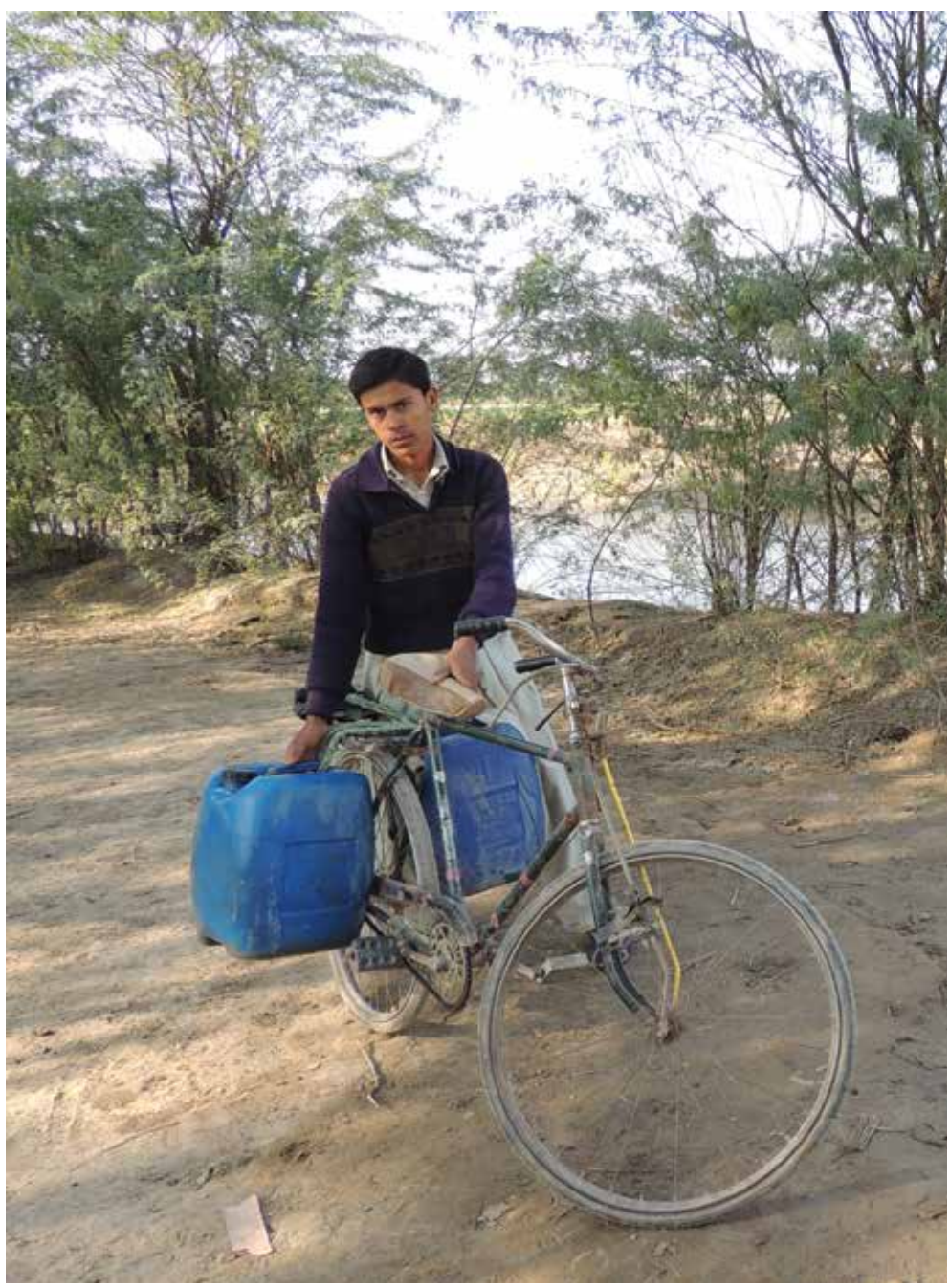
Rudh Kohi System in Pakistan – Achievements, Prospects and Policy Issues – DI Khan Experience

Synthesis notes from Dera Ismail Khan Workshop
23-24 April 2013



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About Water for Livelihoods Project

Acronyms

AC	Assistant Commissioner
ADB	Asian Development Bank
ADP	Annual Development Plan
AWS	Automatic Weather Station
AZRI	Arid Zone Research Institute
CBA	Cost Benefit Analysis
CBO	Community Based Organization
CDF	Community Development Fund
CEO	Chief Executive Officer
CHF	Swiss Franc
CPIs	Community Physical Infrastructures
DC	Deputy Commissioner
DFID	Department for International Development
DG KHAN	Dera Ghazi Khan
DI KHAN	Dera Ismail Khan
DIK	Dera Ismail Khan
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DWSS	Drinking Water Supply Scheme
EAC	Extra Assistant Commissioner
FATA	Federally Administered Tribal Areas
FLDP	FATA Livelihoods Development Programme
FPWS	Flood Protection Wall Scheme
FR DI KHAN	Frontier Region Dera Ismail Khan
FR	Frontier Region
FSC	Farm Services Centre
GEF	Global Environmental Fund
GIZ	The German Society for International Cooperation
GoKP	Government of Khyber Pakhtunkhwa
GoPak	Government of Pakistan
GoP	Government of Pakistan
HID	Human and Institutional Development
IC	Intercooperation
ICS	Irrigation Channel Scheme
IFAD	International Fund for Agriculture Development
IHE	Institute for Water Education – UNESCO
IUCN	International Union for Conservation of Nature
KfW	German Development Bank
K&R	Kulyat & Riwajat
KM	Knowledge Management
KP	Khyber Pakhtunkhwa
LACI-P	Livelihood and Community Infrastructure Project
LPH	The Livelihoods Programme Hindukush
NCS	National Conservation Strategy
NGO	Non Government Organization
NWFP	North West Frontier Province
PARC	Pakistan Agriculture Research Council

PCRWR	Pakistan Council of Research in Water Resources
PPC	Provincial Project Coordinator
RED	Reducing Emission from Deforestation in Development Countries
REDD	Reducing Emission from Deforestation and Forest Degradation in Development Countries
R+K	Rudh Kohi
RKMF	Rudh Kohi Management Fund
SLMP	Sustainable Land Management Project
SPO	Strengthening Participatory Organization
TDS	Total Dissolved Solids
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VDO	Veer Development Organization
WHO	World Health Organization
W4L	Water for Livelihoods Project
WUA	Water User Association
WUMP	Water Use Management Plan
WWDR	World Water Development Report

1 Rudh Kohi System within the National Context

Pakistan has diverse natural resources which provide a variety of valuable products and services to support livelihoods of the rural poor. The total area of Pakistan is 88.2 million hectares, out of which 4.57 million hectares (5.2%) area is covered by the forests. Some 46.7 million hectares (53%) are covered by the pastures and rangelands[1] . Approximately 20 million hectares are cultivated agricultural lands (22.6%) of which 4.0 million hectares are rainfed. The remaining area is irrigated.

Approximately 75% of the country falls in arid and semi arid zone with an annual average rainfall below 250 mm[2]. Spate[3] irrigated areas form a substantial proportion of drylands in Pakistan with roughly an area of 1.4 million ha (9% of the total irrigated area)[4]. About 3 million families depend on this resource. Despite the size and its importance in poverty alleviation, the spate area is nearly invisible in programmes and policies of government and civil society. It covers the entire or major portions of the cultivable land in the districts of DI Khan, Tank, Lakki Marwat, Bannu, Karak, Kohat (KP), DG Khan, Rajanpur, Mianwali (Punjab), Kacchi, Sibi, Jhal Magsi, Qila Saifullah, Loralai, Musakhel, Barkhan, Lasbela (Balochistan), Dadu, Larkana, Jamshoro, and Thatta (Sindh). Rudh Kohi system is termed differently in different areas (Rudh Kohi in KP and Punjab, Sailaba in Balochistan and Nai in Sindh).

Khyber Pakhtunkhwa has 15% of the total land area under agriculture, of which only 23% is irrigated and the rest is rainfed or under some sort of spate irrigation system. Lack of access to sufficient water for drinking and irrigation is a key driver of poverty in water scarce areas such as DI Khan. Most of the people live in a state of uncertainty with regard to water. People's vulnerability is attached with either too much water to manage or too less water to grow food. Droughts are common in spate areas. Such events can cause hardship and even temporary migration. These people face risks every day and need effective coping strategies due to high vulnerabilities. In the absence of reliable drinking water supply, the ordeal of women and children increases.

Swiss Agency for Development and Cooperation (SDC) has funded various initiatives in Rudh Kohi area of DI Khan since 2000 after revising Country Programme (1999) to extend a stronger development support to poverty pockets in KP (then NWFP). The first initiative was the Project for Horticulture Promotion (PHP) which was basically up-scaled from a Malakand based project on fruits and vegetables. A more comprehensive support was however defined after a detailed poverty assessment and farming system study in the district – both concluding that the lack of systematic management / access to water is the main driver of poverty and force behind defining a farming system in the Rudh Kohi area.

In this paper, we describe the main features of Rudh Kohi system in DI Khan and also summarize key findings of some of the major studies for readers' benefit.

[1]National Conservation Strategy of Pakistan – IUCN
[2]Environmental Profile of Pakistan 1998
[3]Spate irrigation is an ancient system of water management unique to semi-arid environments, found in the Middle East, North Africa, West Asia, East Africa and parts of Latin America. In this system fields are irrigated through storing water from seasonal floods of rivers, streams, ponds and lakes. The essential element of spate is flooding the ground either using natural flood from rains in an upstream macro-catchment or creating a flow to irrigate a larger ground. It is a huge management effort to optimize flow of water. A defining characteristic of spate is uncertainty since the number and quantity of floods vary from one year to another. Water is diverted from normally dry river beds when the river is in spate. The flood water is then diverted to the fields. This may be done by free intakes, by diversion spurs or by bunds built across the river bed. A rough estimate of spate area globally is 2.0-2.5 million hectares (ha). The largest area under spate irrigation is in Pakistan (1,402,000 ha)
[4]The Dry side of the Indus – Exploring Spate Irrigation in Pakistan (2014).

The Rudh Kohi workshop April 2013

This paper is based on our one decade of experience in DI Khan as well as deliberations of multiple stakeholders who participated in the two days' workshop held on 23rd and 24th April 2013 in DI Khan. It is aimed at identifying key issues for future deliberation so that a dialogue for up-scaling successful development initiatives can be generated.

Annex 1 documents the agenda of the workshop.
Annex 2 gives list of Participents.
Annex 3 documents examples of development initiatives in Rudh Kohi areas.

The workshop on Rudh Kohi system was held in district Dera Ismail Khan and it brought together the major stakeholders of Rudh Kohi development in the district including local community as well as participants from Peshawar, Islamabad, Balochistan and neighbouring district of DG Khan.

