates and selection through consensus. Farmers did not specify any criteria/minimum qualification for the members of FO/Exe body. However, generally, people want these body to be a combination of educated, young, experienced, economically well off individuals who are honest, and willing to give time for collective work. According to farmers, the tenure of FO should be 2-3 years with the possibility or renewal and removal. None of the farmer groups expressed the fear that

transfer of management may lead to conflicts and new grouping. However, they were concerned that if elections for FO are held on party basis then it may lead to conflict and traditional politics. Majority of the farmer groups was of the opinion that FO should get involve in all development activities. But a couple of the groups were of the opinion that as different skills are required for different type of activates so people with different strengths should be chosen for different committees.

In answer to the question, how the interests of the tail enders, small farmers would be ensured, there were different responses such as

- Chairman should be owner of under 5 acres
- Fixing quota for under 5 for tail enders in exe body of FO
- Let FO be an open forum with no quota for anybody and let farmers discuss and decide.

There was a consensus among all the farmer groups that women should not be involved in FOs and their concerns should be put on the agenda of FO through male member of the family. In none of the villages women were allowed to sit in any committee and their interests are watched by the male members of family or bradry. When a women group, organized by PRSP, was consulted they expressed unwillingness to participate in FO but they wanted to get involved in village cleanliness committee which also deals with wastewater etc.

As discussed earlier, water logging and salinity is not major problem of the area. The major environmental concern that about half of the farmer groups highlighted is the increasing pollution load in the canal water. Source of this pollution is industry in Lahore, and Okara and municipal waste of Sahiwal, which is discharged in LBDC. The condition of river bias, which flows very low during this season, is even worse. All the aquatic life has extinct and even cattle refuse to drink its water. But due to shortage of water, farmers have to use it for cultivation, which may result in harmful dieses or other affects on human health.

In majority of villages, wastewater is use for cultivation. Farmers think that it has urea so where they use this water they put less fertilizer. They are not aware of the affects of disposing human excreta into irrigation system except that it would make the canal water undrinkable.

All the farmer groups are aware of biological measures to maintain irrigation system. They trees are good as they can provide wood for Killa Bushi and revenue for O&M but grass is not good because cattle may damage disty while grazing. Secondly, if slopes of disty are grassed, it would difficult to detect rat wholes.

Bibliography

Banuri. T., and Khan, S.R., *Background Study for A National; Environmental Strategy*, Sustainable Development Policy Institute, August 2000

Eco-Nexus Inc., *Pakistan Protected Area System Review and Action Plan*, PEP-CIDA-IUCN-MELGRD, 1999

Government of Pakistan, *Atlas of Pakistan*, Surveyor-General of Pakistan, 1985 and 1997

Hassan, M., Memon, Y., and Hamid, A., *Returns to Facilitating Farmers' Organizations for Distributary Maintenance: Empirical Results from a Pilot Project in Southern Punjab*, The Pakistan Development Review, Autumn 1999

IUCN, *Biodiversity Action Plan for Pakistan*, IUCN-WWF, October 1997

Khurshid, N., *A Step Towards Wetland Conservation*, World Wildlife Fund for Nature, 1991

Khan, S.R., and Naqvi, A., The Environment-Poverty Nexus: An Institutional Analysis, Working Paper Series, Sustainable Development Policy Institute, August, 2000

Mallon, D., *Biodiversity Guide to Pakistan*, World Conservation Monitoring Centre, 1995

NESPAK-Mott Macdonald, *Executive Summary: Pakistan Drainage Sector Environmental Assessment – National Drainage Program*, WAPDA-World Bank, 1993

World Bank, Rajasthan *Water Resources Sector Restructuring Project, Project Concept Document*, South Asia Regional Office, Rural Development Sector Unit, December 1999

World Bank, *Environmental Assessment Sourcebook, Update No 15: Regional Environmental Assessment*, Environment Department, June 1996

World Bank, *Environmental Assessment Sourcebook, Update No.17, Analysis of Alternatives in Environmental Assessment*, Environment Department, December 1996

World Bank, *Fourth On-Farm Water Management Project: Project Appraisal Document*, Rural Development Unit, South Asia Region, May 1999

World Bank, *Third On-farm Water Management Project: Staff Appraisal Report*, May 1991

World Bank, Pakistan *Private Sector Groundwater Development Project: Mid-term Review*, December 1999

World Bank, Pakistan Private Sector Groundwater Development Project: Mid-term Review – Aide Memoire, Report No. CR.2901-PAK, December 1999

World Bank, Pakistan (Punjab) Private Sector Groundwater Development Project: Staff Appraisal Report, South Asia Region, June 1996

World Bank, Pakistan Punjab Canal Command Project: Project Concept Document, South Asia Regional Office – Rural Development sector Unit, May 1999

World Bank, *Staff Appraisal Report: Pakistan National Drainage Program*, Rural Development Sector Management Unit, South Asia Region, September 1997

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