



Micro Watershed Management for Increased Water Availability and Enhanced Crop Productivity – Kambrial, District Attock, Punjab-Pakistan



**Lt Col Islam ul Haque, PhD, PE, AMIE, TI(M) Retd
Chairman Eco-STEPS, Pakistan, M. Asif - NARC**

[http: www.ecosteps.wix.com/info](http://www.ecosteps.wix.com/info)

islamhaq3@yahoo.com, Tel +923005161673

Integrated Micro Watershed Management for enhanced Crop Productivity and Livelihood Generation- Kambrial, Tehsil Pindi Gheb- District Attock

Introduction

1. Project Geographical Location

Kamrial is village located in Tehsil Pindi Gheb District Attock. Kamrial itself is Union Council headquarter. The geographical coordinates of kamrial are 33°17'13"North 72°34'36"East, with the population of 12437 nos (1998 census) .

Pindi Gheb is located at 110 kilometers from Rawalpindi and 102 kilometers from Attock. It is away 10 Kms from Dhullian Chowk & 47 Kms from Talagang. Tehsil Pindi Gheb is bounded in North with Tehsil Attock, West Tehsil Jand, South Tehsil Talagang District Chakwal, and East Tehsil Fateh Jang. The Indus bounds it on the north-west. The location of kambrial village is marked in red circle in the map , as given below;



2. History

Historically the name Pindi Gheb is the compound of two words "Pind" mean village and "Gheb" derived from the Gheba Rai, or Gheba Khan, the ancestor of the Gheba tribe who came and settled here in 12th century. At the same time the Jodhra tribe settled in this area now the ancestral home of the Jodhra Maliks, who got it in the sixteenth century from their relatives and ancient rivals the Ghebas. The municipality was created in 1873.

After the decline of the Mughal Empire, the Sikh invaded and occupied Attock District. The Muslims faced severe restrictions during the Sikh rule. During the period of British rule, Attock District increased in population and importance. After the independence of Pakistan Attock became an important District of country.

3. Administrative Information

The tehsil is administratively subdivided into 13 Union Councils, two of which form the capital - Pindi Gheb. Pindi Gheb was given the status of Tehsil Headquarter of District Attock in 1904. Tehsil Pindi Gheb, with an area of 1,499 square miles. Its highest point lies in the Kala Chitta Range. There are 13 union councils (UC 48- UC60), with total population of **199439 nos (1998 censuses . Village kambrial lies in union council 60 (rural), with total population of 12437 (1998 censuses).**

4. Weather Conditions

The tehsil is mainly a bleak, dry, undulating and often stony tract, broken by ravines, and -sloping from east to west: a country of rough scenery, sparse population, and scanty rainfall. West along the Indus are the ravines and pebble ridges which surround Makhad. Only near Pindi Gheb town does the broad bed of the Sil river show a bright oasis of cultivation among the dreary uplands which compose the rest of the tahsil.

5. Water Availability

Water availability in Tehsil Pindi Gheb area is very low, mostly tehsil area depends on rain water for agriculture. Weather condition remains harsh most of the years and there is no major water reservoir available in the area.

6. Major Sources of Income

People of Tehsil Pindi Gheb associated with different kind of professions. Sizeable number of population is serving in Army and government jobs, some doing their private business, some are settled abroad and large number of population is associated with cultivation. Weather conditions are extremely harsh and dry hence not suitable for agriculture.

As per gazetteer 1930 (Punjab District Gazetteers Volume XXIX-A, Attock District): the percentage of cultivated area owned by each tribe of Pindigheb Tehsil according to Attock district Jodhras(30%) Awans (32%) Khattar (17%) Pathans (10%) Rajput Chohan (3%) Sayeds (3%) Others (5%).