The workshop aimed at finding a common ground for up-scaling successful practices by various development actors in DI Khan. The workshop was organized with the following objectives:

- Identifying existing good local practices in DI Khan and other Rudh Kohi areas in Pakistan and exchange relevant information on selected practices; and
- Identify common grounds on issues pertaining to Rudh Kohi development in DI Khan (and elsewhere in the country).

The workshop was expected to achieve the following:

- Knowledge sharing on Rudh Kohi from DI Khan – and other Rudh Kohi areas
- A common understanding on key issues faced in Rudh Kohi areas
- Deliberation on dimensions of issues, explore related actors, possible solutions / options and means / synergies
- Identify strategic elements for future planning.

This document is a result of participants' presentations and active discussion during several sessions. We hope that this document serves as a reference for future dialogues for up-scaling development interventions and policy dialogue on Rudh Kohi development.

Rudh Kohi system in DI Khan

DI Khan is the southern-most district of KP with the Suleman Mountains in its west. There are three major Zams[5] in DI Khan namely Draban, Chodwan, Sheikh Haider and two major zams in district Tank namely Tank and Gomal. Annex 4 provides an account of Rudh Kohi areas. In summary, both DI Khan and Tank together have 27% of their total land mass under Rudh Kohi system only in KP.

Rudh Kohi system, also known as a form of Spate irrigation, is based on flood water from hill-torrents diverted through earthen weir and regulated structures for crops cultivation. At times there are sudden surges of high volumes of water from steep hills after rain in the catchment area carrying high sediment loads. Spate irrigation systems have head-works for diversion of flood water into canal network and basin storage for regulation. Spate irrigation systems combine both perennial and seasonal flows. The system functions through managing water and sedimentation according to agreed water rights among farmers along the system.

SPATE IRRIGATION AREAS IN PAKISTAN

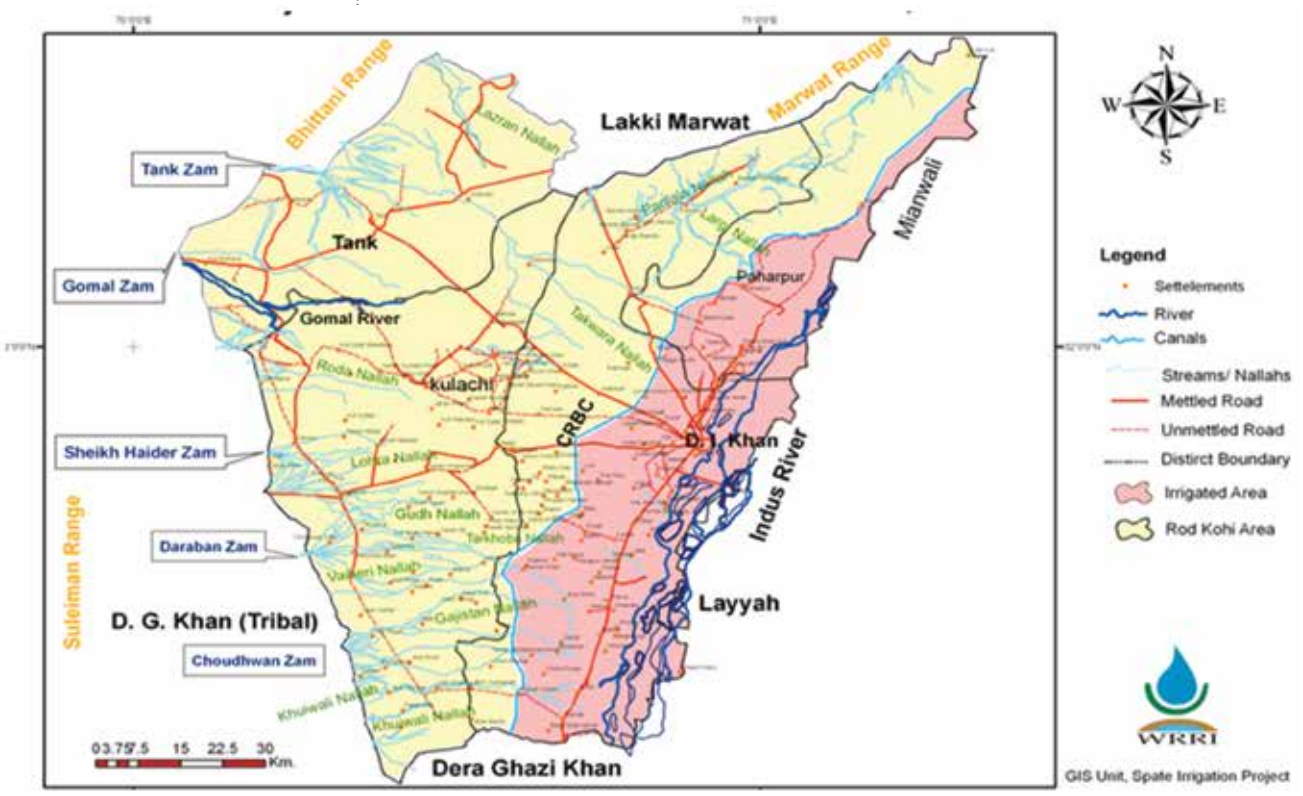
Province / Area	Number of dependent districts	Major torrents or river basins	Potential area (m-ha)	Actual spate cultivated in 1999-00 (m-ha)	Population dependent (Million)	Approximate households	Average land holding (per household)
Federal		-	0.271	-	-		
KP	5	25	0.862	0.109	4.912	708,000	1.234
Sindh	5	-	0.551	0.011	6.994	1,000,000	1.751
Punjab	4	17	0.571	0.048	2.245	319,000	1.789
Balochistan	18	17	4.680	0.185	5.821	841,000	4.756
Pakistan	32	59	6.935	0.343	19.972	2,868,000	9.53

Source: NESPAK 1998; Agriculture Census of Pakistan, Census Organization of Pakistan, 2003

Rudh means beds that carry hill torrents and Koh is a mountain. The system is therefore called Rudh Kohi in DI Khan (hill torrents). These hill torrents emerge after rainfall in the hills and the farmers do their best to intercept these torrents to their fields for irrigation. Rudh Kohi is an unpredictable, and a labour intensive irrigation system mainly based on family labour provided both by women and men. Except for tractor and bulldozer related labour, all agricultural work is done by extended kinship-oriented families. Farmers build an earthen bund (Gandi / Sand) to divert water to irrigate their fields and breach the bund after the irrigation is over so that downstream farmers can irrigate their fields. The farmers construct Gandies[6] in the main Rudh to divert flood water for irrigation through Kas[7]. Farmers construct Wakrah[8] in Kas to divert water into the specific field through field inlet. These fields are embanked all around with earth. After irrigating the field, the farmer closes the inlet, breaches the Wakrah and allows water to the next field. In some cases the level of the field is above the Kas. At times water flows in one direction and does not irrigate the opposite

[5] Source of water; watershed of a hill torrent
[6] Gandies are earthen bunds raised to divert water from the main Rudh
[7] Kas is the secondary channel artificially created due to Gandies. Gated structures have been introduced to regulate water in the Kas
[8] Wakrah is the obstruction in Kas to regulate flow of water into the field.

side. Sometimes the farmers cannot repair the field embankments and at times the flood commences before the farmers' preparation. All these issues are faced by the farmers in their struggle to ensure a successful interception to floods. Usually the farmers repair the field embankment through tractors now-a-days, which is expensive. It is full of risk since it is not certain that the farmers will get the water. Manually the field embankments are raised using bullocks, which is highly labour intensive inducing a lot of exertion on men and women.



Source: GIS Unit, Spate Irrigation Project

Each Zam also has perennial water flow originating from springs but the quantity of perennial flow varies. The quantity is measured in connection with land holding in local units in each Zam. For management of perennial streams at Zams, well established water rights system exist for distribution of water; however, yield of major crops in the area is less than their average potential yield.

Spate irrigated areas face a number of issues and challenges such as:

- Poor flood diversion infrastructure
- Damage to permanent and temporary bunds by floods
- Silting up of conveyance network requiring regular cleaning and then continuous change in river morphology due to sedimentation
- Uncertainty and risks with regard to water availability and therefore agriculture remains below the economic potential of Rudh Kohi areas. Rainfall remains low and erratic
- These areas face extreme weather conditions (45° + and below 0°C). The anticipated rainfall and temperature patterns also pose a lot of challenge in the near future
- Poor water dependent commune face hardships and face existence and livelihoods risks during flood season.

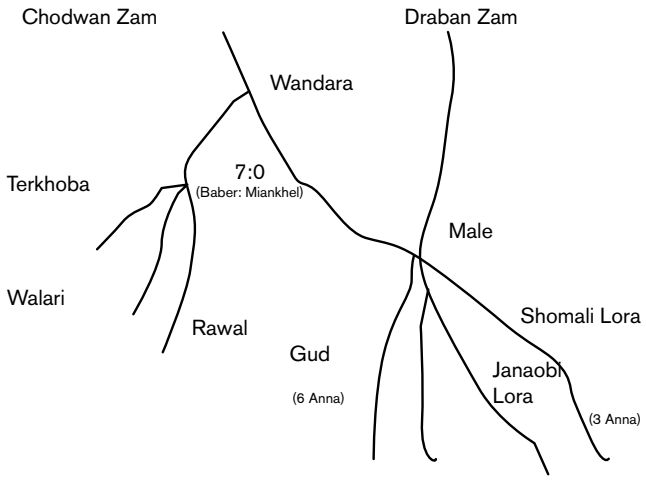
Spate irrigation areas receive little attention from public and private investment owing to the uncertainty factor. There is no or little data available for spate irrigation areas (e.g. hydrology, cropping patterns, climate scenario, etc.) at country, provincial or local level. Also the income generated by these areas during a wet year is hardly depicted in national economic profile. These areas have also received little attention from the academia and government research institutions – and therefore most of the farming is based on centuries old traditional practices.

There are also several misperceptions attached to the spate irrigation system. One being, that the communities are not organized, and most of the farmers fight a solo war with flood water for diverting irrigation water to their fields. There is a lot of solidarity among farmers, particularly during flood season, as they wait for water and get ready with their tools to tame the monster. Spate areas have far more potential than mere subsistence crops that do not even fulfill the annual needs of the farming families. This potential needs to be identified and harnessed.

3. Water Rights in Rudh Kohi

Water rights in larger systems of Suleman Range of Pakistan (DI Khan and DG Khan) have been documented by the British Revenue administration in registers called the Kulyat-e-Rodwar. The settlement in DI Khan Rudh Kohi area started in late 1808 and was completed in 1908. Customary water rights were codified by the colonial District administration in 1905 in the form of Riwajat and Kulyat-e-Abpashi. These registers are still consulted and contain the lists of all the villages responsible for the labour on each bund (Gandi / Sad). A special functionary was responsible for the enforcement of these rules, exhorting farmers to plug gullies and rebuild their bunds (Gandi / Sad) in that era. The Riwajat and Kulyat are followed (locally called Saroba Paina, upstream-downstream water shares) in the streams and in the command areas. One cannot claim that all the farmers are following water rights. Most often downstream farmers are relatively less satisfied and consider themselves on the losing side. Kulyat and Riwajat-e-Abpashi were documented in the era when there was no or little technology available for the construction of Gandies (earthen bunds) and field embankment.

