Integrated Watershed Management Plan:

Sadpara Watershed Area, Sadpara Valley Skardu, Gilgit Baltistan, Pakistan

Premier Mountain Communities Consultants (PMCC) Gilgit Baltistan
Office No. 219, 2nd Floor Qalander Plaza Cinema Bazar Gilgit.
Contacts: 05811-450232, 03449494594/03111013320
Email: info@pmcc.org.pk/ shahid.pmcc@gmail.com website: www.pmcc.org.pk

Supported By: PMU Baltistan Circle, Forest Department Gilgit Baltistan

Forest Complex, Near Aga Hadi Chock, Sadpara Road Skardu, Baltistan

Acknowledgments

This was a hard task by any standards. We had to work in hard geographical & climatic conditions and travel/walk across watershed area.

We wish to thank all who made it possible, in particular:

- Forest Department Gilgit Baltistan which provided us opportunity.
- Mr. Sajjad Haider Sahib Secretary Environment, Forest and Wildlife Gilgit Baltistan
- Dr. Zakir Hussain, Conservator Baltistan Circle Forest Department and his management team, for their complete support throughout this assignment and providing us a good understanding of the various dimensions of this multifarious activity.
- Officials of WAPDA, Agriculture, Health, LG&RD, PWD, W&PD, and Livestock departments of Skardu for their support and valuable inputs at various stages of the mission
- Most respected community members of the Sadpara Valley especially their representatives
- The AKRSP Baltistan region, Mr. Ghulam Muhammad GM Snow Leopard Foundation Skardu, community members who spent considerable time to meet us and share their views and experiences regarding the watershed Area.
- The project team, Miss Marina Begum, Dr. Fida Hussain, Mr. Muhammad Ashraf, Engineer Muhammad Ali, Miss Kaneez Fatima, Miss Naseema, Miss Sajida, Mr. Kiramat Hussain, Miss Koser Bano, Miss Saliha Saba, Mrs. Fida Bibi and Mrs. Shehnaz Rani who visited to field sites and provided information, reports, drawing designs; and the drivers, who worked hard to transport us safely to challenging locations in the region during heavy snow and rains even.
- Mr. Muhammad Ali (National Mobiles Skardu) for providing company and required equipments during the visits of team to Skardu.
- Most of all, we are very thankful to the wonderful staff of Forest Department GB, social activists and representatives of Sadpara Valley, that we visited for, provided us valuable information, ideas and the change process taking place in the watershed area in authentic manner

This was a wild assignment we have ever experienced, it was a great learning experience, and we owe it to all who made it possible.

Shahid Hussain
Director PMCC Gilgit Baltistan
Gilgit, February, 2018

Study Team

Steering Committee

Mr. Sajjad Haider, Secretary Forest, Wild life

Dr. Zakir Hussain, Conservator Forest Department Baltistan Circle

Shahid Hussain Lead Consultant, PMCC Gilgit Baltistan

Marina Begum Consultant, PMCC Gilgit Baltistan

Fulltime Technical Team

Shahid Hussain, Lead Consultant and Team Leader

Mr. Muhammad Ali, Consultant Engineer Civil

Mr. Muhammad Ashraf, Consultant Engineer

Naseema Begum, Sociologist

Mr. Kiramat Karim, GIS Specialist

Sajida Socio Economic Data Surveyor

Kaneez Fatima Social Data Surveyor

Koser Bano Social Surveyor

Saliha Saba, Social Survey Assistant

Thematic Team

Mr. Muhammad Ali, Civil Engineer

Mr. Muhammad Ashraf, Engineer

Dr. Fida Hussain, Livestock Management Specialist

Mrs. Fida Bibi, Gender & Social Inclusion

Mrs. Shehnaz Rani, Management and Finance Specialist

Community Representatives

Abid Hussain

Manzor Amin

Haji Rehmat Ali

Muhammad Yaqoob

Muhammad Abbas Jan

Acronyms and Abbreviations

ADP	Annual Development Plan
AKPBSP	Aga Khan Planning and Building Services Pakistan
ALF	Agriculture Livestock and Forestry
BWCDO	Baltistan Wildlife Conservation and Development Organization
CEO	Chief Executive Officer
CKNP,	Central Karakoram National Park
DoF	Department of Forest
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GIS	Geographic Information System
HHs	Households
ICIMOD,	International Center for Integrated Mountain Development
IUCN,	International Union for Conservation of Nature
KIIs	Key Informant Interviews
LEK	Local Ecological Knowledge
LSO	Local Support Organization
NGOs	No for Profit Organizations
NTFP	Non Timber Forest Products
NRM	Natural Resource Management
PES	Payment for Eco system Services
PMCC	Premier Mountain Communities Consultants
PTDC,	Pakistan Tourism Development Corporation
USAID	United States Agency for International Development
UNDP,	United Nations Development Program
WAPDA	Water and Power Development Authority
WASEP	Water and Sanitation Extension program
WMP	Watershed Management Plan

Chapter

INTRODUCTION

1.1 Background

Catchment Area of Sadpara Dam is 274.5 Km2 consisting of various nallas and tributaries flowing downstream with high velocity in to the reservoir[1]. The dam is the most important source of water for domestic use (cooking, washing, sanitation, watering floors, etc), drinking, agriculture, and generation of hydro electricity for Skardu city and surrounding villages. Apart from these the dam supports ecosystem of the Sadpara valley especially and Baltistan region generally. It further contributes to purify drinking water, regulate: climate, disease and flood in the region. The dam is not only important to generate hydro electricity, as a main source of drinking water for Skardu city and surrounding areas but also to the socio economic development of Gilgit Baltistan as it attracts thousands of the national and international tourists annually.

Basically Sadpara Dam was a natural lake prior to construction of the dam by the government through WAPDA under financial support of USAID in 2009 to meet the increasing needs of potable and irrigation water, and hydroelectricity of Skardu city. The catchment area of Sadpara dam is consisted of slopes, high mountains, permanent and seasonal streams and loss soil on the banks of streams. There are less natural vegetation on the surrounding mountains and slopes of the dam. After construction of the dam, ratio of rainfall has considerably increased which caused heavy snow on mountains during winter that melts in summer and causes erosion of soil. The erosion has damaged agricultural land, irrigation channels that turned cultivable land into barren land. In recent years the community of catchment area is facing challenges to maintain their agricultural land and water channels. The floods damaged many water channels in catchment area and hundreds Kanals of agricultural land, fruit and forest trees are about to dry out. It has been noticed during the assessment survey that inhabitants of watershed are facing shortage of food production, fruit, fodder, firewood, timber, pasture, forest and livestock. As a result many farmers/families have migrated from the catchment area to other parts of Skardu district.

Furthermore, heavy rainfalls during monsoon produces flood in the surrounding up streams that cause sedimentation into the dame which reduces the life and capacity of the dame.

[1] PC-1 of Sadpara Dam water shed management project.

During the construction of the dam no measures have been taken to check and control the erosion in the catchment area of the Dam. Communities living in the area are by large dependent upon income from, land, forest, horticulture, fodder production and livestock.[2]

Forest department Baltistan circle has identified the issues in watershed area and going to play a major role in conservation and management of the Sadpara upper watershed area for economic development through batter natural resource conservation and development. It further intends to: enhance the water produce into dam; increase the expected life of the dam through control of the siltation; stable the environment through plantation and rehabilitation of damaged irrigation channels; and enhance aesthetic value of the surrounding landscapes. Forest department Baltistan circle with its local partner organization Premier Mountain Communities Consultants (PMCC) initiated the study of catchment area of Sadpara dam watershed to develop the integrated watershed management plan.

The study was conducted under the project funded by the government of Gilgit Baltistan. The project aims to enhance the life of the Sadpara dam by reducing soil erosion and degradation, and to ensure environmental conservation, and to enhance aesthetic scene of Sadpara Dam and upstream catchment areas through the concept of integrated watershed management in the catchment area of Sadpara dam.

1.2 Rationale of the Study

Sadpara Dam satisfies the domestic (drinking, cooking, washing, watering), industrial, and public water needs of Skardu city and surrounding villages. It generates hydroelectricity to meet the industrial and domestic demands of public. Furthermore, it irrigates around 15536 acres agricultural land annually from left and right bank canal in the Skardu city and surrounding villages[3]. There are five villages above the watershed area and live a considerable population around the up streams falling into the Sadpara dame. Livestock of the communities are mostly grazing around the banks of the streams and water resources. Open grazing practices are normal in the pastures and community grazing area and livestock use the water of the streams and contaminate the water by defecation. On the other side community use the water of the streams for cooking, washing, and agriculture purposes. There is no any proper drainage system in these villages and waste water falls into the

[2] Project Proposal, watershed management
[3] 2nd Rev PC-1 of Sadpara Dam Project, WAPDA/2002

streams and contaminate the fresh water of the dame. Currently there is no any proper system to secure the water from contamination. Furthermore, erosion, and disilting is shortens the life of dame as it is the earth filled constructed dame. Although the present condition of the water source (Sadpara Dame) has been able to achieve water sufficiency in the command area especially Skardu city and providing no any other services to the communities within the watershed for the last many years, new issues and challenges for the management of natural assets have emerged in recent years. Some of the major issues are:

- Soil erosion in the water shed area;
- Lowering the expected life of water resources (Sadpara Dam)
- Population migration from water shed area
- Exploitation of the natural resources;
- Very limited farm land;
- Very limited forest
- Highly damage ratio of irrigation channels and land
- High flood ratio in seasonal streams
- Construction of development projects without environmental assessment
- Low productivity of agricultural land
- Dependence on firewood for fuel
- Low a forestation in watershed area

Government of Gilgit Baltistan especially the forest department Baltistan circle has felt that the condition of Sadpara Dam's water shed is very sensitive. There is no any proper policy as well as legislations for sustainable management of natural resources especially water resources in country. However, being a mountainous region, Gilgit Baltistan is has main water resource of the country and the Sadpara Dam is the main water resource for the Skardu city and surrounding villages. Therefore, forest department Baltistan circle addressed the issue requested to government of Gilgit Baltistan and received financial support from ADP of provincial government for sustainable management of water resource (Sadpar Dam).

Forest department has adopted the watershed management through community participatory approach for the sustainable development of water shed area. This approach will address water resource management and community development. However, on the basis of this study, it is highly recommended to plan in closed collaboration of people living in the water shed area of Sadpara Dam. Yet the community of water shed is not given priority by the

local government, WAPDA and other concerned stakeholders. Furthermore, no any study of water shed has been carried out prior to construct the dam as well as after the construction of the dam, although WAPDA has carried out an analysis water shed in terms of water quality in [4]three stages: i) up streams, ii) in reservoir (dame) iii) in city (from the tapes of the consumers) in 2012. Finding of the study highlighted poor quality of water at steam and consumer's stages and batter quality at the reservoir (dame). On the other side the dame and the Sadpara valley (water shed area) is a well known place for tourists and annually thousands of national and international tourists visit the area that develops economy of the communities and water resource face threats of being polluted and Skardu city and surrounding villages are facing shortage of water and other natural resources. The analysis shows that Sadpar valley has not been understood properly for sustainable water shed management. Infrastructural, social, environmental and natural resource development has not been implied by considering the values, requirements, and geographical context of the communities living in the water shed area of Sadpara valley. Moreover, efforts and resources utilize for soil conservation and water shed management of upstream need to be utilized for sustainable water shed management through community participation and proper need identification. The study has the following objectives.

1.3 Objectives of the Study

Main objective of the study is to prepare an integrated water shed management plan of Sadpara Dam and survey and mapping of physical infrastructure and engineering works for watershed management and harnessing of catchment areas of Sadpar dame Skardu, Gilgit Baltistan.

The specific objectives of the assignment were:

- Situational assessment & collection of secondary data from relevant offices/ authorities;
- Survey & Mapping of physical infrastructure & engineering works for watershed management;
- Develop Integrated Watershed Management Plan for Satpara Dam Watershed

[4] Drinking Water Report of Sadpara Dam

1.4 Scope of the Study

The following scopes were undertaken in the study:

- Present recommendations on infrastructural development such as: construction of check dams, protective bunds, contraction of water channels, rehabilitation of irrigation channels and stabilization of infrastructure in the watershed area.
- Survey & Mapping of physical infrastructure & engineering works for watershed management and harnessing of catchment areas.
- Organize consultative sessions with WAPDA, LSO Sadpara, line departments and stakeholders on the outcomes of Situation assessment, NRM survey and physical engineering works & interventions
- Workout the economic valuation of infrastructural development services, particularly the construction values of check dams, protective bunds, water channels, and rehabilitation of irrigation channels of water shed of Sadpara dam;
- Prepare a baseline information about the watershed and socio-economic situation of the communities in the watershed;
- Situational Assessment & collection of secondary data from relevant offices/ authorities
- Carry out a consultation meetings with concerned stakeholders for the discussion on the draft report; and
- Prepare the final report of the conservation plan and other several reports of economic analysis;

1.5 Methodology

Mainly the study was comprised of two main components: physical infrastructure survey and socio economic data collection of water shed area. Tools used to collect the socio economic data were: collection of secondary data from relevant departments /authorities, face to face interview from community representatives and FGDs with community members.