Integrated Water shed management project conception in Pothohar Region - A new Initiative for enhancing agriculture Productivity

7. Agriculture is the mainstay of national economy and averagely contributes about 24% per annum in national GDP. The agriculture sector is also mean of livelihood for more than half of the country population. However, due to rapid increase in population, reduced water availabilities for agriculture (due to increased sectoral competition), projected climate change scenarios, the agriculture sector is most vulnerable and concert efforts are required to sustain and rather improve its potential. The productivity of agricultural sector is also important to ensure food securities at affordable rates and to reduce rural poverty by improving associated livelihoods.

8. However, in depth analysis of agricultural sector in Pakistan reveals that almost 90% of the productions come from irrigated agriculture, while only meagre contributions of around 10% is being contributed by rain fed/ dry land farming systems. This is non sustainable and at global scale the ratio between irrigated to dry land farming is about 50:50. The major reasons for meagre contributions from rain fed zones of the Pakistan are reduced investments, higher risks of failures, lacking of awareness and local capacities to undertake innovative agricultural practices.

9. Since massive investments have been made in irrigated landscapes and resultantly improved agricultural productivities and livelihood have been experienced at national scale. Similarly, some sizeable investments are required to be incurred on rain fed zones, so that agricultural productions can be enhanced and associated poverty structure can be dented in these fragile ecologies. Moreover, to over the come the issue of awareness and locales capacities in difficult terrains of rain fed systems, the trainings programs are essentially required at demonstrations site.

10. Pothohar being the larger rain fed zone of Pakistan is stretched over an area of over 2.2 mha and has been blessed with plenty of rainfalls (ranges from 1200 +mm in Islamabad to 650 mm in down towards Chakwal). Due to typical topography of Pothohar, the huge fluxes of surface runoff are generated particularly during short period Monsoon Season and is not only lost but also causes sever land degradations due to erosion process. To promote agriculture in region, these surface waters needs to be essentially harvested wherever feasible and should be efficiently utilized for subsequent agricultural purposes. Moreover, since entire Pothohar is watershed area, so necessary watershed management is essential to ensure better investments returns on water harvesting systems. To further improve water availability and to improve overall environment and ecological perspective, domestic wastewaters can be recycled after necessary treatments.

11. With this background a pilot scale research project was proposed & which is under implementation at village Kambrial, located at Pindi Gaib Tehsil of district Attock to address the issues of water harvestings, efficient utilizations, wastewater, watershed and human resource management. The project is being executed on farmer's field and through participatory basis.

Proposed Watershed Management Project Over View - at Kambrial

12. Therefore, keeping in mind the agriculture potentials of the area, which could not be tapped due to non-availability of water, the micro watershed management concept was planned to harvest and collection rain water. A comprehensive drip irrigation system was planned for pumping of harvested water through solar power driven pumping system. The details of all such interventions are given in the PC-I (attached), however, project summary is appended below;

Project Theme: Improving land and water productivity under irrigated and rain fed production systems (As given in PC-1 of approved Mega Project) , comprises of two components;

a. Component –I (CAEWRI)- Cost: Rs 18.310 Million

- 1) **Project Title:** Demonstration of Innovative Practices to Improve Rural Livelihood Through Integrated Resources Management under Watershed Conditions of Pothohar Region
- 2) **Principal Investigator** (Name & Designation): Abdul Ghani Soomro, SSO and now Mr. Muhammad Asif - Program /Institute/ Centre: Integrated Watershed Management Program/ CAEWRI/NARC, Park Road-NARC, Islamabad
Telephone: Direct: +92-8443658 Ext. 3658 Fax: +92-51-9255074

13. Researchable Issues and Their Significance:

- a. Watershed Management (to reduce erosion and to promote sustainable surface runoff)
- b. Water harvestings and potential utilization (through earthen ponds for agricultural and aquaculture development through innovate irrigation methods)
- c. Conventional energy crisis (solar energy can be used as an alternative)
- d. Meagre land and water productivities (improvement will help in livelihood improvement and reduction in rural poverty)
- e. Wastewater management (supplemental irrigation needs and public and ecological health improvements can be attained)
- f. Community capacity buildings (skill development for modern agricultural practices)