Map 3: Distribution of Rudh Water According to Customary Rights



The lands of Draban zam are irrigated from the Rudh water of Chodwan Zam and Draban Zam. The Chodwan Zam water after getting diverted at Wandara by 7:9 ratio (7 in favour of Babar tribe and 9 in favour of Miankhel) merges with Draban Zam water at 'Male'. This water irrigates the barani lands of Miankhel tribe and its subtribes. The Rudh water is further distributed among tenants according to local Anna, a unit of land with right over water.

In the given map, the flow of Rudhs and distribution of water is described. Zam water is channeled through Rudhs. At 'Male' (merger) waters of Draban and Chodwan Zams merge. Draban Zam farmers have a right of 9 (out of total 16 Anas) in Chodwan Zam as per Kulyat-e-Abpashi. The mixed water of Draban and Chodwan Zam finally enters into Draban Zam lands at Gara Meharban. Local farmers divert this Rudh water to their lands through earthen Bunds on the main Rudh and the practice is regulated by Extra Assistant Commissioner Rudh Kohi Office. The water obstructed through Bunds travels through Pal, Gatta, Kas and finally Wakrah, which irrigate fields.

With the introduction of dozers and tractors for earthen work farmers can construct stronger Gandies. Mechanization has mixed impacts on labour relations. It relieved people from hard labour and created a critical link between increase in violation of water rights and mechanization of irrigation practices. Earlier, it was very difficult to retain water at the upstream and the Rudh water used to irrigate farms even at the tail end. With the introduction of bulldozers, this scenario has changed and the big farmers established power of control over water through construction of strong bunds on main Rudh. Fair distribution of water is the responsibility of the Government, which needs to be reinforced here by introducing changes in Kulyat and Riwajat.

The role of traditional Patti Dari system / Water User Association is to supervise / monitor the water distribution. Their role should be proactive to devise a plan before the flood season rather to act on the basis of the event. The ownership of the land for irrigation with designated Gandies has also changed with land fragmentation. Similarly sanctions for raising more Gandies at certain points in the Rudh for diverting the flood water are given by the Rudh Kohi department which is adding to the inequitable water distribution. Proper and updated dispute resolution mechanism is needed since the fines for violating water rules are nominal and the influentials exploit this for much larger benefits. Some lands do not have the water right. This is mainly due to several reasons e.g. land is located far away from the Gandi, land height is above the Gandi location or in some cases there is natural physical barrier. The lands behind the permanent bund also do not have the right to water.

3.1 Do Kulyat and Riwajat fulfill the need of the present day?

Intercooperation's understanding of water governance is based on over a decade long experience in district DI Khan (since 2001). The projects have introduced two types of interventions: infrastructural measures in a participatory manner in Draban, Chodwan and Sheikh Haider Zams, as well as institutional interventions encompassing service delivery, technical support and governance aspects at the level of community and duty bearer organizations.

The principle of Saroba – Paina is accepted in all the settlements since 1876. The upper riparian have the right to block the bed of the torrent by constructing a Gandi (temporary earthen dam) till the irrigation of their lands. The Gandi must be cut in time to allow the water to irrigate lands below. Every Gandi / Sad has been defined with designated land for irrigation called Raqba Muta'liqa. If the "Raqba Muta'liqa" is not irrigated and the water has started going waste to the un-entitled lands, the Gandi must be breached. The water rights are developed keeping the flow and the layout of the ground in view and the irrigation experience of the past. Mutual consultation however remains the corner stone

of all. A special functionary is responsible for the enforcement of these rules; especially farmers are constructing Gandies and rebuild their bunds.

"Patti Dari" system is a local King-pin of systems, which governed the above details as well as collected resources for various activities. Patti Dars were the nominated persons appointed by community to represent them. They ensured the provision of labour and bullocks for the construction of Gandies and other structures. They ensured attendance of labour and maintained records. They also supervised Kamara (earth moving) work on Gandies and reported the progress to Tehsildar of irrigation and took care of provision of food during construction work. In this entire work, the farmers in the community were obliged to provide all the cooperation and services, otherwise Patti Dars were empowered to fine them. In this way, Patti Dari system served as a social institution in the Rudh Kohi area at Zam level until 1905.

Over the years, these systems have weakened or eroded. Farmers still collect Kamara to construct Gandies however the Patti Dari system does not function in a well defined manner. At the moment, Rudh Kohi Department is working under the supervision of Collector in DI Khan. It consists of Extra Assistant Commissioner Rudh Kohi, a Tehsildar, Naib Tehsildar, Qanungo, Patwari and Darogha. The staff is responsible for operation and maintenance of all Zams and Rudhs in DI Khan Division (DI Khan and Tank districts). Farmers suggest that water distribution is no more equitable and therefore several farmers have been pushed into a cycle of poverty due to lack of access to water.

- More and more violation of Kulyat and Riwajat-e-Abpashi by the Influential (by not cutting their Gandies in time) results in siltation of the main channels. Farmers feel that such interests also interfere in the working of Rudh Kohi department and therefore the department is often crippled to perform its duty properly
- Regular de-siltation of water channels has been abandoned by the communities as well as the government
- Increasing the number of Gandies indiscriminately on main Rudhs (channels)
- Lack of monitoring of implementation of Kulyat and Riwajat-e-Abpashi
- Water User Associations or other forms of social organizations eroded or became dysfunctional
- Coordination within the concerned departments and between departments and communities became an issue with the passage of time.

The question however is, since the Kulyat and Riwajat have in anycase lost their effectiveness, do they serve the need of the day? The farmers are of the view that these documents need serious revision. The measures provided in these documents are quite effective technically. However, the rules have several inroads for the individual influential to interfere and create their own interpretation. Some of the examples for possible changes are given in the following:

a. Gandies should be located at suitable distances and points – often this is not easy due to land topography.
b. There is a need to reduce number of Gandies and merge Gandies that could irrigate more land from single point. Gandies irrigating more land should be allocated more funds for strengthening than those that are smaller in their coverage.

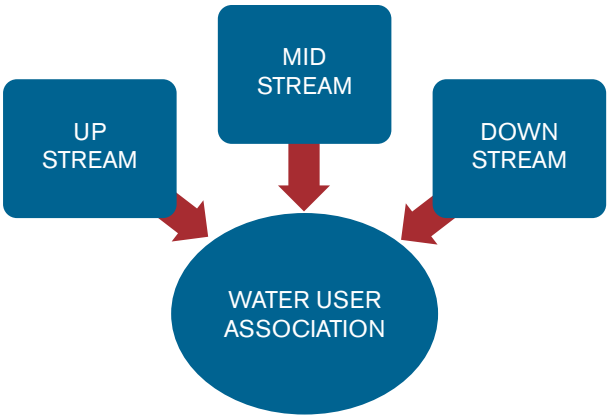


Figure 1: Water User Associations at Zam level

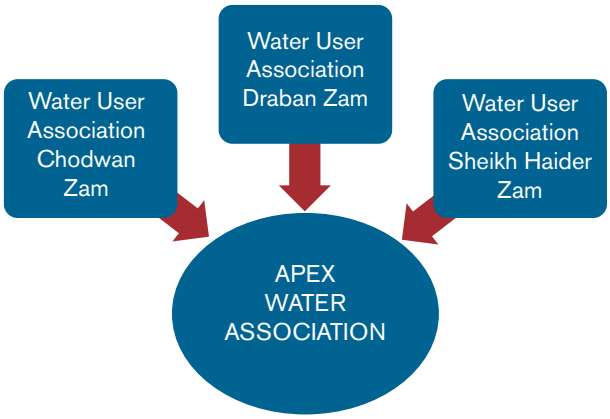


Figure 2: Apex Water User Associations at RK System Level

c. Gandies should be technically designed by developing a workable structure and constructed to reduce the Kamara / siltation in the Rudh.
d. One window operation / single department for implementation / operation of Rudh Kohi system (Rudh Kohi Development Authority).
e. Some measures must be introduced to reduce permanent escape of water from the system during flood season.
f. All the additional Gandies established outside the land settlement must be removed from Kulyat and Riwajat.

On the institutional side,

a. Organize communities into Water User Associations (WUA that are formally recognized by the department.
b. Role of WUA be defined through section 10 of minor canal act 1971 by the DC / collector Rudh Kohi.
c. Rationalization of staff and developmental fund where needed.
d. Proper periodic documentation (preparation for flood after each season) and report to Rudh Kohi collector.
e. The implementation of penal clauses of Minor Canal Act 1971rests with the collector, However after the devolution process and separation of judiciary from administration, the delegation of these powers are not clear.
f. Operation of Rudh Kohi department demands having a base camp in command areas for ensuring an easy access to and by the community.
g. The department needs to have TORs for each staff member, especially ones nominated before the flood season. Such staff should not be transferred during the floods.

3.2 Roles of Water User Association

Water User Associations are organized at stream and Zam Level. This scale is manageable since the members know each other personally, it is easier for members to meet and a Zam may have peculiar issues that are not common to other Zams. The main role of WUAs is to ensure that the benefit reaches maximum beneficiaries (and not just few recipients) and to raise collective voice against the influential for not respecting the Kulyat and Riwajat. The initial step in that direction is to regularly facilitate the department in conducting periodic assessment of Rudh Kohi system for land cultivation and in collection of revenue. When problems are encountered in equitable water distribution, WUAs are to approach authorities to address the main cause of the problem. Active engagement and empowerment of Water user Associations give way to:

- Intensive involvement of farmers as they are knowledgeable, and they are the ones who own / sustain the system
- They will mobilize fund raising and manage funds for earth moving to rehabilitate and maintain the Gandies
- They will monitor upstream and downstream benefit sharing and equity in water distribution
- They are also expected to play their utmost role in mediating conflicts between villages and communities around water.

What is needed to strengthen the Water User Associations?

Legalize the status of Water User Associations (develop by-laws etc.) This is to give legitimacy to these organizations so that the roles they play in their Zam are not objected by the influential.

a. Raise awareness of the farmers on legal understanding of their water rights as well as obligations.
b. Proper procedure of representative body through democratic process
c. Bank account for saving and fund raising procedure.
d. Proper monitoring mechanism (internal and external) and conflict / dispute resolution mechanism.
e. Build capacity of WUAs through trainings in organizational management, record keeping and account operation etc.
g. Links with Farm Services Centre (FSC) if existing, for other related services.