For physical infrastructure survey, engineers and consultants have visited the communities for need identification and identification of vulnerable areas. Communities have arranged visits to the vulnerable and effected physical infrastructure sites. The engineers and consultants visited to the physical requirement areas of protective bunds, check dams, irrigation channels, and vulnerable sites for rehabilitation to prioritize the sites and to survey

for designing, mapping and costing of the developmental projects. However, consultant engineers has conducted physical survey to identified sites and developed drawings, designs, and costing of the identified projects. The detail drawings, maps and cost estimation is attached in **annexure III**

1.5.1 Desk Work: Literatures Review, and Preparation of Questionnaires

Many stakeholders have been visited for collection of literature available already about the water shed area. However almost all sectors/department such as: livestock, forest, agriculture, WAPDA and other NGOs working in the area have been visited formally and requested to provide any available literature related to the Sadpara Dam water shed area. However, WAPDA has provided available data and all the departments mentioned above have fully cooperated with the study team. Several unpublished reports have been received from NGOs especially from Mr. Ghulam Muhammad CEO Snow Leopard Conservation Society, Mr. Sadaqat Hussain AKRSP and Mr. Zafar Project Director WAPDA Baltistan.

On the other side, published reports from journals, books from different sources like IUCN, UNDP, ICIMOD, FAO, Green Empowerment Portaland, Tetra Tech San Diago, USAID Islamabad, websites and other relevant information were reviewed to conceptualize the principals of water shed management plan development, water and soil conservation, infrastructure development, land stabilization. Likewise, topographic maps were developed to get topographical data and information about up streams, land use, land cover, physical boundary of water shed, roads, buildings, forest land, agricultural land and other infrastructure. Geographical boundary of Water shed was demarcated on topographic map using Geographic Information System (GIS). Base map of Sadpara dame water shed was prepared by incorporating major land features like boundary, water streams, water resources, forest, agricultural land, buildings, and social service centers such as: hospitals, schools, first aid posts, police stations, livestock center, agriculture service center etc. Structural questioners (Annexure I) were developed to extract primary data related social, natural and environmental situation from the water shed area.

In addition to the literature reviews the following works were also carried out during the desk work:

- Preparation of questionnaires for face to face interview, Focus Group Discussion(FGD) and Households Surveys to be used during the field study;

- Preparation of a work plan for the overall study and infrastructure survey and methodology.
- Collecting secondary information regarding the forest, agriculture, wildlife, and social services.

1.5.2 Field Work: Collection of basic data, Focus Group Discussions, Interviews of Key Informants and Multi-stakeholder Consultations

Figure 1, *Photo 1:* Community participation in watershed's physical infrastructure identification

Watershed boundary was verified in close consultation with local stakeholders and communities. Infrastructure has been verified and corrections were made on the base map based on the walk in the field. During the verification, sensitizations about the methods followed for the physical infrastructure of the watershed were also carried out among the local water shed committee, and forest department. Social services data has been collected from communities by visiting at their door step. There are five villages in Sadpara valley and these all villages have been visited and consulted with the community representatives to collect the basic data regarding population, agriculture, livestock, and available social services.

Population of the Study

There mainly three regions in the water shed area: upstream (straight from Deosai), right bank stream (Melpin village) and left stream (Chogozong Village). The watershed has been divided into these three regions on the basis of availability of natural resources, feeding water to the Sadpar dam, and on the basis of land system of the watershed.

Upstream includes Mirakh village, Daripa village, lower part of Melpin Village, and upper part of Skillzong village. These villages use the water for irrigation, domestic use, livestock, and washing. The main water feeding resource passes from Deosai plain through this region. Total population of this region is 1360 individuals including people who migrate in winter season to Skardu city and other parts of Baltistan and country. Many families have been permanently migrated to Skardu but they have their agricultural land and therefore they come to Sadpara valley for agriculture in summer season. This region faces bank cutting from Deosai top to near Sadpara dame which damages agricultural land and private forests of the inhabitants. This is the main tributary which feeds the water to the Sadpara dam. This region is rich in Flora and Fauna in the water shed area.

Figure 2: **Agricultural, forest, fruit trees land and irrigation channel damaged by the floods**

Right bank stream includes Melpin village and this stream faces mostly flooded during summer and rainy seasons. It carries lots of mud and stone which may reduce the expected life span of the dame. This region has 250 individuals only. However this village faces soil erosion and bank cutting from two sites and it is one of the most vulnerable regions in the water shed area. The region has lost agricultural land as well as houses, religious centers, livestock and trees in very recent years.

Figure 3: ***Agricultural, forest, fruit trees land and irrigation channel damaged by the floods***

Likewise left bank stream includes Chogozong village which is the largest village in the watershed area and the lower part of Skillzong village.

This stream faces heavy floods during rainy seasons. The floods have

damaged agricultural land, forest and fruits trees, and three main irrigation channels. The region is rich in flora and fauna and feeds water to Sadpara dam as well.

In upper parts of the village private forest has also been grown by the community. Population density is highest in this region then other villages. Total population of the region is about 960 individuals. The region is more vulnerable to landslide and erosion than any other region of the water shed. This region is at risk of flood and bank cutting as well as has huge mountains of lose land.

Focus Group Discussions (FGD), Key Informants Interviews and Multi-stakeholders Discussions

Focus group discussions (FGDs) were carried out to identify the physical and social issues issues, problems and their causes and consequences in all five villages of Sadpara water shed area. Community activists, youth and community representatives have participated in the FGDs. The FGDs were conducted during the field visits amongst Melpin, Chogozong, Skillzong, Mirakh and Daripa communities in upstream, left bank stream and right bank stream in all three regions of the water shed area. The discussions mainly focused on the resources availability, physical infrastructure requirements in water shed, developmental project's distribution and management among the communities living in the regions.

The key informant interviews (KIIs) were carried out separately. The key informants were selected from the diverse fields, of the social, environmental, economic development. The

Figure 4: *Consultation with Community Members.*

participants were social activists, political leaders, community workers, financial specialists, engineers, and businessmen.

1.5.3 Office Work: Data Entry, Processes, Analysis and Report Preparation

The survey data and information were compiled and checked. All the variables were entered into the spread sheet in excel program. Before entering the data, the data entry operators were given orientation to help them understand the context of the study. Final tables were obtained after analyzing the entered data.

Likewise, the inputs obtained from field verifications on base map, land use change map and other thematic maps were entered and the final maps were acquired on respective themes.

Multi Stakeholder Consultation Meeting

A one day long multi-stakeholder session has been conducted in a local hotel for the stakeholders of watershed area. Main stakeholder of the watershed is community and their representatives participated in the session. Government is also major stakeholder and representatives from government departments such as: forest department, agricultural department, livestock & dairy development department, Deosai national park, public health department, education department, Water Management Department, health department, public works department, water and power department have participated. NGOs working in the watershed area also have been invited and representatives from BWCDO, CKNP, PTDC, AKPBSP/WASEP, and LSO have participated. The session was designed in two sessions i.e. inaugural session and breakout session.

Figure 5: Multi Stakeholders Consultative Session Conducted in Skardu, Baltistan.

In inaugural session consultant and conservator forest department introduced watershed management plan, its importance and the role of community and stakeholders. Then the participants were guided towards their role and tasks to be done in the breakout session. Participants were divided in three groups.

In breakout session participants worked in groups and they were provided draft recommendations developed by the consultants to check, review, add professional and need based recommendations for development of watershed management plan of Sadpara watershed management plan.

Figure 6: Participants busy in group work and share their group work to participants

Following three working groups have been formed for consultation:

WG-I: Forestry, Environment, and Water Conservation

WG-II: Agriculture, Food Security, Livestock, Fodder

WG-III: Infrastructure, Social Services (Health, Education, Electricity, Drinking Water), Poverty Reduction

Working groups have worked regressively for hundred minutes continuously and presented their work to audience and other groups and received feedback and questions as well. The final recommendations have been collected to prepare watershed management plan.

1.6 Outcomes of the Study

The expected outcome of the study is a report describing Watershed Management Plan (WMP), and physical infrastructure designing, mapping and estimation of Sadpara dame water shed area.

1.7 Sadpara Watershed Management Plan:

Vision, Mission, and Objectives

The Sadpara Watershed Management Plan is developed with a vision, mission and objectives. This plan is based on interactive study of Sadpara watershed and is expected to be implemented through the proposed activities and physical infrastructure development. Forest department Baltistan circle had close involvement in the study with other local stakeholders. The forest department and other stakeholders will own the water shed

management project to implement with true spirit. The stakeholders of the water shed area especially communities will adopt the findings of the water shed management plan. The vision of the plan is to find the new approaches and ways through contextual experiences about significance of the watershed.

1.7.1 Vision

"The vision for Sadpara watershed management plan is to develop a strong ecosystem with best quality and quantity of water, healthy environment with good liaison among stakeholders and communities with sustainable infrastructure to enhance the projected life of the water source (Sadpara dam) that supplies water to inhabitants of Skardu city and surrounding villages as a heart."

1.7.2 Mission

Water shed management plan presents a conventional knowledge about the significance of Sadpara dam watershed through integrating developmental activities for soil conservation and flood management through people's participation and collaboration among concerned institutional and social actors to ensure sustainable management of water sources.

1.7.3 Objectives of the Plan

Following are the objectives of the ware shed management plan:

- To sustainable development of the ecosystem in the watershed while making infrastructural development;
- To survey and mapping of physical infrastructure and engineering works of water shed management and harnessing of catchment area;
- To integrate watershed resources into community development and soil conservation;
- To adopt public private participatory approach for the conservation, promotion and development of water resources of water shed area;
- To develop a sustainable mechanism among the communities living in water shed area for sustainable water shed management.

Chapter

Study Area: Sadpara dam Watershed

2.1 Introduction

The chapter of the study deals with geographical and socio-economic profile of water shed area of the Sadpara dame.

2.2 Geography of the Watershed Area

The dame has interesting history in the history of Baltistan. Before construction of the current dam, it was an earth filled lack constructed by the Raja Ali Anchan on the Sadpara stream to meet the irrigation and drinking water needs in 1880. That dame has served Skardu city and surrounding villages for centuries. Till 1988 the breached and NAPWD (now GBPWD) has carried out a feasibility study of 40 feet high dam at the same location. The project was included in vision 2025 program in 2001 increased the design from 40 feet to 128 feet of earth fill dam. Physical construction was started in 2002 with objectives to control flood and optimum utilization of Sadpara water flow, meet the needs of irrigation and drinking water and generation 17.4 MW of hydroelectricity for the Skardu district.

Sadpara water shed is located between 26^{o} 45' 57.7" to 26^{o} 52" 30.95"N and 87^{o} 12' 20.43" to 87^{o} 19' 20.20"E in Skardu district of Baltistan region in Pakistan. Geographically water shed commenced from the Sadpara dame to the top of Deosai planes in Sadpara Nullah and to top of mountains on left and right banks. In the water shed area there are five sub villages at the left and right banks of Sadpara stream. There are many other small and seasonal tributaries along with Sadpara stream. These tributaries contribute water to the Sadpara stream which is the main source of water for the dam. These permanent and seasonal tributaries carry heavy floods during rainy seasons and bank cutting may reduce the expected life of Sadpara dam. Apart from the tributaries, Sadpara stream is 15 KM long from Deosai top to fall in Dam.

As five sub villages are located in the water shed area and the Melpin is the nearest sub village in the water shed. The villages have almost 3290 inhabitants (Permanent and Migratory) and there are 370 permanent households. The dam is a tourist resort and there is a road to world's famous Deosai planes along with the stream. Annually thousands of visitors visit the water shed area and Deosai planes as well. There are hotels on the banks of

the dame and Sadpara stream. The wastewater of the inhabitants and hotels causes water pollution. Open defecation system, on site open disposal of human excreta, livestock manure used as fertilizer in the agricultural fields and open grazing of the livestock on the pasture are the major elements that contribute to contaminate the water source of the Sadpara dam.