14. Review of Relevant Literature :

Notwithstanding its declining share in GDP, agriculture is still the single largest sector, contributing 21 percent to GDP and employing 44 percent of the workforce. Pakistan's agriculture is classified as an irrigated one. Out of about 23.5 million hectares of its total cultivable land, 19.62 million hectares come from irrigated area, giving about 90% of its total agriculture production. Cultivable waste is about 8.32 million hectares. Like in other developing countries, poverty in Pakistan is largely a rural phenomenon; therefore, development of agriculture will be a principal vehicle for alleviating rural poverty (GOP, 2008).

In Pothohar, there is capability for both water resource improvement (surface and subsurface) and its management (to improve the efficiency of the offered systems). Water resource development mainly refers to such projects as construction of large or small reservoirs, such as small dams, mini dams and ponds. The collection, storage, maintenance, consumption and management of these sources are of principal importance in these areas. Each millimetre of water collected, stored, conserved and saved in these areas can produce wheat by an average of about 10 kg/ha (Marshal and Holmes, 1988).

The three-month monsoon and erratic winter rain fall made the crop very uncertain in the Pothohar Pleatue. On the other hand the topography of the hilly area with steep ground slopes, helps the rainwater to form numerous streams. Due to high velocities, this water erodes the good land. Apart from damaging the land and the erosion of soil the rainwater thus does not get a chance to soak down and develop any ground water reservoir. Agriculture in these areas, therefore, depends entirely upon rainfall, which at times is very meagre. This cycle of drought is frequently experienced and now witnessed in recent years. Consequently, to conserve the rain run-off for agriculture, the only solution is to build dams, which would also eliminate the hazards caused by delayed rains at the time of sowing and growing when a little delay in rainfall may result into reduction of crop yield to less than half (Small Dam Organization, 2007).

There could be two possible approaches to increase the agricultural production viz. either by bringing more area under cultivation or increasing the yield per acre. The first option is almost flexible, however, the yield per acre could be increased. To increase the crop yield, water input is the most limiting factor particularly in the barani areas (Bhutta, 99).

15. Specific Objectives:

- a. Demonstration of Improved Rainwater Water harvestings and Potential Utilization through innovative Technologies for Agricultural purposes.
- b. Wastewater Management for Safe Reuse in Agriculture at Selected location.

- c. Community Capacity Building Program for Improved Agricultural Practices and Dissemination Initiatives

16. Methodology, including Experimental Design and Data Analysis

- a. Site selection based upon criterion
- b. Recruitments and Procurements of Staff
- c. Establishment of Site office
- d. Baseline surveys, development of maps etc.
- e. Construction of water storage reservoir
- f. Introducing BMPs for watershed management.
- g. Designing and installation of solar pumping irrigation system
- h. Installation of drip/ sprinkler irrigation system for demonstration purposes
- i. Wastewater treatments through affordable biological means
- j. Short term Community capacity building programs
- k. Organizing FFDs, Seminars/ workshops etc.
- l. Development of brochures, leaflets, research publications etc.
- m. Studies will be developed to estimate sediments, water productivity enhancements, and performance measurements of solar-based irrigation system and to evaluate impacts on wastewater treatments etc.
- n. Relevant data of sediment transport, solar radiations and performance of high efficiency irrigation systems, water productivity evaluations, wastewater treatment effectiveness and reuse potential etc. Moreover data of meteorological parameters will also be taken on regular basis. Data of soil and aquaculture health will also be ensured.