4 Poverty situation in DI Khan

A comprehensive poverty assessment study was conducted in Rudh Kohi area of DI Khan in 2000 by Intercooperation. The study determined that there are various socio-political and ecological factors determining poverty situation of a particular group in the area. These factors include land ownership, size of land, physical location of land in relation to water source, control over water source, resource base of the family, ethnic and religious origin, capacity of a family to repay loans and occupation, and connections of a family with local administration and police. Poverty is directly linked with the availability of water in Rudh Kohi area. Natural causes of poverty include low and erratic rainfall, erosion and flash floods which take away the limited assets of the already poor communities. The mechanism of production and reproduction of poverty includes tenure arrangement of share cropping, the access to markets, or loans needed for production. Peasant families make up the bulk of what is known as the 'rural poor' in the three Zams. Labour migration, often strong and sturdy men in a household, is seasonal and triggered by non-availability of water for irrigation purposes.

In Rudh Kohi area, poverty is essentially linked to the water politics exercised by the local influential. Major cause of the disputes in the Rudh Kohi area is water rights. Legal provisions are often limited and the main mediation services are extended by the Extra Assistant Commissioner (EAC) Rudh Kohi based in Revenue Department. Tenants also take their water issues for resolution to social institutions such as Hujra[9], Chowk[10] and Salis[11]. The power relations surrounding production are essentially between the farming households – (the peasant) – and the landowners, merchants, or moneylenders. It is a typical quasi-feudal and patriarchal society with power vested in men, from a pre-modern

[9] Hujra: A drawing room where guests are entertained in Pashtun areas of Pakistan.
[10] Chowk: the junction of two roads
[11] Salis: 3rd party

sector (the Zamindar[12], peer or tribal chief) and a modern sector (the civil bureaucracy, local administration, the court, military and police). Since Rudh Kohi system of irrigation is labour-intensive, exchange marriages take place within the biradary (kinship) at rather early ages. Women are expected to produce many children during their child bearing ages, putting a lot of burden on health of women and children but also on the well-being of the entire family trapped in poverty.

4.1 Land Tenure Arrangements and Indebtedness Phenomenon

After two land reforms (1962, 1973), almost all the farmers have land holding (minimum 12 acre). The tenancy is Qabza[13] tenancy (by occupancy) while some land owners give their tenancy on specific time renewal basis. In tenancy, 3 shares go to the tenant and 2 to the owner. The tenant gets a larger share because he is responsible for the field management like repair, seed, etc. In case of trees the tenants have no share (except for Qabza tenancy). In Kharif crop, the grain share remains the same while in straw / fodder 7 shares go to tenant and 1 share goes to owner. In case of perennial water, 1 share goes to the tenant and 3 to the owner. Owners provide for all the expenses. The tenant is not responsible for harvesting.

Under this arrangement all farm-related expenses (mainly seed and ploughing) are the responsibility of the tenant besides providing family labour for the collective and individual irrigation work. Displacing these tenants is not easy for the landowners as they do major investment in land development and for the reasons of legal complications and social pressure, which is very strong and invisibly exists in the area. Study team observed that this type of land tenure was most common in the Draban Zam. In the other type of tenancy, landowner has the Qabza of land and tenant works on the farm on half sharecropping basis. The owner provides all the agriculture inputs. Such tenants are only found to be working in Gara Isa Khan, the center of political power in Rudh Kohi. Under both tenure arrangements the owner pays agriculture tax and he also chooses the crop. Apparently tenant families without Qabza are more prosperous than tenants with the occupancy right

Table 5: Tenure Arrangements for Natural Resources in Rudh Kohi Area

Natural Resource	Tenant: Owner (occupancy right with the tenant)*	Tenant: Owner (occupancy right with the owner)*
Crops	3:2 Tenant: Land development, Kamara earthwork, seed, ploughing and harvesting Owner: Agriculture tax and choice of crop	2:2 Tenant: Ploughing and harvesting Owner: Land development, water for irrigation, seed, agriculture tax and choice of crop
Fodder	7:1	3:1
Trees (only Qabza tenants	3:2	2:2
Rangelands	Grazing rights are unrestricted in Rudh Kohi	

(* Occupational right of a tenant is proclaimed under Tenancy Act 1950 - Ejectment)

[12] Zamindar: A rich and influential local landlord
[13] Qabza: are those tanents that can not be removed from the land without negotiations

for the simple reason that they work under the direct influence of the political elite and water is available to them in abundance for the irrigation purposes and for which major earthwork is not required.

There is a high level of indebtedness in the Rudh Kohi area, at times also in the shape of grains from the owners to be recovered from the next harvest. Farmers have limited access to agricultural loans because the lending institutions demand financial and land guarantees, which they don't have.

4.2 Farming system in Rudh Kohi

According to Intercooperation's study on farming system (1999), Rudh Kohi agriculture is subsistence for tenants and majority of self-operated owners, to ensure food security for their families. Majority of the households in DI Khan live below subsistence level due to low agricultural productivity. Despite large land holdings, there is an overall paucity of farm area in comparison to farming households. There is an institutional vacuum at the village level with no traditional body that manages farmers' issues. The Rudh Kohi system of irrigation requires a lot of earth work and home-work to prepare oneself and one's field for next year's flood. As this costs money, costs lobour and time and yet luck factor is the most domineering – a flood bigger than a farmer's preparations can frustrate all plans of a Rudh Kohi farmer. Water use efficiency is essential by making the system work per its potential with limited water. Soils in Daman area (land between foothills and CRBC) vary from sandy near mountains to silty clay in the south while silty loam to clayey loam in the middle. Soil erosion, sedimentation and silt build up in Rudh Kohi system, are the major soil related problems. Clayey soils of Rudh Kohi have higher moisture holding capacity. Water scarcity and poor water management practices are among the major issues in the area. Livestock production is the backup support system of poor farmers. Small herds of sheep and goats are maintained by the tenant families to provide liquid cash in case of emergencies. These small animals are scavenger in nature and even survive on dry fodder during fodder deficit months. Each extended family of 3-4 households keeps more than 20 small ruminants and all the households have free grazing rights. Tenant farmers are often reluctant to make long term investment. The crops consist of a local mixture of low yielding varieties. There is a need to introduce more productive oriented agriculture, through location-specific adaptive research.

4.3 Do current practices Confirm to varying availability of water resources?

Captain Croswaite's[14] statement given in1902 still holds true that in Rudh Kohi agriculture water is everything and without water land is of no worth. Farming in Rudh Kohi area is totally dependent on availability of water. Therefore this question is to be assessed in view of climate variability and seasonal shifts in water flows. Torrential rains cause partial damage to the crops and also cause runoffs that are hard to manage by farmers with their current practices. There is limited data on hydrology of Rudh Kohi waters and therefore one cannot say with confidence if there is more or less water that flows down into the Rudhs. This assessment can anyway partially help since Rudhs are not well maintained, many are silted and therefore efficiency of water flows for crops use is largely affected around inland areas rather than the source. These

[14]Captain Crosthwaite was the Settlement Officer of DI Khan District (presently the revenue districts of DI Khan and Tank)

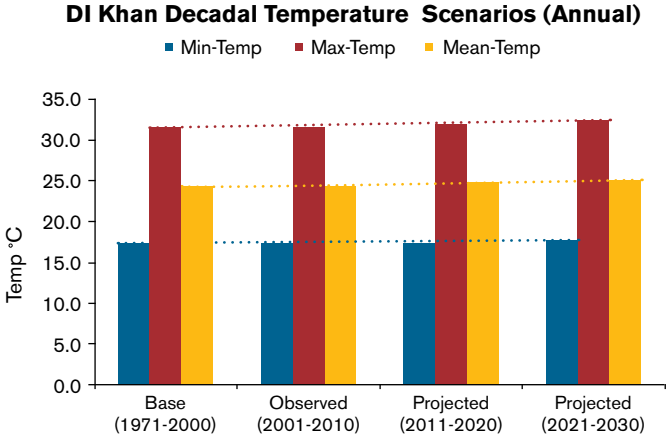
circumstances also limit the choice of crops (Wheat, Gram and oil seeds in Rabi and millet, sorghum and melon in Kharif) to capture often limited rain and moisture.

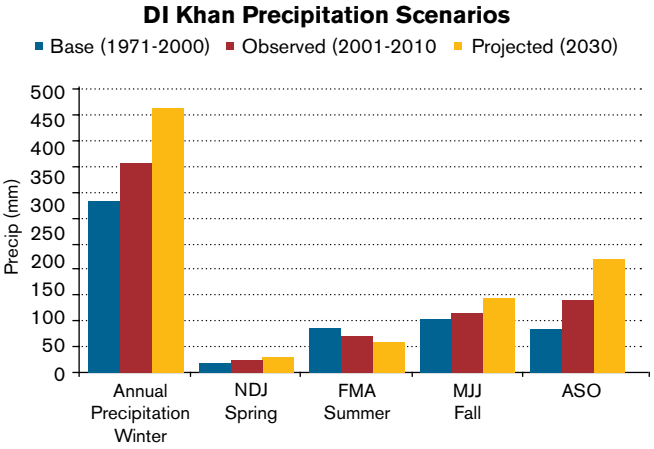
There is a widely known seasonal calendar of cultural and cropping practices which is mainly governed by availability of water. This calendar however needs a review since a few timelines do not hold anymore (Annex 5).

There are also certain seasonal shifts owing to the day / night average temperatures (see next chapter).This requires varieties that can cope with changing temperature (and rainfall) regimes and therefore is beyond farmers' ability to deal with the issue. Research has a certain role in producing short duration varieties that can demonstrate resistance to water stress.

5 Another dimension– Rudh Kohi areas and climate change

DI Khan is highly prone to disasters such as droughts and flash floods. During the 2010 floods, DI Khan was the second most severely hit district of KP after Swat. Apart from this, there are debates about gradual climatic changes building the case for a long term and suitable adaptation strategy in agriculture. A study conducted by Intercooperation and Pakistan Meteorological Department gathers that rainfalls in the upstream as well as within the catchment will have an erratic pattern. There is a slight increase in the average temperatures during the day time. The seasonal patterns for temperature change indicate that winter will become cooler falling by about 0.3 °C on average per decade. Springs will become hotter by about 0.7 °C per decade that may also imply early summers. The study shows that temperature increase will be higher in magnitude in higher altitude areas. This is directly influencing hydro-meteorological balance of the Rudh Kohi area and causing stress for the farmers. Farmers' perception also confirms that rainfall has gradually decreased over the last 30-40 years and the floods have become less regular and more unpredictable. The villagers' knowledge of early signs of opportunities and disasters has also been documented in DI Khan. The villagers, for example, report that a cold breeze blows from the north-east forming clouds named "Bakarwal" which brings rain in monsoon. When cold breeze blows from north-west and forms a cloud called "Chunda", rains arrive in summer. Sometimes clouds from south-east also bring rain. In winter, the clouds from east and west bring rain but the intensity and frequency has decreased overtime. At sunset and dawn, a coloured sky (Palewij) and warm winds from the south indicates a dry year. Dust twisters on the western side in summer also suggest less rainfall, and so on. This knowledge is precious and when combined with scientific knowledge, it may become easier to predict risks and opportunities and plan accordingly.





According to this graph and accompanying data, winter will become cooler falling by about 0.3 °C on an average per decade. Springs will become hotter by about 0.7 °C per decade that may also imply early summers. The summer and fall temperature trend show insignificant changes with only a slight increase in maximum temperatures (day temperature) but a declining trend for minimum temperatures (night temperature).