2.3. Drainage Networks: Sadpara Stream

Sadpara River originates from Deosai Plains and foot hills of Sadpara Mountains. Within the watershed the total length of the main channel of the stream is 17.17 km. The stream flows through the Sadpara valley (4.35 km) and mountains and finally across the outlet into the Sadpara Dam. Its major tributaries are Chogozong, Skillzong and Melpin Nallahs which are permanent water sources while dozens of seasonal and rain-fed rivulets from right and left bank of stream and Dam also contributes to water resource. These permanent and seasonal streams originate from top of the mountains of watershed which bring loss soil and mud from these mountains. Main source of Sadpara River is Deosai plains where thousands of livestock rear in summer season and their shelters are being constructed on the right and left banks of the river as well as they mostly contaminate the water by open defecation in the stream-fed water rivulets. These permanent streams and seasonal rivulets are supplying drinking water to the Sadpara valley, Skardu city and surrounding villages of District Skardu. Sadpara catchment area is very highly vulnerable to erosion of banks, loss soil water contamination by the livestock.

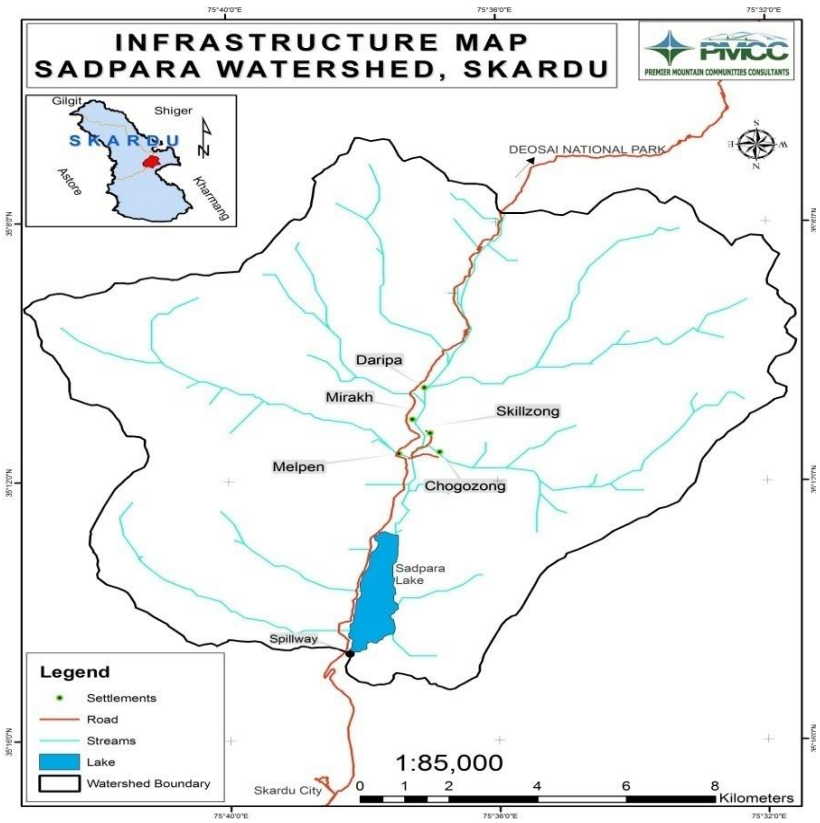

Figure 7: infrastructure map Sadpara Watershed area

2.4 Socio-economic Profile and Responses

2.4.1 Demography and Population.

There are around 289 households in the watershed. The division of the households' in accordance to the sub villages are: Melpin 48, Dari 52, Mirakh 51, Skillzong 64, and Chogozong 74. Many of the households have seasonal residence especially in summer they come to Sadpara only for agricultural activities. These seasonal households have been migrated to Skardu city and surrounding villages because of harsh weather, lack of social facilities and disasters. Total population in the watershed is about 3278 comprising of 49% women and 51% men. On an average, the family size is about 11.3 persons/HH in the watershed. The literacy rate is very low especially in women and high ratio in drop outs in high and higher secondary level. The percentage in higher education even of male is not satisfactory in the watershed area. Poverty is the main cause of poor educational status which compels both female and male to quit their education at high and higher secondary level. Mostly, male go to Skardu city as well as other cities for jobs, labor work and female remain engage with domestic work.

There are many factors driving people for migration from watershed but most common are the lack of social services, poor infrastructure network, poverty, least job opportunities, increasing natural disasters, low productivity of agricultural, erosion of agricultural land, high flood ratio in streams, un secure food situation, high fluctuation of electricity, lack of drinking water and low agricultural land. Almost all the migrated people interviewed said that they migrated to Skardu city for better facilities and livelihood. Migration trend is continuously increasing because of encroachment of flooding streams and disasters towards left and right banks of the streams as well as seasonal Nallas. Forest in the watershed is sever condition which even could not provide fuel wood for the population of the watershed for the dreadful of the winter season. The agricultural activities hardly provide food only for three months and the population in the watershed is at high risk about food security. Most of the population is engaged with agricultural activities along with skilled and unskilled labor work. Some of the people are engages with tourism sector as well and the area has shaped very famous mountaineers who have claimed more than six highest peaks in the world. Mountaineering has a vast scope in the watershed area if government pays a considerable attention towards the sector in watershed area.

2.4.2 Institutions

There are significantly lower number of social organizations and institutions in the watershed as compared to other areas of Skardu district. Their involvement in the conservation of the watershed is also not considerable. Neither the community nor the government departments put considerable efforts to mobilize the inhabitants of the watershed towards conservation in terms of water, forest and natural resources. There was no any water consumers committee and watershed management committee. However, a community representative committee has been formed locally to lend a helping hand to implement a project approved by the GB government for watershed area. These members only lend their helping hand because they are neither organized nor have any proper organizational setup. This community representation committee can be formally organized and train them to mobilize the population of watershed. There is a forest conservation committee locally formed by the Sadpara community which has traditional system of operation and maintain customary laws applied on the forest since old ages. However forest coverage steadily decreases as mentioned by the community members due to the lack of resources to strengthen their capacities to conserve natural resources especially forest and water sources. There is dire need of efficient, organized, and self sufficient institute which could mobilize the community to conserve natural, forest and water resources in the watershed area.

2.5. Economic Activities, Production and Food Sufficiency

Agriculture, livestock, wage labor, and self employment through trade and tourism including hoteling, tour guide and mountaineering are the major sources of livelihood in the watershed. The major source of sustenance of 90% family is wage labor (skilled and un skilled), 100% population is engaged in agriculture in any form fully or partially; 100% of the population have livestock but in minimum numbers of (2-3 animals). Decade ago people had large numbers of livestock flocks but this numbers have decreased and currently few households have more 30 animals (goats and sheep) in watershed. Every house hold has land holdings but agricultural land is also decreased because of distribution, disasters, floads and land erosion. Every house hold in the watershed holds minimum of three Kanal of agricultural land and maximum ten Kanals. Next to agriculture, wage labor (skilled & unskilled) is the highest source of income for livelihood and sustenance. Most of the labor population work in Skardu city and surrounding areas as

well as few are working in other parts of GB and Pakistan. Some of the households earn their income from self employment especially from trade and tourism including mountaineering, pottering and tourist guiding. Mountaineering is significantly contribute to the income of the population in watershed. Government and private job remarkably contribute to the income of the communities of watershed.

2.6. Land Holdings (Cultivated and Barren Land) and Production

Almost every inhabitant of the watershed is holding a piece of agricultural land, cultivable land, forest and barren land. Cultivated land is so for very limited which ranks from minimum three (3) kanal to maximum ten (10) kanals only. They have cultivable, private forest (limited) and hundreds of kanal barren land. The land distribution in the watershed is hardly 1.7% cultivated 3.3% cultivable and 95% barren land where social forestry can be grown. 100% of the population has their own land for agricultural land irrigated by the channel water from nearby streams. The channels usually damaged because of high floods in streams and disasters annually. Most of the barren land situated on the mountains where forest can be grown through social forestry system.

Cultivated land has low fertility and production because of lack of awareness about modern agricultural techniques and technology. Mostly of the population cultivates potatoes as a cash crop, wheat and vegetables as cereals for domestic use. Potatoes have average production while wheat and vegetables have low production. Most of the farmers follow traditional farming techniques and they neither aware about the modern farming techniques nor about modern agricultural technology. Lower production is the result of lack of awareness, lack of scientific study, soil investigation, and natural disasters. Farmers use DAP fertilizer and pesticides without soil investigation to increase production which causes many other troubles major of that is water contamination in the Sadpara dam.

Food production from cereal crops in the watershed is trivia and is not meeting the requirements of the existed population. They hardly meet the requirements of wheat for only 1.5 months, 3 to 5 months of vegetables.

Furthermore, average total food availability is only for three months of the year. The food is deficit for 9 months in the watershed. This is because of low productivity, high ratio of loss while and after harvesting, changing of rain and climatic condition, insufficient land for

Cereal crops, traditional farming practices, lack of innovative farming techniques, lack of irrigation facilities, no soil investigation and research and many other reasons. Although the land availability for cereal production is very limited in the watershed, the production can be increased by conservation farming practices along with the use of modern techniques, technologies and practices. So, high value crops, nitrogen fixing crops, and agro-biodiversity should be promoted in the watershed rather than cereal crops.

2.7. Livestock and Fodder Status:

Livestock Types	Livestock in Numbers.				
	Melpin	**Skillzong**	**Chogozong**	**Mirakh**	**Dari**
Goat, Sheep	200	360	600	100	500
Cow/Buffalos	65	360	160	120	50
Zo/Zomo	05	180	120	5	80
Total	**270**	**900**	**880**	**325**	**630**
Average	**6.625**	**14.06**	**11.89**	**6.3**	**12.11**

Table 2.3: Existing Livestock in the Watershed by Sub-villages

Livestock is the one of main sources of income in the watershed. Mainly there are three types of livestock exists i.e. Goat/sheep, Cow/Buffalo and Zo/Zomo (cross breed of Yak). Chogozong and Skillzong villages are richer comparatively to other sub villages of the watershed as they have more number of livestock.

Average livestock in Skillzong is highest as number of livestock is about 14 per HH and lowest is Melpin 5.6 per HH. According to the farmers and elders of the watershed this ratio was higher a decade ago. But there is no any proper historical literature and data available.

Conventionally open grazing system takes place in entire watershed especially in Autumn and Winter seasons even in cultivable lands and private forest. In summer livestock remains in the Deosai plains and other mountains for open grazing which is the common property of all villagers. Because of open grazing, particularly in Deosai plains and other mountains, livestock is contaminating water resources especially of the fresh stream waters by open

defecation. Famers have even constructed livestock shelter besides the streams to facilitate their animals for drinking water. This is a devastating situation for the Sadpara dam which is the main source of drinking water of entire Skardu city and surrounding villages.

Fodder status within the watershed is concerned, annual fodder requirements is also lower as farmers mentioned. They have less fodder cropping land because of that they rely on open grazing mostly. Livestock damages forest trees, flora fauna and water resources while open grazing in the forest and this is mainly due to lack of proper knowledge and resources (like ponds for animals drinking water, protected areas for new forest and) about livestock management and its benefits.

2.8 Infrastructure:

Deosai Road is the main road in watershed area that connects watershed with Skardu city. During construction of Sadpara dam the road was converted to Right Side Mountain. Road remains blocked usually in rainy, windy and snowy seasons. During spring season it faces avalanches and land sliding especially rock falling from mountains because of melting of snow. Moreover, link roads' network within the watershed is also vulnerable that remain effected because of flood water. Community of Skillzong and Chogozong usually faces hindrances during water raise in summer and flood in Deaosai stream. The main Deosai road near Melpin remains effected by the stream water and flood.

There is twenty to thirty minutes drive from Skardu city to the watershed but every road including Deosai road, in the watershed is being constructed haphazardly without taking any deterrent measures to control erosion and landslides. There are no any protective side walls as well as drains even on the main Deosai road. As a result soil erosion and stone falling remains continuously on the main Deosai road. As a result watershed faces dangers of soil erosion and landslides during rainy, snowy and windy seasons.

Water channels are constructed by the communities for irrigation usually damages at headwork because of floods and raising water in summer seasons. Protective bunds and safety walls are urgently required to save the agricultural land, soil erosion and bank cutting of the streams. Bank cutting and soil erosion is the main cause to silting the Sadpara dam which reduce the life of Sadpara dam. Check dams can also be constructed in the upper areas of the Nallahs to prevent the soil deposits in the available and identified spaces of Nallahs.

Toilet facilities are not available in the watershed area. Only 10 to 20 percent of the population has the toilet facilities and these facilities are reserved for the guests especially. Most of the population uses open pit toilets for defecation. These open pit toilets are harmful for public as well as main source for contaminating fresh stream water. Many people of the watershed area use open space as toilet along stream banks. This is the high risk for surface water contamination in Sadpara watershed due to insufficient quantity and quality of toilet facilities.