17. Expected Outputs and Outcome/Impact: (In Bullets, maximum Three)

- a. Improved land and water productivities for local food security
- b. Improved ecological and public health through better watershed management
- c. Improved livelihood and trained manpower availability

18. Project Duration: 02 years

19. Total Project Cost (Rs. in Million): 22.110

Project Outcomes - Watershed Management at Kambrial

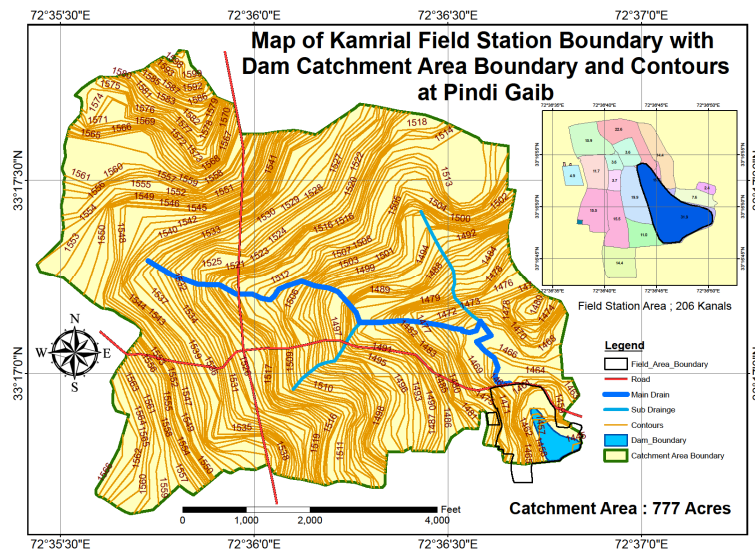
20. Micro-watershed management is an excellent concept of boosting and enhancing agriculture productivity aimed to livelihood generation, improving bio-diversity & eco-system, recharge of ground water aquifer in water scarce area of village Kambrial etc. The project took-off with lot of enthusiasm & commitments by the staff of CAEWRI/NARC and project implementation started on **1 June, 2013** which could not progress as per given / conceived methodology, mentioned in the PC-1. At many occasions, during the initial implementation stages, the said project met many failures and

impediments, but the outcomes have over shadowed all the difficulties, the details of outcomes are as under;

- **Proper functional site has been established at Kambrial, Pinid Gheb**
- **Infrastructure Development**
 - **Site Office**
 - **Automatic met-observatory**
- **Development of rainwater harvesting system (55 acres-ft) capacity**
- **Installation of solar pumping system**
- **Establishment of high value fruits plants (Olive , Grapes etc) over at area of 4 acres.**
- **Rain gun fed wheat crop over an area of 3 acre.**
- **High value vegetable tunnel farming**
- **Creation of market linkages**
- **Procurement of Research and other capitals items has been accomplished amounting Rs 2.985 million**

The photographic activity details are as under;

- 1). **The requisite base maps of watershed & command were prepared by Mr. Tariq- NARC, showing locations and various structures and ground lay outs / boundaries . The GIS map, as prepared , is shown, below**



2). The existing check dam was rehabilitated out of 62-55 account head on fast track bases , with the minimum capacity of 9 million gallons, as shown in below photo;



3). The existing embankments of the main reservoir were further developed with stone pitching and geo-membrane of 25000 square feet was also laid to reduce seepage. The main reservoir has been filled during the recent rains , having water storage capacity of 18 million gallon, as



Various views of check dam with indigenous control mechanisms

Spillway and Control Mechanism in the Check Dam



The solar panells , coupled with solar pump & indigenous filter are shown below;



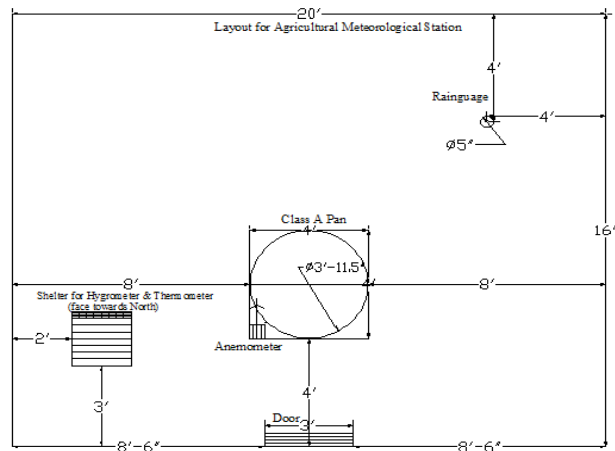
- 4). Automatic weather station has been established which scientific data recording, as shown below