The annual rainfalls in DI Khan district have increased in the last decade (2001-2010) when compared to the 30 year normal base (1971-2000). These are further expected to significantly increase by 2030. The spring season rainfall is showing a slightly decreasing trend. For all the other seasons rainfalls are expected to significantly increase, especially in the fall season that may be pointing towards the fact that monsoon season is prolonging. The monsoon rains also occur during the month of September.

Some of the Implications

Winters are getting cooler but the rising spring temperatures are showing a trend of an early summer.

- This trend will increase vegetative growth of the winter crops but the early maturity due to warmer temperatures in spring will affect the grain formation of wheat crop with the resulting decline in yields
- Similar declines in wheat yields have already been reported in the semi-arid areas in the south of the country
- These areas have already crossed the thermal limits of the existing wheat varieties and the growing season lengths have reduced from optimal 160 days to about 140-135 days
- No such short duration varieties are currently available for the wheat crop in the country
- Given that rainfall is showing an increasing trend in DI Khan district that may therefore benefit rainfed areas, necessary measures would also be needed to introduce water conservation practices e.g. mulching, rain water harvesting and water storage techniques
- Adaptation measures may also look at the possibility of re-introducing / improving seeds of traditional crops like pulses, millet and gram that are heat and water resistant under the changing climate

- There are associated hazards under the climate change scenarios e.g. early floods
- Increasing trends in rainfall accompanied with high intensity rains may further increase the possibility of flash floods in DI Khan district.

Genetic research has to focus on developing short duration varieties for the plain areas including DI Khan. Operational research requires focus on testing and developing cultural practices to mitigate the warming effects on crop e.g. for:

- Adjusting sowing windows – maybe an early planting of the existing varieties
- Minimum tillage technologies to reduce loss of soil moisture
- Adjusting number of irrigations etc.

In summary, DI Khan is already known as a fragile district as far as its exposure to risks is concerned (floods and droughts). Changing temperature and rainfall scenario further complicate the situation and therefore need urgent attention since cost of ignoring these trends will be very high and will be largely borne by the poor farmers of Rudh Kohi region.

6

The art of engineering – Infrastructure efforts in flood basins like DI Khan

DI Khan is not an easy area for engineers since the soil structure and act of water both are quite tricky to deal with. There is a need for special set of skills combined with good knowledge of Rudh Kohi area and good communication with the local inhabitants. There are several cases of failure to learn from. One of such cases was tabled in the Rudh Kohi workshop by Water for Livelihoods project and several other examples were quoted to draw learning from these failures.

The event:

A Gabion wall construction collapsed as a result of winter flood in Gandi Ashique village of Draban Zam. A senior hydrologist was sent for the analysis. According to the findings, the Gabion Wall design was defective on the basis of soil conditions in the area. The Bund Structure collapsed due to piping phenomenon through the sub-soil / base of gabion structure. Water therefore acted as a force to pipe away soil under the structure and hence the load of the structure went down. The escape culvert capacity was less than the expected flood discharge, there was no cut-off wall provision to increase seepage path for decreasing exit gradient and reduction from danger of piping after soil boiling downstream. Also provision of restricted resources in designing the structure lead to compromised design, which did not work.

How could we prevent this loss / enhance age of the structure?

- Stone Masonry Wall design should be according to the soil conditions in the area. The face of the wall should be protected by bitumen or polythene sheets to minimize seepage perfect structure
- The abutment could be protected with Rip Rap or Stone Pitching in addition to polythene sheet
- Cut-off wall provided to increase seepage path for decreasing exit gradient and reduction from danger of water piping
- Culvert capacity should be increased, so that there should be no danger from water overtopping the Bund

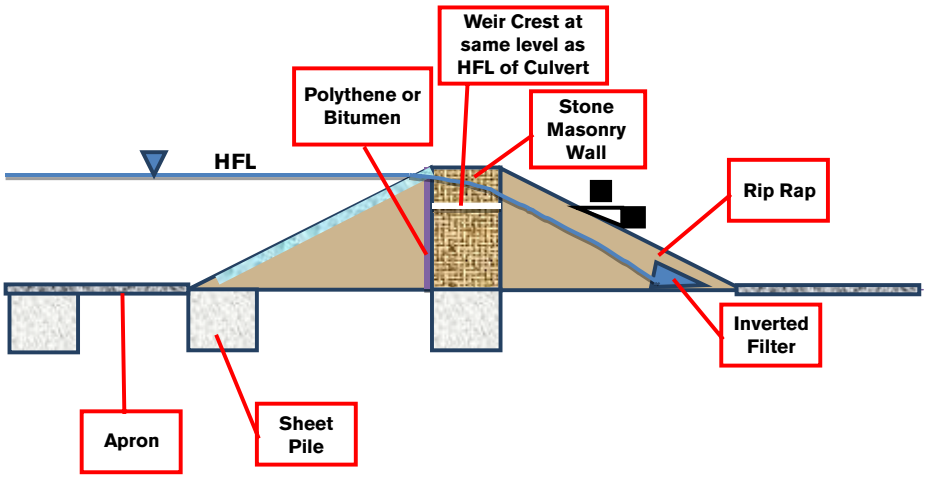


Figure 3: Possible Cross-Section of Bund at Gabion Wall Location

A conclusion from this analysis is that in the context like Rudh Kohi, it is very important for the engineers to learn and conceive innovative techniques to erect better structures that withstand force of water. This is an area where clayey soil together with water acts as an enemy of the structure and therefore certain means are necessary to prevent losses by understanding soil structure and pre-empting extreme action of water. It is worthwhile therefore to invest time in qualified engineers to give them skills to deal with such special situations to minimize failures. These skills may be built by engineers who have gained a lot of experience working in these situations.

7

Drinking water in Rudh Kohi area: The Access-Quality debate

Drinking water by definition is water that is intended to be ingested by human beings. Water is polluted when it contains materials that make it unsuitable for a given use. Although huge quantity of water (about three fourth) exists in the world but the reservoirs of usable and drinking water are rather limited. The most painful reality is that water is itself polluted by humans, which is a big threat not only to a mankind but also to the whole biological world.

Major sources of water pollution include municipal sewage, industrial wastes, contamination from agriculture and landfills. Adverse human health effects from water can be divided into four main categories:

1. Water-borne Diseases: Water-borne diseases caused by the water that has been contaminated by humans, animals, or chemical wastes. Water-borne diseases like Cholera, Typhoid, Dysentery, Polio, Hepatitis A and E, Diarrhoea, Anemia, are the most fatal diseases among many others.
2. Water-based diseases: Those caused by aquatic organisms that spend part of their life cycle in the water and another part as parasite of animals. Water-based diseases are caused by a variety of tapeworms, roundworms and tissue nematodes that infect humans.

Although these diseases are not usually fatal, but they prevent people from living normal lives and impair their ability to work.

3. Water-related vector diseases: Those transmitted by vectors, such as mosquitoes and some flies that breed or live in or near water. Malaria, yellow fever, dengue fever, sleeping sickness, are some of the common diseases.
4. Water-scarce diseases: Diseases found in conditions where water is scarce and sanitation is poor, such as trachoma, and tuberculosis etc.

Water- related diseases are a growing tragedy, killing more than 5 million people each year, 10 times the number of people killed in wars (WWDR, 2003).

7.1 Drinking water quality facts

According to the WHO more than one billion people in low and middle income countries lack access to safe drinking water. This number represents more than 20% of the world's population. It is estimated that 2.4 billion people suffer from water related diseases. National Conservation Strategy (NCS) states that almost 40% of deaths are related to water borne diseases.

- Some 60% of all infant mortality worldwide is linked with infectious and parasitic diseases, most of them water-related (WWDR, 2003)
- About 5,483 people die daily of water-caused diarrhea – 90% of these are children under five
- The World Health Organization estimates that 80% of all infections are traceable to poor water conditions.

UNESCO ranks Pakistan's water quality at 80th out of 122 nations. A 2009 report by Woodrow Wilson International Center for Scholars position, Asia Programme, notes around 40 to 55 million Pakistanis not having access to safe drinking water. The Pakistan Council of Research in Water Resources (PCRWR) assesses that 40% of all reported illnesses are water-related. This is the same as global average. Water-borne infections and parasitic diseases account for 60% of infant deaths in our country. Media reports suggest

that nationwide, 630 children die each day from the waterborne illness of diarrhoea. Most of the diseases in Pakistan are water-borne.

The main sources of drinking water in Pakistan include hand pumps and motor pumps which together provide 61% of households with safe drinking water (Hussein, 2005). Rural areas of the country have little access to drinking water; though, the situation is also not very encouraging in the urban areas. However, one must not forget that the fragile balance between rural and urban areas which ensures stability and harmony in the country; while also checks mass population movements towards urban areas.

In KP, the official statistics claim that 63-64% people have access to safe drinking water. The remaining population is forced to rely on unsafe drinking water sources (Hussein, 2005). About 46% of the rural population in KP depends on dug wells or draw water from a river, canal or stream.

7.2 Drinking water in dry areas – a subject for wellbeing

In dry areas such as Rudh Kohi, DI Khan and other districts, the largest source of drinking water is rain water collected in earthen ponds. Ground water is either virtually non-existent or is highly brackish. The “safety” and “quality” of pond water is way below the international standards. Conventional water treatment is very expensive and unaffordable for the communities in these areas. Flood water used for irrigation is also stored in ponds for all the domestic purposes including drinking by human and livestock, washing clothes, utensils etc. Flood water brings mud, animal and human faeces and other foreign materials to the storage ponds. Mud transported to the ponds causes dense turbidity. The higher the turbidity, the higher is the risk for the drinkers to develop diseases because contaminants like viruses, bacteria can easily attach themselves with the suspended solids. Only few water supply tanks are available in the areas which are quite insufficient.

Women in these areas are compelled to cover a distance of miles for a few liters of potable water. This issue has shortened the economic growth of communities since most of the family time is spent in search of water or dealing with various illnesses. Wastage of time in collecting drinkable water from remote areas keeps women away from their children and family and keeps them out of the household matters which results in a poor family foundation. Similarly the girls and children who serve their time in bringing drinkable water are away from educational activities which creates illiterate generations - a major hurdle in the way of the economic race.

7.3 Quality issues and way ahead

Drinking water is assessed on its chemical properties, physical quality and biological contamination. Chemical attributes are measured by Total Dissolved Solid (TDS), Total Hardness and hardness with reference to presence of Calcium, Magnesium, alkalinity, presence of Chloride, Sulphate, Nitrate, Nitrite, Total Ammonia, Iron, Zinc, Manganese, Copper and so many other minerals and elements.

Fortunately it has been found out that pond water quality at Rudh Kohi area is chemically safe to drink. This is good news since removal of chemical contamination is an expensive affair. Turbidity and faecal Coliform that cause several diseases are the major contaminants in the pond water. Fortunately Bio-sand filter can easily remove these contaminants to a high extent and can improve physical and biological quality of water.