Melpin, Dari and Chogozong clusters have access to community managed tap drinking water while Mirakh and Skillzong have no access to tap water. They fetch water from streams and irrigation channels for drinking and domestic use. That is harmful for public health because livestock also uses same sources for drinking water.

2.9. Fuel Wood and Energy Requirements

Fuel wood is the main source of energy for heating and cooking for the people of watershed. People collect fuel wood from the forest and especially for winters. Their private forests could not meet the requirements of the fuel wood for heating and cooking. The sources of fuel wood decreasing with the passage of time which causes deforestation and environmental degradation. The population totally depends upon the fuel wood because of lack of alternative energy resources in the watershed. Fuel wood consumption rate is very high because of severe weather conditions as winters are longer then summer in the watershed. There are no alternative energy sources because of that region faces shortage in energy sources which causes deforestation in the region. Because of that forest quality is worst in watershed.

2.5.4 Awareness of Communities and Stakeholders

For sustainable water conservation both at community and stakeholders must be aware about negative changes in the watershed area and water resources. Conservation practices to sustain watershed condition are of major concern in the watershed. At community level communities are satisfied of the current conditions except disasters and floods because they are unaware about the threats and future issues. As per our field visits to the water shed area, there is dire need of proper conservation plan developed through participation of communities and conduct community awareness sessions about watershed and resource conservation. It has been observed during field visits that mostly the farmers

practice conventional farming by plugging for cultivation on slope lands. Terrace farming and proper water outlets are not yet introduced in the watershed to save fresh stream water from contamination and higher the production. Communities are completely unaware about inter cropping practices on slope lands. Communities are unaware about conservation of water resources, fresh water availability, importance of forest, consequences and causes of deforestation. They only dependent on fuel wood for their livelihood. For sustainability of the watershed, perceptions of the communities need to be transformed and a concept of a win-win relationship between supply of watershed services and community's needs need to be built. Consultants and experts believe that this can be achieved through: Capacity development programs (for communities and stakeholders), alternative energy and capacity building for scientific agriculture framings, control mechanism on the uses of services, substitution of settlements from the banks of fresh water streams and water sources. Furthermore, professional development trainings for the staff of forest department and exposures of study visits for the high officials for mountainous countries like Nepal, Bhutan, Thailand, Malaysia etc should be organized for knowledge transformation and batter conservation of watershed. On the other side, the stakeholders especially the GoGB has not passed any watershed and soil conservation act for sustainable watershed management. No any policy has been made in Gilgit Baltistan for the development of water and natural resources. As the watershed of the Sadpara dam supplies drinking and agricultural water for the whole population of Skardu city and surrounding villages. However, the command area faces shortage of water in terms of quality and quantity. There are no activities on behalf of the agriculture department as well as livestock, public health engineering department, water and power, forest wild life department, WAPDA, etc. for conservation of watershed area.

In the above prospect all the stakeholders of Sadpara watershed area have shown positive responses to address negative influences on the watershed conditions during Multi-stakeholder's consultative session. The negative impacts and tentative solutions has been reflected concern chapter. The perception acquired from the Multi-stakeholders session gave a clear picture of community participation in the watershed conservation activities and watershed management. These communities may meet the current needs of livelihood of local communities without compromising the future needs of future generations. The study also shows that the local stakeholders themselves can address their problems related to watershed management.

Chapter. Three.

Economic Valuation of Goods and Services

3.1. Introduction

Sadpara watershed is very imperative for Skardu city and surrounding villages for providing drinking water, generating hydroelectricity, and water for irrigation, water for domestic use (washing, cooking, and cleaning). The watershed also provides facilities to biodiversity, fodder for livestock, herbs, fuel wood, timber, and medicinal plants. Water users of the Skardu city are facing water issues especially contaminated water and shortage of water for irrigation because of the improper watershed management in upper streams. Water quality is much below than national water quality standards. It is very deteriorating and is found to unsafe especially during floods and summer season. This is because of the pesticides used in agricultural activities, livestock herding in upper streams and open sewerage in watershed area. No any effort has been made yet to protect the fresh stream water from contamination and managing the watershed in past by local and national government.

The inhabitants of the watershed are dependent on this watershed for fuel woods, fodder, woods for construction, and other minor resources. As mentioned in the previous chapters, the observed problems are: lack of social services, lack of alternative energy resources, increasing pressure on the watershed resources, lack of mobilization motivation activities, lack of understanding of ecosystem services and lack of knowledge of the importance of the watershed and its conservation among communities and stakeholders, no watershed management authority and poor or no coordination between watershed residents and government authorities. During the study became in the notice that government department also lack in coordination and communication. There is no any proper mechanism and understanding among WAPDA, water and power department Gilgit Baltistan, forest department, public health engineering department, tourism, agriculture and livestock departments.

Therefore, there is dire need of a mechanism to conserve this watershed for drinking water supply to the Skardu city and promotion of livelihood of the marginalized Sadpara community. This chapter provides tentative estimate of

economic valuation of services and goods available in the watershed area. these services and goods are directly or indirectly used by the people of watershed catchment and command area of Sadpara dam. The chapter further will explore the opportunities of financial resource creating activities to maintain and conserve watershed and natural resources available in the watershed area.

3.2 Economic Valuation: Lessons Learned

Goods and services are traded in the market and their economic value is indicated by the market price. However, in case of environmental goods and services which are often not traded in the market or are traded in the imperfect markets, their true economic value is underestimated. Inadequate recognition of the true value of an ecosystem is because of the lack of attention by the policymakers and managers who take management decisions are tilted in favor of environmentally degrading practices. It usually results in inefficient resource allocation and thus, depletion, degradation and overexploitation of the environmental resources which eventually lead to loss of social welfare (Barbier, 1991).

Economic valuation methods place consumer's preferences in the center and thus ecosystem goods and services are valued by people are based on the welfare they obtain from them. Economic valuation of a natural ecosystem helps policymaker quantify in economic terms their relative importance, and thus, in deciding the level of investment for their conservation. From the economics viewpoint, investment for conservation would go on increasing until per additional unit cost returns the benefits worth more than or equal to that and has no incentive to invest more beyond that point. However, this principle would not be applicable when there are no choices and alternatives sources for drinking water available for the target people in the project. Thus for analyzing the aggregate costs and benefits from goods and services, through Total Economic Value (TEV) framework, an appropriate managerial policies can be devised for effective management that benefits both society and the health of the ecosystem.

Over the past few decades, economic valuation of non-marketed ecosystem goods and services has received much attention, yet it remains as a challenge and work is in progress (Krchnak, K.M. 2007). For example, it is often difficult to measure reliably the services like natural hydrological functions, sustainable upper stream agricultural

practices and associated protection of command areas against flooding, sedimentation etc. Several tools and techniques can be devised and used widely for valuing the non-market benefits, and costs associated with the environmental and natural resources (Farber et al., 2002). It includes tools like avoided costs, replacement cost, factor income/effect on production, travel cost, etc.

Economic valuation of the ecosystem's goods and services is relatively a new concept, especially in the developing world like Pakistan and deprived region Gilgit Baltistan. During review of available literature on economic valuation it has been noticed that no any efforts on the topic have been made in Gilgit Baltistan. In this study, it is a first and pilot effort to valuate of direct use goods and services. In the study forest, and water has been considered initially to valuate. Although economic valuation requires a detailed valuation of direct and indirect use of all the goods and services available in the watershed to explore and estimate but it requires more financial resources and time.

3.2.1 Valuing Forest

Forest goods especially fuel wood which is consumed for heating and cooking by the population of the watershed. While, timber wood and non timber forest (flora fauna, biodiversity, herbs and medicinal plants) have not been valuated in this section. The fuel wood has been valued according to the annual consumption in the watershed by communities and current market rate of fuel wood in the region. As many of the NTFPs are not traded in the established markets, estimating their value is often harder than that of timber benefits. Most commonly extracted forest ecosystem products from Sadpara watershed are: firewood, fodder, herbs, timber, etc. These goods are usually collected for household use while some of these resources are traded in the local market of Skardu city. Valuation work in this study considers only the fire wood because it has already market rate and demand as well as market prices are available which are used to value fire wood.

3.2.2 Valuing Water:

Water from Sadpara watershed is being used for drinking, livestock and irrigation by the people living in catchment and command area of Sadpara dam. In this study, drinking and irrigation water is considered as intermediate goods that contribute to

agricultural products, as well as finished goods for drinking purpose mainly to Skardu city and surrounding villages. The value of water is considered the national expenditure on the water. According to UNICEF, Pakistan spends $1 on 1070 liters of water while this ratio in the Asia Pacific countries is 128 dollars per litter. WAPDA supplies water from the Sadpara dam to the command area to fulfill all requirements of Skardu city. Their daily water supply estimated and average will be calculated on the given Pak Rupees. One dollar is converted according to market rate of Rs. 105 which is current rate.

3.3 Economic Value of Water and Forest of Sadpara Watershed Area

3.3.1. Water:

As earlier mentioned that Sadpara dam is the main source of water for irrigation, drinking, washing, cleaning, livestock, etc for the Skardu city and surrounding villages. Skardu city is totally depending upon the Sadpara dam for its water requirements. Sadpara dam supplies 7.1 Million gallon (4.5 liters a gallon) daily for irrigation, drinking and other uses to command area. Watershed provides 31950000 liters of water per day to the dam and command area. If the water considers as goods and valuated as per Pakistan's national expenditure on water as mention earlier $1 ($1=105PKR) per 1070 liters. Total value of daily water supply is Rs. 3135280 and then Rs. 94058411 per month. Contrary to that, population within watershed also uses water from this watershed and other water resources which has not been evaluated.

3.3.2. Forest:

As mentioned earlier that forest of Sadpara watershed supplies multiple products but we here valuated only fire wood consume in Sadpara valley annually. Fire wood is mainly used for two purposes one is cooking and second is heating. The fire wood consumption volume varies from home to home. Because it depends upon family members and rooms requires heating. Traditionally kitchens (locally called home) are common place for cooking in the watershed. Kitchens normally remain heated during cooking while other living and bed rooms are required to be heated when these are being used especially at evening and nights. Here an average amount of fire wood has been calculated with HH by considering average size of family and houses. There are total 289 households in watershed (Sadpara valley) all including migrated people.

Local customary rule is that people who are belonged to Sadpara valley but living in Skardu city can take firewood from watershed area for domestic use but cannot sell this firewood to others. This is a collective decision (a good one) to save natural forest and environment. On average every household consumes 2800 kg of firewood annually. Total firewood consumption in watershed is 809200 Kgs annually and price is Rs.20 per kg in local market of Skardu city. Total value of firewood is PKR. 16184000/= (sixteen million one hundred eighty four thousand rupees) per annum in watershed.

Timber wood, fodder, forage, medicinal plants, herbs and many other goods and services of forest are not being evaluated in this study. One can guess about the other goods and services from the above estimations of firewood from the forest.

3.4 Major Benefits of Watershed Management

Gilgit Baltistan especially Skardu district avails large number of benefits from the watershed however, it provides multiple services and opportunities to the communities of watershed as well as to the country. WAPDA has constricted earth filled dam on the previously existed lack to generate hydroelectricity, irrigation water, drinking water, and water for daily life requirements. These services are provided to the population of Skardu city and surrounding villages. Providing fresh water for the inhabitants of the command area is the one of major aims of the Sadpara dam and the aim of this study is to develop a plan for preservation of fresh drinking water as well as saving it from contamination. It further aims to improve expected life of the Sadpara dam through conservation of forest, protection of sedimentation and erosion of stream banks as well as mountains during rains. Sadpara dam and watershed area is a prime location for national and international tourists in Gilgit Baltistan. Annually thousands of the tourists visit the watershed and Deosai.

WAPDA is the sole responsible for the maintenance of the Sadpara dam to generate hydro-electricity and Water and Power department is responsible for distribution and billing. During literature review it has been noticed that there is no any proper understanding among provincial government, WAPDA and Water and Power department. As contacted with officials of these departments no any proper understating was found. Therefore, neither any department has given attention

towards the watershed nor seriously involved in the management and conservation of watershed and resources. Recently, Baltistan circle of forest department, Gilgit Baltistan had made some efforts and seriously looks into the issue with the support of Government of Gilgit Baltistan. This plan is the part of that watershed management project approved by the provincial government.