The details of automatic weather station is as under;

Agricultural Meteorological Station has been developed as per scientific layout. The following instruments are installed for meteorological data

- **Thermometer**
- **Hygrometer**
- **Anemometer**
- **Rain gauge**
- **Class A Pan**
- **Automatic weather station**



- 5). The solar panels along with solar pump have been installed and test runs have been carried out successfully, as shown below;



The technical details of Solar Pennell system are as under;

The

- Panel System = **Permanently Fixed**
- Facing: **South**
- Tilt Angle = **Latitude = 31° +**
- PV Panel = **Mono Crystalline**
- Size of Aray = **4.9 KW**
- Pump type: **DC submersible**
- Motor Power required: **5 HP**
- flow rate = **6.5 + lps (avg)**
7+ lps (peak time)

The details of high value vegetable tunnel farming is as under

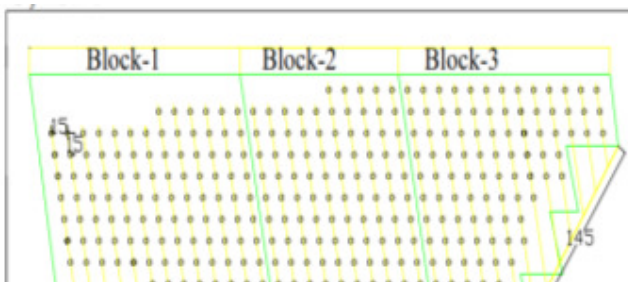
Drip and Mulching for tomatoes in Tunnel

- **Variety= Sahel Hybrid**
- **Bed length=60ft.**
- **Bed Width=2 ft.**
- **No of Beds=3**
- **P*P=1.5ft.**
- **R*R= 1/2 ft.**
- **No of lateral per bed=2**
- **Total no of laterals=6**
- **No of Plants per lateral= 32**
- **Total plants=192**
- **Total plants germinated=192**



The value fruit plantation is shown as under;

P*P=15ft
R*R=15ft
elevation difference from storage tank=24ft
distance from storage tank=375ft
Plants in block-1=108(pear)=0.79acres,
Plants in block-2=105(pomegranate)=0.60acres,
Plants in block-3=90(loquat)=0.69acres.
Total area=2.1acres



Recommendations

21. Keeping in view the mid-term progress update and observations/impediments , following recommendations are made to complete the project to meet the desired objectives during financial year 2014-2015;

- a. Revision of PC-I for carrying out/ assigning / or correction of relevant account heads to the corresponding procurement item
- b. Early release of funds for the current financial year- 2014-2015, to complete the left over works.
- c. Allocation of additional finances for construction foot bridge upto solar pump platform in the reservoir.
- d. Provisioning of 4 men wooden boat for repair/maintenance of solar pump and filter post structure , located in the reservoir .
- e. Provisioning of three light/watch towers, to be operated by solar system, for night hours repair & maintenance of earthen embankments , spill ways /dam structures and for security .
- f. construction of RCC wall (100x20x1.5 feet) in front of existing dam wall in the main reservoir , as the existing dam wall was not a hydraulic structure . Moreover, with the addition of RCC wall the reservoir capacity will increase twice the existing capacity.
- g. Provisioning of 30,000 square feet of 0.5 mm geo-membrane for reducing seepage rate, as the soil is sandy loomy in character.
- h. Installations of two solar operated tube-wells for pumping out seepage water during dry spells.
- j. Allocation of new & road worthy project vehicle for project activities, as the old project vehicle is a old / vantage Mazda 1985 model, which most of the time remains out of order.
- k. Immediate clearance of all the liabilities of financial 2013-2014, as all the contractors are pressing hard for early payment of their investments.