It is true without any doubt that the quality of water in dry areas, especially in areas like Rudh Kohi is not acceptable by any human standards – yet the first and the foremost issue in these areas is to ensure "access" and then subsequently proceed towards "quality improvement" in a gradual manner. Research in cost effective and locally affordable methods for water treatment is essential. Even when water quality is improved at source, promotion of hygienic handling of water from the source to the consumption point is essential, not only in dry areas but in all rural societies of the country. Ironically, field experiences show that communities in Rudh Kohi areas have become so accustomed to dirty pond water that the provision of cleaner water through filtration or other means did not much appeal to their interest. They still preferred pond water due to the taste familiar to them. Therefore besides working on quality of water, it is also essential to demonstrate to the users the financial gain of investing in water quality and treatment. In this regard, it is essential to recognize women as the primary actors in drinking water management.

8. Summarizing the key issues for the future course and way ahead

Based on participants' inputs, there is considerable scope to improve people's livelihoods in Rudh Kohi areas on many fronts. The issues have been grouped in the following matrix:

Water management strategy and techniques	**Water User Associations**	**Hazard Risks, climate scenario**
Rudh Kohi area has a special feature due to the soil texture and nature of floods. Therefore a simple application of engineering practices may not bring success to the investment. It is not about the money, it is about the right technique in the right place to secure investment from failure. There is a need for multi-partners to agree on a menu of major activities, broadly understand their relevance and effectiveness, and clearly bring out what did not work in the field so that we can avoid overlaps and mistakes. An integrated water master plan for the area can help bring partners and resources closer.	Water management in Rudh Kohi area demands intensive involvement of farmers since they are knowledgeable, and they will sustain the system. Farmers collect and manage funds for earth moving to rehabilitate and maintain the earthen bunds. They also take their problems and feuds to the Rudh Kohi department for ensuring upstream-downstream benefit sharing and equity in water distribution. There is a need to strengthen WUAs so that they are capable of governing just water flows and resolve conflicts. WUAs need to seek recognition for what they do. Their particular function is to ensure access of farmers to water rights and advocate for justice when they are not adequate.	Flash floods originating from Koh-i-Suleman are regular phenomena and the farmers turn these floods into opportunity under the traditional Rudh Kohi system. There is no reliable hydrological data that can help assess the quantum of water received in the catchment. The extreme variability in an exceptional year cannot be managed by traditional irrigation systems and needs greater measures for preparing the area against risks. Unprecedented and erratic rainfalls pose risk to local livelihoods. Protection spurs (bunds, shehr-Panah) are the most used methods to divert water from the villages. Can villagers bear costs of such structures? And how they should be designed.

Water or safe drinking water?	**The water use efficiency**	**Preparing future champions**
Areas like DI Khan suffer water shortage – hence access and quality are both issues. Historically, people excavate shallow ponds where rain water is collected. This water is used by animals as well as humans for drinking and other purposes. Most of these ponds dry up when there is no rain for a longer time. These ponds have become better with plastic lining in the bottom; a few are deeper and even lined. Sand filters have also been introduced but they are short-lived and do not assure complete safety which enhances quality but not safely. How to improve quality and safety of drinking water for humans when there are not many options?	Water use efficiency must be an inevitable criterion for selection of crops. Nowadays it is replaced with the term water productivity measured in the same unit i.e. kg / m^3 of water. Normally, the farming system in Rudh Kohi areas of DI Khan consist of wheat and gram while sorghum, millet, melon and mustard are also common in the farming system. Other minor crops such as Guar, medicinal plants, mushrooms, sesame, forest trees and local vegetables can also be supported, yet there is a little knowledge on this.	Incorporate spate irrigation in the relevant college and university curricula to broaden the limited pool of experts. In case of DI Khan, there is an opportunity in the face of Gomal University where students can be practically oriented to the unique Rudh Kohi system in the district. Agriculture University Peshawar is also a large hub of multi-expertise around water and crops. This university recently volunteered to establish a Centre for Climate Change which provide a knowledge and service hub for adaptation to Climate Change and timely preparedness and adaptation in agriculture.
Good quality and meaningful networking We as development agencies working in Rudh Kohi areas have to speak the same language and follow complimentary approaches for ensuring better impact. This can be done through partnerships and better networking of all those that work in spate irrigation in Pakistan. Such a networking gives birth to compliment institutional strengths through creating synergies on concrete joint ideas.		

Intercooperation as one of the development agencies working in Rudh Kohi area believes that all the agents of change and service providers must speak the same language and follow complimentary approaches for ensuring better impact in Rudh Kohi area. This can be done through partnerships and better networking of all those that work in spate irrigation in the district. We also believe that DI Khan today provides several replicable experiences for other Rudh Kohi areas in Pakistan. A better networking and good quality knowledge management can facilitate this process in the country.

8.1 Quick recap of the discussion and policy agenda

a. Revisiting Kulyat-e-Riwajat Abpashi

1. There is no need to repeal and revise these laws. Some review into these laws, especially penal clauses, can solve the issue. Unfortunately several power brokers have made inroads to break into the system using top down influence to seek illegal approvals. These advances need to be checked and corrected.
2. Strictly see for unauthorized approvals of Gandies sabotaging rights of legal Gandies (in muta'liqa command area). "Ghair bandobasti Gandies" must be canceled (for ghair muta'liqa command area).
3. In future, new Gandies must not be allowed if they are not correctly identified under the law – such permissions must be given after consultation with WUAs.
4. Revise the amounts of penalties – most are outdated and can easily be ignored by perpetrators.
5. If laws are effectively implemented and just actions taken against illegal / non breach of Gandies in time, most issues will be resolved.

6. Rudh Kohi area should be given a well-deserved priority by the government.
7. Risk: In case of new bandobast (land settlement), political interference and influential's role cannot be avoided. There are always strong political interferences, but dealing with those depends on person in authority who deals with the pressure.

b. Water User Associations

1. These are organized at up, mid and down streams and represent all the villages within these command areas.
2. Ensure that these associations are democratically established and are transparent in their procedures / decision making.
3. Recognize these bodies as a support to government to manage the system.
4. Consider RK management funds establishment by interested communities and donors.
5. How to legalize WUA? Which law? What powers? By-laws under Riwajat + Kuliyat or Minor Canal Act be enacted to give legal cover.
6. Risk: WUAs must act in a just manner and must not turn into a toy of influential or play the same role that an influential used to play.
7. EAC Rudh Kohi office is willing to register WUAs, provided that the representation is allowed per area under the management of WUA.
8. The Government insists on coordination with RK revenue department (NGOs, projects, farmers' organizations and government). However their own credibility is often at stake.

c. RK Development Fund

1. One such fund was established by SLMP with 0.9m seed money at mid stream of Sheikh Haider Zam (2011) for Kamara and Shehr Panah.
2. Such fund is managed by a committee of villagers.
3. This committee needs to be institutionally embodied in WUA.
4. Establishment of funds, subject to strong institutional capacity of the WUA, which eventually should be registered.
5. RK management fund is an opportunity: e.g. supplement resources provided by RK department or any other development agency.
6. Replicating RK Fund requires: (1) evaluation on use of this fund after 3 years (2) Review of guidelines (3) Review of auditing procedures.
7. Once WUA's are legalized, the provision of fund becomes legal and hence replicable.

d. A new institution such as Rudh Kohi Development Authority

1. The idea originated in the past, and was studied.
2. It was not only meant to improve water management system but all inclusive and adequately empowered bodies.
3. It was also to look at other livelihood needs of the Rudh Kohi areas.
4. However, the issue got lost due to a struggle between existing institutions mandated to provide services for taking the charge of such authority.
5. Do we have a specialized manpower to serve the authority?
6. Concern: Not to create a new institution without appropriate human resource and right level of mandate.

e. Adaptation to climate change

1. Urgent need to address this, build on experiences in 2010-2013.
2. Therefore a strong case for adaptation in case of agriculture.
3. Adaption: Producing short duration / appropriate water stress resistant varieties suited to projected temperature / rainfall changes.
4. Revisit seasonal calendars with respect to cropping (sowing windows).
5. Climate variability: Risk of flash floods, preparedness is essential.

f. Drinking water

1. Global emphasis is on safe drinking water. In DI Khan high dependence on pond water, highly turbid but little chemical contamination.
2. A few efforts on water filtration – but (1) scale limited (2) filters ensure improved quality, not safety per WHO standards.
3. Currently issue with access to drinking water – long distances, migration during dry spell.
4. Improving water storage (access) of water for domestic consumption is a first priority
5. Gradually dwell on quality and safety issues (Techniques? Cost? Social willingness, scale?, service cost?).
6. For donors' awareness: Promote access first and at the same time explore on quality aspects.

g. Overall / general remarks

1. Nearly 50,000 cusec water is lost every year to the Indus – this resource is a missed opportunity.
2. Rudh Kohi area is a low priority area in terms of right allocation of funds, appointment of good staff and willingness to award new development projects.

8.2 Summary of Recommendations

Recommendations have been grouped into five major domains:

Institutional areas:

1. Form a commission to review K+R and aforementioned issues.
2. Recognize WUAs and RK Fund as a legal body and part of management of the system but ensuring their just way of constitution and working.
3. RK department to be activated – assess impediments faced by this department in effective implementation of laws. Highly politicized department also need improvement in working.
4. Linked with the above, assess the need for Rudh Kohi Development Authority and find measures / options for its establishment.

Adaptation / DRR

1. Immediate attention needed: (1) In agricultural research to adapt to projected climate change (2) Prepare channels to receive unanticipated quantity of water. Who takes the lead to prepare an adaptation strategy?
2. Community based DRR / structural measures to improve preparedness for DRR. Enhance coordination function of DDMA.

Efficiency of the system

1. Main channels be cleaned / widened – both for irrigation and conveyance of excess floods.
2. Establish technical guidelines for structures – DOs and DON'Ts – and orient all the stakeholders.
3. Restock earth moving equipment (bulldozers, front-loaders), essential for construction of earthen diversions and guide bunds, and working out the private sector institutional mechanisms for continued service delivery. The role of Agricultural Engineering department needs further transparency in their operation and service delivery mechanism.

Capacities to improve services

1. Bring the spate irrigation into higher education learning.
2. Document good practices and disseminate knowledge. Training of Farmers, NGOs, Academia and even practicing engineers regarding special challenges of Rudh Kohi areas for security of investments made in this field.

Livelihoods

1. Drinking water: Ensure access first – but work in a parallel phased approach on quality and safety (WHO standards) and awareness, particularly involving women.
2. Crops diversification by introducing and exchanging improved seeds.
3. Ensure implementation of adaptation plans prepared on the basis of local knowledge and climate scenario to secure food production with little water and shorter growth spans.
4. Mainstream DRR in all interventions.