The assessment does not identify any considerable cost for watershed management except the activities identified in the PC-1 especially of the infrastructure which has to be constructed in watershed area. However, there could be prospect of huge amount cost to watershed communities if they change their current land use system to conservation practices that may results batter hydrological services. As communities of watershed cultivating slop lands using fertilizers and chemicals randomly in agriculture that causes contamination of water and exploitation of forest biodiversity and water resources unsustainable manner. Batter watershed management would result to present hydrological remuneration in the form of fresh and hygienic drinking water for the inhabitants of command area which will defiantly reduce health issues. Furthermore, it will provide continuous water for agricultural activities and domestic use along with other multiple direct and indirect benefits.

The economic valuation of the above goods and other available goods and services of the watershed have huge potential to provide economic benefits through implementing many kind of financing systems including PES (Pay for Ecosystem). The system can be self financing and sustainable if proper mechanism can be developed for obtaining the remunerations and properly utilizing them for the conservation of watershed. This system can be introduced by providing incentives to those who depend on the resources and goods of watershed for their livelihood and involved in the agricultural and livestock activities in upper lands of watershed. Furthermore, the benefits can be shared with the other members of the watershed management. In addition to that financial resources can be generated from recreational and regulating services (these need further study for batter assessment of value). The financial income from these sources can be utilized for conservation of water, forest and other natural resources.

Chapter. Four

Role of Gender in Watershed

4.1 Introduction

Gender equality does not simply or necessarily mean equal numbers of men and women or boys and girls in all activities, nor does it necessarily mean treating men and women or boys and girls exactly the same. It signifies an aspiration to work towards a society in which neither women nor men suffer from poverty in its many forms, and in which women and men are able to live equally fulfilling lives. It means recognizing that men and women often have different needs and priorities, face different constraints, have different aspirations and contribute to development in different ways. (DFID Gender manual 2002. P.6)

Gender analysis in the watershed management looks at how women and men are involved in managing land, water, forest, pasture and other natural resources conservation practices. Similarly, it focuses on their degree of access to control natural resources and decision making processes. It can help to explore the relationship between women and men in the watershed management and open avenues and opportunities for achieving equity between them in the watershed management and its development.

This chapter provides a brief overview of the gender status in Sadpara watershed area. The analysis is based on field observations, focus group discussions and key informant interviews.

4.2 Gender Role in the Watershed in Different Aspects

4.2.1 Household Activities

It was observed in the watershed during field visits that women are more engaged in the domestic and agricultural activities. They spend more time to gather firewood and fodder for household animals. They physically work out in the agricultural fields to grow wheat, potatoes, maize and vegetables. They start working from preparing land to grow crops to watering and harvesting. But after harvesting men usually deal with business persons to sale their cash crop like potatoes. Men don’t spent much time on agricultural activities because they usually go to city in

search of work. Their land hardly provides food only for three month therefore they men have to go for jobs and labor work in the cities to meet the requirements of family.

It has also further noticed that women have more role in water contamination because they use stream water for washing cloth, carpets and other household items. In many places of watershed women direct wash cloths and other items in the streams because they have no any other alternate place and facility to wash mentioned items. However, most of the women are illiterate and they are even not aware about the negative effects of water contamination. They usually let their livestock in the stream water for drinking which is a drastic situation for water contamination.

4.2.2 Land Management

In Sadpara watershed women are more involved than men in land management and agriculture activities. In a day time, women contribute more time for agricultural activities than men because men usually goes out of home for earnings to support their family as life is very harsh especially in winter season which is longer than summer in watershed. They have less job and income generating opportunities in watershed.

4.2.3 Conservation and Preservation of the Resources

Men in the Sadpara watershed tend to have more awareness as they have better knowledge in preserving and conserving croplands, planting and protecting forests and other natural resources for everlasting use because they have to more authority in decision making than women in household and communities based decisions. Although women have more involvement in compare to men in land management, firewood collection, livestock raring and fetching water.

4.2.4 Economic Activities

Sadpara watershed is the sole territory for poor, lower middle and middle class families. All the families do not have enough agricultural land the productivity of the land is also very low because of steep topography and continuous erosion. The area situated in a single cropping zone and mostly the land remains barren in long winters. Therefore, the major occupation of the men of the watershed is laboring

(skilled & unskilled), and few are engaged with the tourists and retail business in Skardu city and surrounding areas. Major occupation of the women is agriculture, domestic household chores, livestock rearing and firewood collection.

Some of the families are engaged with tourists and local business. They have good hotels in Skardu city and even reasonable hotel in watershed. Tourist's guides and mountaineering is a well known sector in watershed and well known international climbers belong to the Sapara watershed such as: Hassan Sadpara (Late), Nisar Sadpara, Muhammad Ali Sadpara and their followers. However, the trade of hotel and tourism is not much beneficial because of short summer season, high ratio of disasters. Recently two hotels on the left bank of Sadpara dam have been vanished completely from existence and the owners get not any financial support for reconstruction of their hotels. According to local people, they prefer not hotel business because they have no financial resources. Besides if this business they have livestock but in small scale because they could not provide fodder throughout the year as they have lack of sufficient pasture and fodder cropping land.

4.2.5 Decision Making Process

Decision making process is one of the key factors to know the gender status in the household and the community level as it plays a vital role in people's participation in utilization, conservation and preservation of natural resources. Here, efforts have been made to analyze the gender status within the households and communities with special emphasis on women's decision making process as compared to their male counterpart. This was done on the basis of responses obtained in the focus face to face interviews and key informant interviews about different activities. It revealed that women in the watershed have least role in household decision and community based activities. In HH activities women have equal role like fetching water, collection of firewood, agricultural activities etc. but they have no any role in participation in communities meetings, social activities, organizational activities, marketing of products, etc.

The issues from the perspective of gender and social inclusion have been focused on agricultural activities, income, awareness about the degradation and conservation of the services provided by the watershed, skills and knowledge related to watershed

management and its importance and on labor contribution and wages and their involvement in the development related works.

4.3. The major issues in this regards are:

- Reduction rate of the forest in Sadpara watershed area found to be higher and that is negatively affecting the health, income and work burden of women;
- Communities of the watershed (both men and women) are not aware about the consequences of natural resource depletion and environmental degradation. If fact knowledge about conservation awareness is virtually nil in the communities.
- Education and training related to watershed management for both men and women is absent.
- There is a massive gap in collaborative decision making among men and women of watershed especially in community based activities, conservation and natural resource based activities, conservation and natural resource management.
- Household activities have more burdens on women while men remain out of home activities. That dis-balances equal participation in developmental activities.
- As a result society could not progress towards development, prosperous, sustainable resource consumption.

Chapter. Five

Sector Wise Problem Identification and Analysis of Issues in View of Conservation

5.1 Introduction

This chapter deals with an overview of the major issues related to watershed identified by the consultant through participatory rural appraisal. These issues and problems have been divided in three main sectors.

- Infrastructure, Social Services (Health, Education, Electricity, Drinking Water), Poverty Reduction (Economic)
- Agriculture, Food Security, Livestock, Fodder
- Forestry, Environment, Water Conservation

The issues and problems related of infrastructure, socio economic, and environmental. The problems identified in the watershed are land degradation, water contamination, food deficiency, flood risks and not enough coordination stakeholders. Likewise, people of command area of Sadpara dam face the problems of water contamination, inadequacy and consequences of environmental degradation in a direct or indirect way. They face health issues because of the water contamination and most of the population suffers from the water borne diseases in Skardu city.

In general, both human and natural forces cause these problems. The human induced causes are free grazing feedings, over exploitation of forest products (specially for fodder and fuel wood) conventional farming practices, dilatation of soil fertility, shifting framings, encroachments of lands, forest depletion and weak relationships among the communities of five sub villages. Meanwhile, natural forces have accelerated the problems and made it even worse. Some of the natural forces that create watershed degradation are: sensitive land system, insignificant land capability for the cultivation, erratic rainfall, floods, landslides, loss slopes, bank cutting of streams, avalanches, harsh climatic condition etc.

5.2 The Problems

The four major problems concerning socio-economic, bio-physical, and institutional issues identified by people of watershed in face to face interviews, Kay Informants interviews and Group discussions were:

1. Insufficient food production and poor income levels;
2. Flash floods, landslides and erosion;
3. Threat to environmental services (water, forest, landscape beauty and bio-diversity); and
4. Weak linkage between communities, watershed management stakeholders and government departments.

5.3. The Issue

In relation to the above mentioned problems, the sector wise issues were assessed and analyzed from conservation view point as well as from the aspect of watershed management and monitoring.

- Infrastructure, Social Services (Health, Education, Electricity, Drinking Water), Poverty Reduction (Economic)
- Agriculture, Food Security, Livestock, Fodder
- Forestry, Environment, Water Conservation

5.3.1. Infrastructure, Social Services (Health, Education, Electricity, Drinking Water), Poverty Reduction (Economic)

The problems identified under this section are:

- Lack of social services in water shed area
- Lack of community participation in development of social facilities
- High ratio of failure of social services projects especially drinking water, etc.
- Poor living conditions and unsafe drinking water**.**
- Lack of primary and secondary health care system, especially at grassroots level**.**
- High drop outs in education especially of women in water shed are**a**
- Infrastructures do not construct according to national standards and disaster resilience standards
- Lack of awareness in utilization of natural resources in sustainable way to reduce poverty from water shed area.
- Lack of health facilities and health awareness programs in water shed area

- Sustainable production and utilization of alternate electricity for the communities of water shed area.
- Lack of awareness among the communities to conserve water resources and running water from contamination
- Lack of adequate capital resources for self-employment especially for poor**.**
- Lack of employment opportunities in dam management institution from Sadpara watershed area
- Inadequate skills and technical capacity
- Loss of property during floods and other natural disasters.
- Lack of disaster preparedness, disaster mitigation and disaster management among communities of water shed area

5.3.2. Agriculture, Food Security, Livestock, Fodder

Problems and issues identified under this section are:

- Low access from agricultural land to market
- Uncontrolled grazing and low milking livestock
- High gap between food demand and supply
- Lack of storage facilities for fruits, food and vegetables
- High input production cost and low production per unit
- Single cropping zone and land remains barren most of the year
- Lack of impact and vulnerability assessment of agriculture products
- High ratio in while and postharvest losses
- Rapid migration from watershed towards city.
- High ratio in erosion of agricultural land
- Disaster hits agricultural land & lower the productivity
- Lack of organic agriculture & farming awareness.
- Low yield animals, fodders and crops.
- Lack of farmer's knowledge about modern agricultural techniques and technology.

5.3.3. Forest, Environment and Water Sector

Following are the problems and issues identified by the communities and stakeholders:

- Inadequate supply of safe drinking water

- Mixing of agricultural waste water with fresh stream water.
- Unplanned disposal of solid waste, agricultural waste water, livestock garbage within water shed areas contaminating natural streams
- Indiscriminate conversion of forest lands and watershed area of the dam into residential and other uses resulting in contamination, siltation and decrease of water storage.
- Unplanned disposal of solid waste within catchment area of watershed contaminating natural streams and Sadpara Dam
- Impacts of climate change resulting into floods and drought cycles
- Increased intensity & frequency of disasters & health issues in watershed and command area
- Depletion of natural resources e.g. water, forest and glaciers
- Lack of proper maintenance of plantations
- Deforestation & forest degradation
- High pressure on the forest because of high demand of fire-wood
- Change of land use from agricultural to infrastructure
- Lack of coordination between departments (forest, environment and water management)
- Lack of awareness about water conservation and watershed management

5.4.Analysis of the Main Issues of Watershed

In this section we will present an analysis of the main issues of the watershed. This analysis is analyzed in consultation with community members, field observations and key informant interviews. During consultation with community members and KIIs guided questions were used.

5.3.1 Land Use of Sadpara Watershed

The land of Sadpara watershed is highly vulnerable for agriculture conservation and agriculture. Watershed has insufficient agricultural land and low production capability for crops farming. The watershed is situated on high altitude in the mountains therefore; it has slop land and degraded with respect to soil erosion. It faces high degradation in Melpin and Skillzong sub-villages because of high ratio in bank cuttings of streams. Skillzong has a mass mountain of loss soil which frequently slips and damages water channels and other infrastructure. Most of the agricultural land is alluvial and depositional surface which causes bank cutting from both sides of the stream in allover watershed and especially in Melpin and Skillzon. Melpin, Choghozong and Skillzong are widely affected from the bank cutting and stream diversion. There is much potential for formation of temporary reservoirs because of falling rocks and sandy clay deposit. This causes high risk of flush floods in the lower areas of these villages. Therefore, it has been suggested to construct permanent check dams in these Nallahs to save deposit in the upper areas. The wastewater of the agriculture flows into the streams directly where farmers use fertilizers, pesticides and excreta of livestock as fertilizer. This waste water highly contaminates the water of Sadpara dam which supplies drinking water to the whole of Skardu city and surrounding villages. Contaminated water causes water borne diseases in command area. (It is rough information shared in Stakeholders meeting by participants that the ratio of water borne diseases is high in Skardu city. It requires verification from relevant departments especially from health department)

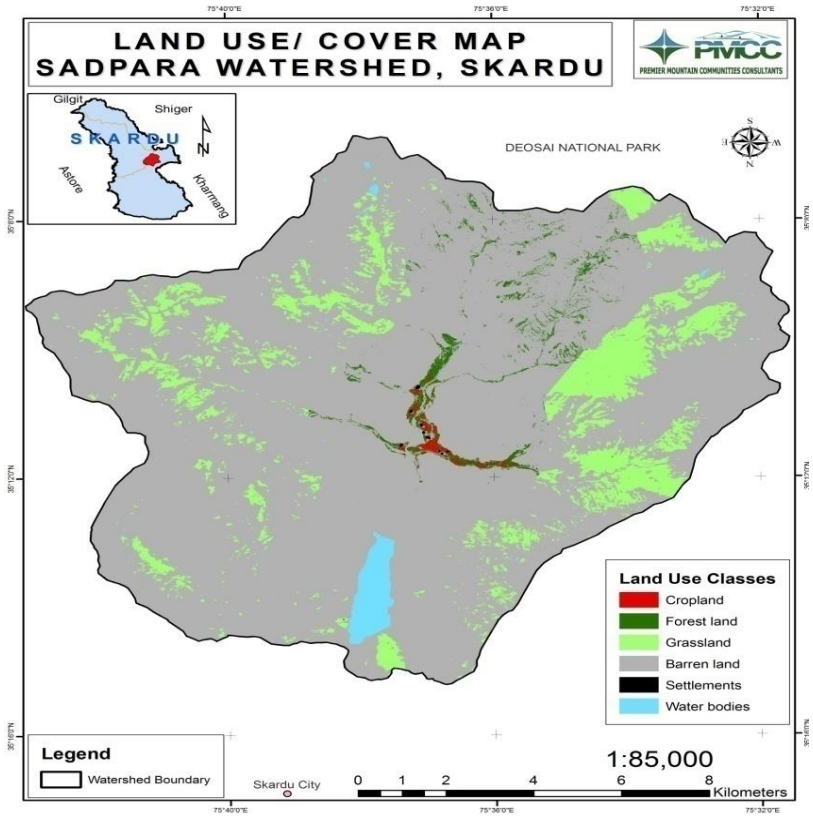

Figure 8: Land Use Map of Watershed Area

The upper areas of watershed especially Daripa region is rocky loam which is not suitable for agriculture and even for plantation of fruit trees. It is more feasible for evergreen plants. It is easily observable that fruit trees could not grow after a specific size and bear less fruits as well. Therefore, it requires forest coverage protection for minimum of fifteen years from human and livestock interventions. On the other side people use available agricultural land for construction of buildings and other infrastructure (roads, schools religious centers, police posts, health posts.etc). Both human activities and natural disasters change the land use from agricultural activities to settlements and barren land. In addition to human encroachment there is no any proper system that has been adopted for effective and efficient land use. Therefore, it is envisaged to high risk if proper land use plan is not adopted. Self governance order 2009 for Gilgit Baltistan has not addressed the watershed management for sustainable consumption and production (reproduction) of forest and water resources in Gilgit Baltistan. Therefore, Government of Gilgit Baltistan must develop land use policies strategy in the view of watershed management.

7.3.2 Water Source Conservation and Water Supply Management

The beneficiaries of Sadpara dam are facing scarcity of water for domestic use and agricultural activities especially in the surrounding areas of Skardu city. Water users use drinking water from Sapdara dam without any purification process and as mentioned earlier that wat5r of the Sadpara dam is mostly contaminated. But the availability of water in terms of quality and quantity depends on the people's land use practices and their involvements in forest zone in the watershed area. Creating awareness about water use and mobilization of community towards watershed conservation can play an important role in maintaining quality and quantity of water. but no any mechanism has been yet developed by any civil organization of governmental department. However, Baltistan circle forest department initiated a project with the help of GB government to train the communities of Sadpara valley. WAPDA is main stakeholder of the dam but there is no agreement between the WAPDA and local communities of the upstream region of the watershed.

Some facts related to water problems identified from the analysis of the study and in the ground level are listed above.

The water quality in the watershed depends on the flood, acid rain and land use practices and human interventions and behaviors and people's understanding about watershed. Significant uses of fertilizers and pesticides and disposal of chemicals discharge of domestic wastewaters and draining water without treatment and contamination risks to the fresh stream water. Development of proper sewerage system, providing alternative facilities for washing and livestock in the watershed, construction treks for animals away from water streams, construction of animal sheds in Deosai plains and upper pasture area away from fresh streams and development of proper agricultural waste water treatment is dire need of time. Other than that these issues are likely to deteriorate water quality in the coming years. Water tested by the WAPDA and Gilgit Baltistan Environmental Protection Agency shows that the water is polluted and very low quality. Therefore, most urgent is providing training in watershed conservation and management especially in water conservation to the communities of Sadpara valley. Construction of check dams and safety walls in nallahs is also dire need to protect from silting and erosion.

5.3.3 Forestry

The forest cover of the watershed has decreased in last two to three decades as mentioned by the local elders. They further mentioned that the community is totally depending upon the forest for firewood in the watershed. That dependency on forest resources is significantly increasing annually and it will continue to be exploited till providing alternative energy sources and development of private forest for the communities of Sadpara valley. Growing private and public forest may reduce pressure on natural and ever green forest. Local communities have barren land where private and public forest can be grown. Fuel wood demand will be increased with population growth therefore alternate sources of energy must be explored very soon. On the other hand vegetative cover determines the condition of the watershed in regards to erosion. Soil conservation professionals say a dense cover of vegetation is the most powerful weapon for reducing erosion (Singh, 1990). Based on the field visit and local consultations, the vegetative cover in the watershed is not satisfactory. But have large scope to increase vegetation cover in Sadpara watershed. However, open grazing of the animals may harm the newly planted plants therefore, it is suggested that control grazing practices should be introduced through consultation with local communities. However, alternative energy resources especially

hydroelectricity can be provided on free of cost to the inhabitants for heating and cooking as dam generates 17 mega watt of hydroelectricity from the water resources of Sadpara valley.

Forest related activities must be divided in two main segments i.e. conservation and development. Existed forest must be conserved from deforestation and further forest must be grown through public private partnership and social forestry.

5.3.4 Agriculture

Only about 1.7% land in watershed is feasible for agriculture while other land is barren. Erosion, bank cutting and disasters decrease the existed cultivable land annually. The major agricultural problems identified are loss of soil fertility due to heavy erosion, degradation of agriculture lands due to free grazing, inad-equate local institutions to address farmers' problems and low animal productivity in the watershed. The main causes of these problems are: farmers mostly practices customary agricultural techniques, farmers moved into labor work for batter earning because agriculture do not have enough income to meet the family requirements annually. The agriculture of the watershed hardly provides food for only three months while people meet their requirements for other months of the year from market. Therefore, agricultural sector must be developed in professional way. Department should analysis the soil and introduce modern techniques and approaches of agriculture as well as high production crops. Farmers do not adopt any conservation measures especially handling waste agricultural water to go into fresh stream water therefore, they should be given training for batter and conservation agricultural practices. Furthermore, farmers do not care about soil management on slope lands during agricultural activities.

5.3.5 Disaster

Sadpara watershed has faced different disasters over last few years. The villagers have lost lives and property during these disasters faced. There is a consensus among the community that being better prepared would have meant lesser losses of lives and property. The main problem and limitations in disaster risk reduction are poor measures enforcement of the existing practices, climatic and non-climatic threats to potential assets and weak mechanism of community to enhance capacity. Upper land

of watershed is unstable soil slopes and farmers did not adopt terrace farming. No measures have been taken by any department or NGO in watershed to control soil erosion. Erosion and bank cutting of the streams in upper region in the mountains cause heavy floods and damages the properties of the communities in agricultural lower land. Therefore, vegetation stabilization should be promoted to stabilize the loss soil. Similarly to protect bank cutting of the streams, and protect heavy floods in the streams a detail bio engineering study from the speed water flow from mountainous region aspect is required for long run stabilization of Loss Mountains and banks of the streams. Construction of check dams especially in the Nallahs of Melpin and Skillzong are urgently recommended to reduces the high pressure of floods which causes disaster in lower lands and silting of Sadpara dam. In low lands near community agricultural and residential areas, structural measures like spur, embankment and gabion boxes are suggested. Mostly in the Nallahs guided walls along the flow of water is recommended because direct hit of the water on high pressure damages the spurs and gabions constructed at banks of the stream. Previously, at the bank of Deosai stream some protective walls have been constructed but structures could not face the flow of water. Most of the walls are damaged within one year and resources are drained in the streams. Contrary to that community led approach consist of disaster preparedness measures like development of Watershed Disaster Management Committee (WDMC) as a community organization is not formed yet therefore, WDMC should be properly formed to cope with disaster at community level. WMDC will organize awareness sessions to mobilize and motivate communities of the watershed for conservation of watershed as well as cope with disasters.

For long term management to control flood risk in lowland, several measures can be adopted. For example, construction of houses and shelters for livestock near to flood zone should be discouraged, systemic channeling of the main-flow should be developed, Plantation of trees to support guided walls should be make mandatory for the farmers to control erosion. Furthermore, bio-engineering measure should be adopted on the overland flow zone, and capacity buildings programmes should be conducted on a regular basis for the community members as they are the first responders to the disasters. For this a Watershed Disaster Management Plan (WDMP) for Sadpara watershed is immediately required.

Community of watershed has consensus on the raise of rainfall after construction of Sadpara dam, further they mentioned that ratio of the disaster is also increased after construction. However, it is a hypothesis which requires scientific study whither it is true or false. The study should investigate the real and factual causes of increased disasters in the watershed however, some common, general and universal causes has been mentioned in this study. Furthermore, current climatic trends shows that frequency of rainfall in the watershed is not much above normal rainfall pattern and situation is not certain for current few years. It varies from year to year and shifted the rain pattern from initial winter season to late winter and initial spring season. As a result ratio of flush floods has increased and natural, physical and human assets are threatened in watershed, Sadpara dam and even Skardu city. Natural assets like agricultural land, forest land, pasture, and biodiversity is threatened. Likewise, physical assets i.e. irrigation system, drinking water supply system, houses, animal shelters, roads and social services providing buildings such as schools, dispensaries and religious centers have threats. Meanwhile, other human assets like human life, psychological strength and knowledge, agricultural and other development intentions also been threatened by continuous disasters and floods in watershed.

Melpin, Skillzong and Choghozong are more prone to flush floods from the streams that originate from the high ups of mountains. These streams frequently change route and deposit sediment in agricultural land and Sadpara dam. In this connection, future hazardous threat to climate change impacts on climate sensitive areas in the watershed needs to be studied. Meanwhile, non-climatic threats like weak institutional mechanism, overexploitations of natural resources particularly land and forest in the watershed have made the watershed vulnerable to extreme weather events. A detail study is required to obtain specific climate change impacts on watershed services of Sadpara watershed area.

5.4 Conclusions

All the problems and issues discussed above in all the sections are practical and solvable by the local government and communities living in the Sadpara watershed area. Initial financial resources may provide by the GB government and further income may be generated from watershed's services. For example watershed provides water for the whole city and surrounding villages and as earlier discussed

that Pakistan spends Rs.105 on 1070 liters of water and this rate can be reduced multiply to generate income for the conservation and sustainability of watershed. Watershed has forest and wildlife and through giving licenses for legal hunting of wildlife and cutting of old trees as timber to generate huge amount for watershed. Sadpara dam and watershed has attraction for tourists and annually thousands of local, national and international tourists visit the dam, watershed area and Deaosai plains. A nominal fee can be charged from tourists as donation for conservation of dam and watershed and that may be collected through watershed management committee which can be notified legally by the government of Gilgit Baltistan. Likewise, other services like agriculture, fuel wood, herbal and gemstone exploration may generate income for watershed. There is a huge deposit of stones which can be leased to produce crush pebbles for construction use as demand of crushed pebbles is high in Skardu city. These pebbles can be easily supplied to Skardu city as it has easy approach from watershed to Skardu city. Boating in the dam, and fishing in the dam can generate huge income for the watershed as well.

WAPDA produces hydroelectricity and sales it to local consumers in Skardu city and surrounding villages through GB water and power department even to the inhabitants of watershed. However these (WAPDA and GBW&PD) department have no proper understanding which can be bring under a proper system and spare five to ten percent or any other amount of total income can be fixed for watershed conservation and management.