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Other documented and available knowledge material

1. The villagers' knowledge of early signs of opportunities and disasters documented in DI Khan (Intercooperation).
2. A study of temperature and rainfall projection for the future (Pakistan Meteorology department and Intercooperation).
3. Calendar of farmers' activities in Rudh Kohi areas (Veer Development Organization, Strengthening Participatory Organization).
4. Assessment of water availability and evaluation of traditional Rudh Kohi irrigation system in Khan (Intercooperation).
5. Effect of different water depth application on the yield of wheat in Rudh Kohi area of DI Khan (Thesis Agricultural University Peshawar).
6. Development and testing of low cost sand filter for purification of pond water at household level (Thesis Agricultural University Peshawar).

7. Directory of terms in Rudh Kohi (Intercooperation, Veer Development Organization, Strengthening Participatory Organizations).
8. Case studies on specific examples (Intercooperation, SLMP).
9. A detailed map indicating high risk locations in terms of Rudh Kohi floods (Intercooperation, GIS lab Forest Department).
10. Institutional mapping – who is involved in Rudh Kohi DI Khan and with what roles?
11. Village land use planning (SLMP) Sheikh Haider Zam.
12. Livelihood assessment and household typology (Intercooperation).
13. Economics of Rudh Kohi – examples (Intercooperation).
14. Several briefing notes, review papers (Spate Irrigation Networks).
15. Ample background material / literature at http://www.spate-irrigation.org/resource-documents.
16. An introduction to village based Rudh Kohi Management Funds – SLMP.
17. Study on "Action Research on rainfed agriculture in Rudh Kohi, DI Khan" (Intercooperation).
18. Study on "Review of the existing policy and operational framework of Rudh Kohi Irrigation system in DI Khan and scope for its strengthening" (SLMP).

Annex 1

Two Days Workshop

Rudh Kohi Development

23rd and 24th April. National Club DI Khan

Day 1: April 23rd April		
S. No.	**Content**	**Lead**
09:00	Opening Session - Recitation - Welcome note - Workshop Objectives - Round of introduction - Key note speeches (technical, local development perspectives) - Explore further understanding of the workshop? - Opening remarks by Chief Guest	Facilitator
11:15	Tea Break	
11:30	**Presentation 1:** Water management techniques, aspects, practices	Engr. Noman Latif Sadozai
12:00	**Presentation 2:** Water rights and Governance	Munawar Khan Khattak
	Defining groups and tasks	Facilitator
13:00	Lunch	
14:00	**Introduction of key questions to the group**	Facilitator
14:15	**Group work (including Tea) *:** - Technical aspects Rudh Kohi (2) - Governance of Rudh Kohi (2)	Participants
	1: Rudh Kohi management experience elsewhere	Presenter: Mr. Munir Baloch Facilitator: Tawheed Gul
	2: Rudh Kohi structural challenge	Presenter: Khan Mohammad Facilitator: Aamir Mughal
	3: Rudh Kohi management fund	Presenter: S. Irfanullah Facilitator: Nadeem Bukhari
	4: Role of Rudh Kohi department	Presenter: Irfan Masud Facilitator: Munawar Khattak
15:30	Plenary discussion / report from groups	
17:30	Close the day, Tea	

Day 2: 24th April 2013		
09:00	Recap of Day 1	Facilitator
09:30	**Presentation 3:** High risk / fragility in Rudh Kohi	Nadeem Bukhari
09:45	**Presentation 4:** Drinking water access and quality	Usman Qazi / Tawheed Gul
10:00	Defining groups and tasks	Facilitator
11:00	Tea Break	
11:15	**Group work (including Tea) *** - DRR / Adaptation to Climate Change (2) - Drinking water (1)	Participants
	1: Structural measures for DRR + DRM at community level	Presenter: Muhammad Asad Salim Facilitator: Dr. Arjumand Nizami
	2: Agriculture in Rudh Kohi areas	Presenter: Shafqatullah Baloch Facilitator: Munawar Khattak
	3: Efforts for improving quality of drinking water	Presenter: Iqbal Zeb Facilitator: Aamir Mughal
12:30	Plenary discussion / report from groups (group 1)	
13:00	Lunch	
14:00	Plenary discussion / report from groups (group 2 and 3)	
15:30	Synthesis of two days	Facilitator
16:45	Next steps / commitments	Participants
17:30	Closing remarks, Tea	

* Each group commences with a small case study / presentation connected to the topic by a presenter and later proceeds with group deliberation. Please choose a presenter for your group for plenary. Please ensure to bring notes on cards / flip charts / ppt – In case of only oral presentation please handover your notes to the facilitator.

Annex 2

List of Participants

S.No.	NAME	ORGANIZATION	DESIGNATION
1.	Mr. Mushtaq Ahmad Jadoon	District / Divisional Administrator	Commissioner DI Khan
2.	Mr. Irfan Ullah Mehsud	District / Divisional Administrator	Assistant Commissioner / EAC DI Khan
3.	Mr. Farooq Ahmad	Soil Conservation	Distt. Officer
4.	Mr. M. Azeem Khan Baloach	Rudh Kohi Irrigation Department DI Khan	Sub Divisional Officer (SDO)
5.	Mr. M.Anwar Shah	Agriculture Ext. Balochistan	Director
6.	Mr. Syed Mushtaq Ali Shah	PMD	Director
7.	Mr. Rizwan Ahmed	University Of Agriculture Peshawar	Director Planning & Development
8.	Mr. Nasim Javed	Agriculture Eng. Dept. Bannu KP	Assistant Agriculture Engineer
9.	Mr. Sardar Latifullah Sadozai	Retired Govt. Officer	Lawyer
10.	Mr. Amin Ullah Gandapur	Ex – Minister	Retired Major
11.	Prof. M. Azam	Gomal University D.I Khan	Professor
12.	Mr. Ahmed Zeb	SERVE	Chief Executive Officer (CEO)
13.	Mr. Farnaz Khan	Community Uplift Program (CUP)	Deputy Programme Officer
14.	Mr. Tariq Ali	Irrigation Department	Irrigation Engineer
15.	Mr. Sahibzada Irfan Ullah	SLMP	PPC – KP
16.	Mr. Faheem Khan	Veer	Executive Director
17.	Ms.Afsheen Zaidi	Veer	Project Manager
18.	Mr. Allah Bux	Meta Meta	Secretary Spate Irrigation
19.	Mr. Fahad Bajwa	Meta Meta	Intern
20.	Ms. Rania Zaidi	SPO DI Khan	Programme Officer
21.	Mr. Asghar Ali Khan	SPO DI Khan	Planning Specialist
22.	Mr. M. Zaheer-ul-Ikram	Pakistan Agriculture Research Council (PARC)	Director
23.	Mr.Munir Ahmad	PARC	Project Incharge Spate Irrigation DG Khan
24.	Mr. Noman Latif	PARC	Project Incharge Spate Irrigation DG Khan
25.	Mr. Khizar Hayat	PARC	Office Assistant Spate Irrigation DI Khan
26.	Mr. Hayat Ullah	PPAF – KfW	Senior National Expert
27.	Mr. Shah Nazaw Khan	Farmer	Farmer
28.	Mr. Ismat Ullah	Villager	Community
29.	Ms.Jannat Bibi	Villager	Community
30.	Mr. Marwat	Villager	Community
31.	Mr. M. Tariq	Villager	Community
32.	Mr. Malik Yaqoob	Water User Association (WUA)	President
33.	Dr. Arjumand Nizami	IC	Country Director
34.	Mr. M. Asad Salim	IC	Programme Officer
35.	Mr. Mahmood Hemani	IC	Consultant
36.	Mr. Nadeem Bukhari	LPH – IC	Team Leader
37.	Mr. Aamir Mughal	LPH – IC	Regional Programme Coordinator - South
38.	Mr. Shafqat Ullah Baloch	LPH – IC	Agriculture Advisor – South
39.	Mr. Munawar Khan Khattak	W4L – IC	Team Leader
40.	Ms. Tawheed Gul	W4L – IC	Deputy Team Leader
41.	Mr. Khan Muhammad	W4L – IC	Irrigation Engineer
42.	Mr. Mujahid Shah (Late)	W4L – IC	Field Engineer
43.	Mr. Sajid Hussain	W4L – IC	Field Engineer
44.	Ms. Ismat Majeed	W4L – IC	Community Development Facilitator

Annex 3

Examples of development initiatives

Swiss Agency for Development and Cooperation (SDC) and Intercooperation (IC)

1. SDC launched its first project in the south called **Project for Horticulture Promotion (PHP)** in 2000 which focused on improving crops and vegetables in DI Khan.
2. **Project for Livelihoods Improvement** (PLI: 2003-2007) focused on Rudh Kohi area (Draban and Chodwan Zams) in improving water conveyance and management for enhancing people's livelihoods. PLI worked for equitable access to water (drinking and irrigation) through initiation of a multi-stakeholder dialogue, strengthening of water users associations, demonstrating judicious water use practices in the upstream and revive a just system of historical Rudh Kohi management. PLI also worked on promoting successful varieties of crops, certified seed production and of grain storage. Men and women improved livestock management through Farmer Field Schools. An effort was also made to establish a cadre of local facilitators and service providers in agriculture / livestock. This project was implemented together with two highly competent local partners: Veer Development Organization (VDO) and Strengthening Participatory Organization (SPO).
3. PLI was taken over by SDC funded **Livelihoods Programme**. LP (2008 ongoing) upheld PLI's focus on equitable access to irrigation water and expanded its focus on disaster risk reduction. Gated structures, protection bunds and technical assistance in spate aagriculture / livestock management have been the main focus of the project.
4. **Water for Livelihoods project** up-scaled Rudh Kohi development in formal collaboration with Pakistan Agriculture Research Council. This project is also working on development of water resources in Karak district in KP, where mini dams and other water storage techniques are being applied, apart from supporting communities in converting flood water into irrigation facilities (instead of mini disasters).

UNDP GEF – GoP: Sustainable Land Management Project (SLMP)

1. SLMP initiated pilot scale activities in 2009 in the Sheikh Haider Zam, DI Khan under a title "conservation of soil and water in the Rudh Kohi area with the involvement of local communities". The project outcomes included enabling grassroots community institutions, revival / strengthening of Rudh Kohi system, rehabilitation of degraded rangelands, establishment of farmer plant nurseries, rainwater harvesting, and promotion of dryland afforestation and introduction of alternate livelihoods (fruit orchards). Some of the activities aiming at strengthening of Rudh Kohi system were earthen and masonry structures for improved conveyance and control of flood water control of en-route, and on / off-farm soil erosion and water diversion bunds and dykes.
2. The project has introduced village based participatory land use plans and Rudh Kohi Management Fund (RKMF) at Zam level which are two unique aspects of the project. The village land use plans provide a platform for interplay between farmers, government institutions and CSOs to evolve comprehensive solutions to land based problems. The idea of establishment of fund is rather new, however it enhances perspectives of greater community involvement and empowerment on water management issues at Zam level. The fund is established with matching grants from project, and managed by a capacitated Fund Management Committee represented by village committees and the SLMP implementing partners. The project is currently working with the provincial government and research institutions to identify the Rudh Kohi problems and solutions and devise a comprehensive strategy for development of the system.