Some other issues such as traditional agricultural practices can be altered to improved agricultural practices through trainings and community mobilization. Dependency on forest resources can be reduced thorough providing alternative energy resources and private forest development for firewood in the communities, infrastructure development especially to control bank cutting and silting; spurs, check dams and guided walls can be constructed in the Nallahs. Rehabilitation activities are important as there are many water channels which have been damaged by the floods and disasters. Soil stabilization is a huge issue which can be addressed through bio engineering, social forestry, efficient irrigation system and construction of protective walls.

Economic opportunities can be provided through green house vegetable production in winter, grow herbal and medicinal plants, and proper land use and increase livestock breed. Value added products can be produced through from meat, milk and fur of the livestock. Fur of livestock can be properly utilized to produce traditional handicrafts, carpets and dresses which have enormous demand in national and international market. The communities will be required small financial support and training for generating these products. In fact these problems and issues provide a basis for developing the appropriate policies, strategies and programs which are discussed in the next chapter.

Chapter. Six

Suggested Activities, and Strategies,

6.1 Introduction

Sadpara watershed management plan is conceptualized based on the vision to develop a strong ecosystem to enhance the projected life of the main water source (Sapara dam) which is the life line for the inhabitants of Skardu city and surrounding villages.

This chapter suggests activities and strategies to promote ecosystem services for sustainable development, conservation of natural resources, and harmonized the stakeholders of the watershed for watershed management. These activities and strategies have been divided in below three main areas:

1. Social Services Sector (Health, education, drinking water, electricity, poverty reduction, infrastructure)
2. Agriculture, Food Security, Livestock and Fodder
3. Forest, Environment and Water

6.2. Social Services Sector

(Health, education, drinking water, electricity, poverty reduction, infrastructure)

6.2.1. Introduction

Effective public service delivery is fundamental for conservation and development of any watershed area. Harsh climatic and geographic condition, Low level of economic activities, frequent blockage of only linking road, destroying floods, landslides and weak infrastructure in the watershed enlarges the need of social services that is the fundamental pillar of social protection. Core public services such as: education, health, drinking water, sanitation, electricity, infrastructure and social safety such as income generating opportunities to tap the poverty are key factors of social safety of the watershed communities. Social safety of the inhabitants is the integral for batter conservation and development practices in the watershed. As they have direct influence upon the natural and water resources of watershed. In addition to that they are also important for nurturing a capable and mobilized workforce to

generate income for themselves considering the future generations through sustainable development of resources. Providing basic living facilities to communities of the Sadpara watershed will impart long lasting impressions on the conservation and management of watershed.

Access to education in the watershed area especially for girls is problematic therefore ratio of the drop outs in middle and secondary level is higher than Skardu city. Girls as well as boys could not complete their education because of higher investment on education which they cannot afford.

6.2.2. Goals and Objectives to be achieved:

The main goal of the section is to ensure all the social services available for the communities of water shed area in terms of quality and quantity. Following are the objectives identified to achieve through public and stakeholders participation in sustainable development and conservation of watershed.

- Ensure safe and disaster resilience infrastructure in the water shed area
- Ensure availability of qualitative social services in water shed area
- Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.
- Ensure that all learners acquire the knowledge and skills needed to promote sustainable development, conservation of natural resources in a sustainable way to reduce poverty from water shed area.
- Ensure disaster preparedness, mitigation and management services in water shed area.
- Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.
- Ensure healthy lives and promote well-being for all at all ages in water shed area.

6.2.3. Suggested Activities and strategies to achieve the above goals and objectives:

- A study (PRA suggested) should be carried out to identify and evaluate the conditions of available social services and need identification survey to identify social services needs.

- Conduct awareness sessions and workshops for community members of water shed area to avail and best utilization of social services for the betterment of communities.
- Communities should be organized into different volunteer organizations for sustainable development and implementation social services projects.
- Public private partnership should be encouraged to promote quality and affordable education in water shed area.
- Motivation sessions and workshops should be conducted for community members especially women to motivate to enroll out of school children and reduce drop out ratio particularly in context of girls education.
- Project maintenance committees should be formed comprising of community members and govt. line departments who will look after the social services projects after completion of the projects.
- Upgrade existing dispensary of the water shed area
- Introduce health and environment club in the schools.
- Health and hygiene training programs to be introduced for community members especially house hold members and youth in water shed area.
- Incorporate environmental health and healthcare waste management components into training programs.
- Encourage private sector participation for alleviating poverty.
- Encourage and facilitate participation of civil society organizations including CBOs in poverty alleviation programs.
- Upgrade human resources, especially women and other vulnerable groups, through increased allocations for education, skill development, health, agricultural development and environment.
- Skill development with the objectives of ensuring employability.
- Increasing productivity and value addition in agriculture to increase employment opportunities and poverty reduction.
- Increase tourism (Especially ecotourism) and provide professional training to the youth of the water shed
- Provide best opportunities to the existed climbers and provide climbing training to the new comers

- Establish a climbing training institute for the novice climbers as Sadpara has strong strength in the field
- Intensive information, education and communication campaigns will be developed and implemented to promote water conservation and cleanliness.
- Invest in proven methods and technologies to minimize wastage (e.g. in the agricultural sector), promote conservation and gain efficiencies.
- Protect groundwater through management and technical measures like regulatory frameworks, water licensing, artificial recharge especially for threatened aquifers, and adopt integrated water resources management concepts.
- Intensive information, education and communication campaigns will be developed and implemented to promote water safety, water conservation and its sustainable use and safe hygiene practices.
- Capacity building and developing the knowledge base to manage the canal delivery water system in water shed area.
- Develop and implement a water policy using an integrated water resources management (IWRM) approach
- Invest to upgrade the existing transmission, distribution infrastructure to provide hydroelectricity from WAPDA electricity generation system
- Strengthen the existing small hydroelectricity plants in the upper streams to provide continuous energy supply especially in the winter session
- Establish a hydroelectricity power plant to provide energy for heating and cooking for the community of water shed area
- Disseminate fuel efficiency cookers and energy saving devices such as fluorescent bulbs, as and when they become cost-effective.
- Improve traditional sewerage systems' infrastructure and install new sewerage systems on an urgent basis to safe stream water from contamination
- Ensure Compliance of building by laws in the new and existing buildings especially in the context of mountainous regions.
- Develop Mechanism for lying of infrastructure services like drinking water supply network, sewerage and drainage line as per contextual planning regulations especially according to the mountainous regions' development planning

- Disaster resistant buildings and infrastructure by supplementing the mountainous regulations for construction.
- Arrange public services such as fire and rescue services, emergency medical services including ambulances as well as law enforcement for the watershed area.
- Empower local bodies (CBOs, government departments) with human and technical capacity to handle the collection, transport and disposal of solid waste.
- Improve transport services by adopting and developing alternate transportation facilities especially route from Skardu city to water shed area. Existing route is highly vulnerable especially during rainy, snowy, and windy seasons.
- Construction of Protective Bunds, guided walls in the seasonal streams and permanent Nullas to protect bank erosion
- Construction of check dams in flooding Nullas of water shed area to protect the dam from floods
- Arrange concern field oriented training programs for community members especially for youth and women
- Strengthen local institutions especially community based organizations and introduce modern organizational behavior in the organizations for smooth operation and sustainability of the organizations to increase water and conserve water and other natural resources.
- Ensure women and persons with disabilities' participation in economic activities to increase their empowerment through providing skills in domestic activities, food processing, fruit processing, value addition in agricultural products, handicrafts, home industry and entrepreneurship.
- Establish inclusive business centers of the local products to promote value addition and natural resource conservation and increase employment opportunities for all sectors of the society in the water shed area to decrease pressure on natural resources especially forest.
- Sensitize and train the communities of the water shed area to adopt sustainable consumption and production approach to minimize negative impact on environment, forest, water and natural resources as increasing

demand of energy, food, water and other resources has resulted in resource depletion, pollution, water contamination, water resources depletion (melting glaciers rapidly) .

- Strengthen mechanisms of modern communication, information and extension networks and utilize them effectively for the promotion and conservation of natural resources to strengthen water resources and increase expected life of Sadpara dam which is the main source of drinking water, water for domestic use, agricultural and power generation.
- Encourage research at location, organizational and departmental level with a focus on water shed management and natural resource management in Sadpara water shed area.
- Focus on investment on human resources at higher education, technical and professional education level so that they can play a vital role in sustainable development.
- Promote tourism and train local inhabitants in echo tourism and natural resource conservation and development.

6.3. Agriculture, Livestock, Food Security (ALFS)

6.3.1 Introduction

Less than 2 percent of the total land in the watershed is arable and it requires considerable investment in irrigation. Watershed has significant opportunities to scale up the livestock to cope with the food security challenges. Contemporary challenges mainly in the sector are the gape in cereals, livestock, commercial fruits and food security for the inhabitants of the watershed. They face low productivity such as farmers have low yielding animals and agricultural crops. The cost of providing inputs is higher (in shape of seeds, fertilizers, harvesting, fodder and efforts) while output from livestock and agricultural crops is comparatively very low. Distance from the market, inadequate transport, and lacking storage infrastructure affect the marketability of the

existed products. This hampers the attention of the farmers towards agricultural activities and inhabitants are at high risk in food security. Moreover, value addition practices in agricultural and livestock products are scarily not practiced in watershed even much scope has been identified in the sector. Organic milk and meat products as well as agricultural and fruits products can be introduced for the tourists as watershed has great attraction for national and international tourists. Enhancing the transformative role of the agricultural sector and strengthening management of livestock is important in watershed. The sector requires actions to enhance productivity, providing storage and processing facilities, mitigate production losses, boost commercialization through value addition and scale up horticulture and high yielding animal breeds. Contrary to that building the capacity of farmers and relevant departments to coordinate their activities with community members and service providers (hotels, guest houses and tourist outlets) will be important to develop the sector as well as watershed management.

6.3.2. Goals and Objectives to be Achieved:

Agriculture, livestock and food is the primary source of livelihoods for the people of watershed therefore, main purpose of this sector is to meet the food requirement of the inhabitants of watershed and command area of Sadpara dam, and promote sustainable agriculture, livestock and fodder in watershed.

- To achieve food security for the people of watershed through enhance productivity, mitigate production loss, boost commercialization by value addition in the agricultural and livestock products.
- Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production to eradicate extreme poverty, high food security, reduce drought, flooding and other disasters to improvee land and soil quality
- Introduce high yielding animal breed and value addition practices to accelerate farm activities to ensure food security in watershed area.
- Enhancing the transformative role of ALFS sector to strengthening the natural resources especially forest, wildlife and water in watershed area.

6.3.3. Suggested Activities and strategies to achieve the above goals and objectives:

- Focus on on-farm crop residue and waste management and optimal fertilizer use.
- Focus on improving water use efficiency for irrigation through using sprinkler and trickle irrigation and encouraging on-farm water management.
- Introducing of high yielding animals as mostly farmers has low yielding animals.
- Encourage traditional use of inorganic fertilizers in agricultural activities to reduce health vulnerability.
- Promote water efficient and low-delta crops in watershed reduce pressure on drinking water for Skardu city.
- Rehabilitation of road from farm to market access.
- Provide training to the farmer to adopt environment friendly agricultural practices
- Restore and rehabilitate the traditional water channel systems in watershed catchment area as disasters has damaged many existed water channels
- Construction of new water channels on the left and right bank of Sadpara Nallah to increase arable land in watershed area.
- Increase productivity by promoting value addition by making it income generating activity in agriculture and livestock
- Impart on farm trainings to the farmers of watershed.
- Introduce community managed free grazing on the high pastures and common community areas.
- Provide training to farmers of watershed about modern agriculture technique at community level.
- Promote sustainable harvesting and safe storage of agricultural production and food items.
- Encourage and facilitate the participation of civil society organizations including CBOs in the programs and projects.
- Up gradation of the existing irrigation infrastructure in the watershed to make it resilient to disasters especially construction of spurs and protective bunds on water channels
- Introduction of high yielding crops and animal breed in watershed area.