Pakistan Agriculture Research Council

Pakistan Agriculture Research Council (PARC) introduced a number of techniques that helped better management of water in Rudh Kohi irrigation system both at Rudh and field level in the areas. PARC operated in spate irrigated area of DI Khan between 1995-2010 and carried out research on water diversion / distribution, conveyance and application.e.g. 3, 4 and 5 steel gated structures to reduce the drudgery and unreliability associated with the construction of these earthen bunds, field inlet / outlet to manage water in the field. Other experiences include construction of stone-gabion spillway, spill weir, improved diversion structures and planks controlled distribution structures to improve application efficiency.
Other development projects have also replicated these techniques in the field at a larger scale and area is gaining benefits of these interventions.

Spate irrigated areas of DG Khan: Vehowa has extremely hot and dry conditions and arid characteristics of climatic features with rainfall ranging between 250-350 mm. Vehowa is one of seven major hill torrents of DG Khan and its total command area is 0.2 million hectares of this only 13% is irrigated with perennial flows and the rest is spate area.

As such the scientists recognize a number a merits of Rudh Kohi system in DG Khan. Farmers are well educated to deal with the system, have well defined and documented water rights, the overall cost of maintenance is low (when compared to canal irrigated areas) and soils are often fertile in flood basins since floods bring fertile top soil from up streams.

The system in DG Khan faces similar problem as elsewhere in similar contexts. People living in the area are suffering from acute poverty and uncertainty. There are improper and inadequate diversion and distribution structures that are frequently dismantled. Lots of precious water is lost due to crude practices and illegal water cuts by the influential.

Spate Irrigation Management Project of PARC has performed a great deal with water application structures resulting in 29% increase in perennial flow area, 56% increase in spate area throughout the country. Other impacts of interventions include:

- Reduction in water loss up to 33%
- Improved water conveyance efficiency up to 60%
- Improved water conveyance efficiency 67%
- Expansion of Irrigated Area i.e. 655 acres to 900 acres
- Reduced water conveyance time up to 67%
- Increase in Irrigated Area (Rabi) 72.46%
- Increase in Irrigated Area (Kharif) 79.65%
- Increase in Cropped Area (Rabi) 69.18%
- Increase in Cropped Area (Kharif) 75.83 %
- Increase in Crop Yield / Acre 44.17%
- Decrease in Expenditure 161%
- Increase in Income 92%

These results were acquired within a span of 10 years.

Other initiatives in the offing

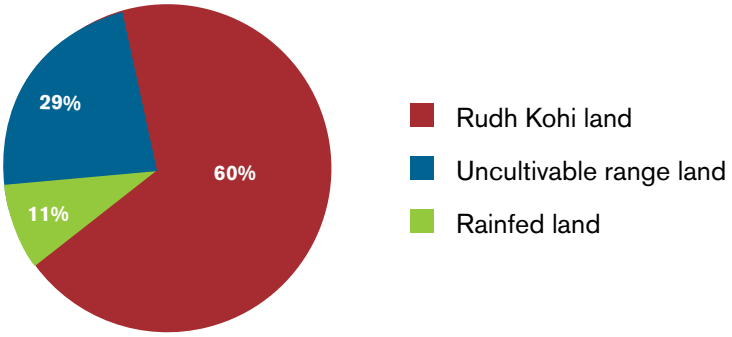
Apart from small and large scale initiatives taken by several humanitarian organizations after floods of 2010, there are a few development initiatives in the pipeline. One of them is the PPAF's Livelihood support and promotion of Small Community Infrastructure Project (LACIP) with co-financing from German Development Bank (KfW) and technical support from Intercooperation. LACIP aims to reduce the poverty levels by increasing economic opportunities in the Project region. DI Khan is one of its districts where support in small infrastructure and livelihoods will be extended through local NGO partners of PPAF. Disaster Preparedness and Mitigation will be a major focus of the Project.

Annex 4

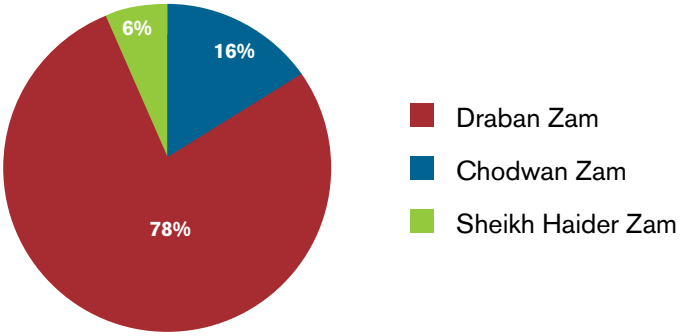
Fact Sheet Rudh Kohi system

Total land in three Zams in DI Khan is 136,547 Hectares[15]. Of this 81,521 Hectares is Rudh Kohi, 40,241 Hectares is uncultivable and rainfed area includes 14,785 Hectares. The existence of 14,827 households and over 134,755 people depends on this resource. There has been an acute shortage of freshwater for both domestic and livestock use. Farmers build earthen reservoirs which are filled by either rain or runoff water for drinking from spate. Often the humans and animals share drinking water from the same ponds leading to health hazards. The ponds dry up during scorching summer due to high temperatures. People have to travel long distances fetching water for daily needs and only migrate when the last drop of water evaporates. Major source of water for irrigation in the foothills comes from the Rudhs or hill torrents. There are 30 Rudhs in DI Khan and Tank that carry both perennial flows and flood water in the Zams. The Chashma Barrage is constructed on the River Indus and canal irrigated areas have been developed on the banks of the river. Chashma Right Bank Canal irrigates 260,000 acres of land in DI Khan, however, spate irrigation continues to be important in DI Khan for the remaining above-canal areas.

Land distribution Chodwan, Draban and Sheikh Haider Zams DI Khan



Rudh Kohi land distribution Chodwan, Draban and Sheikh Haider Zams DI Khan (ha)



[15]These statistics come from Revenue Department of DI Khan. We acknowledge support from Faheem Iqbal, Veer Development Foundation.

Annexe 5

Rudh Kohi Seasonal Calendar

Months	Activities of Flood Received Farmers	Activities of Perennial Farmers
May	• Harvesting and Threshing of wheat and Gram • Storage of Wheat and Gram • Selling of Straw and Storage in Heaps • Collection of share for the Gandi Construction	• Harvesting and Threshing of wheat and Gram and its transportation at threshing floor • Land Preparation for Mug Bean or Sorghum / Millet, • Arrangements of Thresher and Threshing

June	• **Weeding at Fields**
	  • Strengthening / Preparation of Field Embankments
	  • Management of Melon fields and its picking and transportation at market
		• Weeding / removal of vegetation
		• Strengthening / Preparation of Field Embankments
		• Management of Melon fields and its picking and transportation to market

July	• Gandi Construction and Field Embankment work completion • Disc Ploughing at Fields • If flood received than irrigates fields	• Selling of Perennial water • Sorghum / Millet Cultivation • Harvesting of Sorghum / Millet fodder and its transportation / selling in the market
August	• Irrigation of Bunds • Sowing of sorghum / millet in fields which irrigate in early July • Cluster Bean (Guar) Cultivation • Planking for moisture conservation at the end of month for gram cultivation	• Cultivation of Mustard, Vegetables etc • Land Preparation for Barley and its cultivation
September	• Cultivation of Mustard and Gram • Weeding • Ploughing and planking for the wheat crop moisture conservation	• Irrigation of Mustard and Barley • Preparation of land for the wheat cultivation • Selling of Sorghum / Millet fodder • Preparation / Setting of Channels for the wheat crop fields irrigation
October	• Gram Cultivation • Ploughing and wheat cultivation • Harvesting of Sorghum / millet • Sowing of Barley at field embankments and in fields	• Tools / Implements settings • Distribution of water through the use of Shill • Finalization of wheat fields

November	• Sorghum / millet harvesting and handling	• Distribution of wheat land and its draw • Ploughing and land preparation • Watering of what fields and at Vatar condition wheat cultivation
December	• Supervision / Follow-up of Wheat and Gram crops and its fencing • Weeding • Fuel Wood Collection for the winter • Grazing of Gram crop	• Watering of wheat fields at irrigation turn • Urea / DAP Application • Weeding manual and through use of weedicides • Selling of Barley and Mustard standing crops
January	• Selling of Mustard standing crop • Irrigation for Musk Melon Fields • Supervision of Wheat • Grazing of Gram crop	• Supervision of Perennial water distribution • Fields preparation for the Onion cultivation
February	• Supervision of Wheat and Gram Crop • Cultivation of Musk Melon	• Watering of wheat fields • Cultivation of Onion and vegetables
March	• Harvesting of Gram Crop • Threshing Floor preparation for wheat and Gram • Harvesting and Threshing of Mustard	• Watering of wheat and vegetables at irrigation turns • Preparation for the threshing floor
April	• Harvesting of Gram and Wheat	• Harvesting of wheat • Transportation of wheat at threshing floor

Glossary of Terms

Bund – Earthen Diversion Structure
Chodwan – Name of Village and one of the Hill Torrent Name
Draban – Name of Village and one of the Hill Torrent Name
Gandi – Earthen Diversion Structure
Kharif – Summer Season
Kulyat and Riwajat – Rules and Traditions
Paina – Down Stream
Rabi – Winter Season
Raqba Muta 'liqa' – The Land having rights to get Irrigation from a specific Gandi or Bund
Saroba – Up Stream
Shehre Panah – Flood Protection Wall
Zam – Hill Torrent
Patti Dari – Local Term used for management system in Rudh Kohi
Darogha – Messenger (convey message to the villagers)

About Water for Livelihoods Project

The Water for Livelihoods (W4L) project builds on earlier relevant experience gathered in the Livelihoods Programme in water sector (during 2008-2011). The Water for Livelihoods (W4L) project started in August 2011. It completed its Phase I in 2013. During the 1st phase, project began with small village based activities and gradually up-scaled to medium sized schemes beyond a single village. At the same time the project invested in forming Water User Groups in catchments / or around water schemes and also Operation and Maintenance Committees to ensure sustainability of physical interventions. During the 2nd phase, Project works in four districts i.e. Chitral, Karak, DI Khan and Tank. This phase of the project builds on the experiences of Phase I and concentrates in geographical areas where water is the most critical resource and its optimum use is essential for livelihoods and security of people living in those catchments. The overall goal of the project is to: "Contribute to agricultural development and enhancing rural economies in ecologically fragile, semi-arid and poor districts of Khyber Pakhtunkhwa through equitable access to water." The tool applied is called Water Use Management Plan (WUMP) based on integrated water management principle. WUMP preparation is to achieve an effective, equitable and efficient use of water resources on a local level. The other purpose is to agree on one water agenda in a unit and then acquire resource allocation around it. WUMP also will form the basis for sector dialogue, which will help in identifying reform agenda. This project is funded by Swiss Agency for Development and Cooperation (SDC).

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