- Provide training to the farmers for promotion of horticulture in the watershed as area is favorable for horticultural activities
- Provide training to farmers on while/post harvest technique and handling of crops to mitigate the production losses
- Promote commercialization activities through value addition in livestock and agricultural products and encourage innovations along the value chains.
- Provide technical and financial support to the farmers in value addition, processing and marketing
- Developing infrastructure especially of storage facilities, fruit and food processing to meet the food requirements
- Restoration and development of agriculture land for food and fodder production as large area of agricultural land is affected by flood in watershed
- Encourage access to markets through improve road infrastructure and transport facilities.
- Facilitate farmers in packaging and labeling of value added organic products.
- Promote farm forestry practices by planting multipurpose fast growing indigenous species to meet the needs of food, fuel wood and fodder for livestock.
- Encourage public and private investments in the sector.
- Develop new varieties of crops which are resistant to cool stress, less vulnerable to heavy spells of rains, and less prone to pests and diseases.
- Introduction of contour and terracing.
- Construct separate tracks to high pastures for livestock from water ways/streams
- Vaccination schedule program should be followed to reduce the mortality of livestock.
- Adopt Sustainable Consumption and Production principles to ensure food security for all through food availability, food access, food use, utilization and stability.
- Approach leg assembles for subsidy on agriculture inputs.
- Adopt agricultural practices like crop diversification, proper cropping patterns, optimized planting dates keeping in mind the climate change and geographical trends of the watershed area.
- Use integrated engineering, cultural and biological soil conservation solutions to prevent soil degradation.

- Control soil problems like water logging, salinity, and soil structure deterioration, soil and water erosion.
- Implement crops zoning strategy through research by agriculture department.
- Strengthening hill torrent irrigation system for increasing productive land area.
- Encourage agriculture drought and disaster management practices to tackle desertification.
- Coordination for social analysis with respected departments.
- Formation of community based marketing association and strengthened them through technical and financial assistance.
- Focuses on improving water use efficiency for irrigation system and improving/living of water corners etc improving water storage rain water harvest.
- Promote water efficient and low delta crops.
- Increase per unit income by promoting value addition in agriculture and livestock products.
- Impart on farm training for farmers of watershed for batter management of agricultural and livestock farming
- Restore and rehabilitate the traditional water channel system and water drainage system
- Introduction of high yielding crops.
- Land development and restoration of Agriculture land affected by recent flood.
- Introduction of contour/terracing.
- Community awareness about organic farming.
- Construction of check dams, water storage/tank /pouch in seasonal nallahs.
- Crops going strategy through Agriculture research.
- Construction of storage facility at village level.
- Coordination with respective department for foil analysis.
- Formation of community based marketing association.

6.4. Forest, Environment and Water

6.4.1 Introduction

Forest, environment and water are the key resources of the watershed area and management of these key resources is main purpose of this watershed management plan. Management of forest and water resources basically requires policy actions however; community involvement is the core for the management of forest, water and wildlife resources. The resources should be linked with the financial benefits for the watershed community through income generating opportunities such as: eco-tourism, trophy hunting (trophy hunting is widely experienced in GB which has great impacts and results), developing pay for ecosystem development mechanism etc. Providing hydro electricity for domestic requirements such as cooking and heating will be a catalyst for forest and water resources conservation and development. Watershed area faces swear, harsh and long winter season and community depends upon forest fuel wood for cooking and heating their houses. Average household consume 2870.58 kg (71.76 mun) of fire wood annually in watershed area and the whole watershed community consumes 829600 Kgs. (20740 mun) of fire wood. All this fire woods is being extracted from private and public forests. On the other side timber wood requirements are also meet from the forest for construction purposes. Increasing hydroelectricity supply for heating and cooking will reduce pressure on forest and environment therefore communities should be provided free or subsidized electricity to save the environment, forest and water resources.

Moreover, there is a large scope in plantation in water shed area especially through slope stabilization. Watershed is a mountainous region therefore; slope stabilization techniques will be fruit full for forest development and soil conservation. Furthermore, due to integrated nature of watershed, negligence of one sector affects largely on other sector as well. Such as fodder shortage for livestock emphasizes towards open grazing in pastures and forests where animals affects on natural regeneration of forest. Therefore, control grazing should be introduced through CBOs and community participation. Agriculture and livestock departments should invest in fodder and fodder producing crops and high yielding animals. For forest regeneration, forest department can introduce private forest growth with the help of communities. Department can establish private forest nurseries to grow forest trees and these trees can be purchased from nursery to provide communities.

Environmental sustainability mostly depends upon forest, bio diversity, water resources and land development. Therefore, management of forest, water and land development is core to sustaining the environment. Plantation of trees on rangelands and denuded lands and fencing them to avoid open grazing will impact positively on environment. Planting forest trees on farm land should be discouraged because it will reduce cereal, food and fodders capacity which ultimately impacts on forest regeneration. Commercial harvesting of forest for timber from private sector must be combined with successful regeneration of forest. Watershed communities requires to be encouraged to conserve forest and water resources through designing activities to generate economic incentives such as providing free electricity for cooking and heating especially in winter seasons; developing pay for environment system; eco-tourism. Prepare a feasibility study to redesign forests as watershed forests and delegate management responsibilities to the respective communities through their

community organizations to overcome conflicts between communities and government departments.

6.4.2. Goals and Objectives to be achieved:

Ensure availability and sustainable management of water, forest and environment resources for all.

- Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous waste agricultural and domestic water and reduce contamination of fresh stream water by livestock.
- Ensure sustainability of environment in watershed area.
- Reduce pressure on forest and sustainable develop of forest through forest regeneration, afforestation and slope stabilization.
- Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation in watershed area.

6.4.3. Suggested Activities and strategies to achieve the above goals and objectives:

- Intensive information, awareness and communication campaigns can be developed and implemented to promote water, forest, and environment conservation.
- Construct check Dams to save the flooding in the seasonal and permanent nallahs to save the silting and increase the life and capacity of dam down to meet local water requirements of Skardu city and surroundings.
- Invest in proven water irrigation methods and technologies to minimize wastage (e.g. in the agricultural sector), promote conservation and gain efficiencies from available water and forest resources.
- Capacity building of the communities and developing the traditional knowledge base practices to manage the canal delivery water system in watershed area.

- Promote farm forestry practices by planting multipurpose fast growing indigenous species to meet the needs for timber, fuel wood and fodder for livestock.
- Develop appropriate programs at the watershed level to increase forest cover.
- To increase forest cover, provide incentives and alternative sources of energy, like hydro electricity for cooking and heating in winters, liquefied petroleum gas (LPG), solar energy and micro-hydro power stations, to the local inhabitants and to substitute firewood in the upland.
- Introducing fuel efficient stoves and insulation of house using of indigenous knowledge to reduce swear winter pressure.
- Implement regulatory frameworks, and customary laws related to water consumption for agriculture and adopt integrated water resources management concepts.
- Risk mapping for possible avalanches, mud flow and landslides in vulnerable mountain areas should be developed and precautionary measures taken accordingly by infrastructure development such as protective bunds, gabions, check dams and protective walls on erosion sides.
- Employ a participatory approach in water management that will engage all stakeholders, particularly marginal groups like women and poor.
- Strict enforcement of Forest Protection laws in particular to limit and control powerful timber interests.
- Implement National Drinking Water Policy and National standards for drinking water at all levels
- Protect stream water through management and technical measures like regulatory frameworks, water licensing, artificial recharge especially for threatened aquifers, and adopt integrated water resources management concepts.
- Intensive information, education and communication campaigns can be developed and implemented to promote water safety, water conservation and its sustainable use and safe hygiene practices.

- Private entrepreneurship and public-private partnerships for enhancing access of safe drinking water, operation & maintenance of water supply systems, resource mobilization and capacity development can be promoted.
- Encourage the recycling and reuse of agricultural and domestic wastewater through advanced scientific techniques such as employment of microbes.
- Construct separate tracks for livestock from water ways and water points and sheds to and in upper pasture areas.
- Promote integrated watershed management including ecological conservation practices in uphill watersheds.
- Promotion of REDD+ (Reduction of Emissions from deforestation and degradation) program in watershed area for preservation of forests through private sector led carbon sequestration and carbon credit generation. A clear regulatory process needs to be developed urgently to oversee REDD+ activities to ensure rights of forestry stakeholders and indigenous populations.
- Strengthen the existing forestry research and training institutions with adequate infrastructure and technical manpower development. Creation of research wing in forest department.
- Take following measures to protect forests through REDD+ mechanism for integrating sustainable use of natural resource.
- The carbon value of the forests in watershed needs to be financially identified and quantified in both current as well as future terms to develop carbon reference emission level;
- Develop REDD+ strategy
- Develop necessary safeguards required to implement REDD+;
- Address drivers of deforestation in watershed area of Sadpara Dam
- Launch awareness program for implementation of National Drinking Water Policy and National standards for drinking water at all levels (watershed and command area of Sadpara dam).
- Develop standard operating procedures for planning, designing, construction, monitoring and operations and maintenance for various categories of water supply schemes.

- Legislate and enforce tourism/hotels and domestic wastewater management practices.
- Increase water use efficiency in agriculture through sprinkle and drip irrigation
- Ecosystem based water management
- Finance feasible approach to maintain and modernize existing and building new water infrastructure.
- Legislate and enforce agricultural and domestic wastewater management practices to protect environment, in particular water resources, from further degradation.
- Promote integrated watershed management including ecological conservation practices in uphill watersheds.
- Consider expanding protected areas in the watershed area with respect to ecological parameters including conservation of wildlife and its habitats in all vulnerable ecosystems.
- Introduce the concept of payment for ecosystem services (PES) to achieve sustainable development.
- Develop and sustainably manage the stream side forests along with irrigated plantation and tree plantation on farm-lands
- An eco-tourism plan of action should be initiated and finalized to include the provision of support infrastructure as well as focused marketing strategy and also generating revenues.
- Introduce proper sewerage system in watershed area.
- Promote slop stabilization and private plantation on barren land especially by planting ever green plants.
- Wildlife conservation interventions including mammals, carnivores and aquatic biodiversity.
- Promotion and improvement of indigenous living styles and living infrastructure construction methods.

- Improvement of natural forest through artificial regeneration.
- Awareness project regarding climate change and global warming.
- Pasture and range land improvement techniques.
- Creation of forestry research wing for production of scientific, contextual mountainous knowledge production
- Eco-tourism promotion for strengthening of watershed through income generation and community empowerment
- Community based regulation to control free grazing which effects natural forest regeneration.

6.5. Proposed Land Use

Less than two percent of the land in watershed area is arable and difficult mountainous geography obstacles the land development and land use. Mountainous geography and harsh climatic conditions increase the land development cost and decrease the productivity therefore, land use study is of the watershed area is fundamental, since land resources play a strategic role in the determination of people's economic, social and cultural progress (Bhandari,n.d). In the context of harsh weather and mountainous geography, proper land use policies should be developed for watershed as well as for the whole region under observation of existing land use conditions and exploitation of services and the land capability based on its slope criteria and other land features. The land within the watershed cannot support the settlement with its population growth for the next ten to twenty years. Therefore, for the increasing population and new settlements

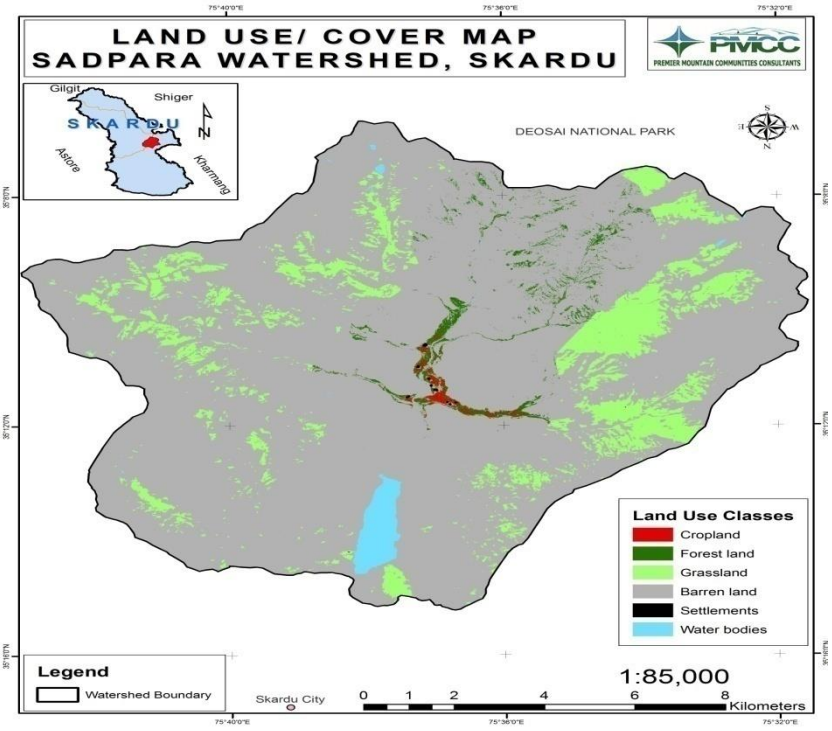

Figure 9: Land Use/Cover Map

land use policy is the fundamental. It is proposed that existing built up areas having high flood risk and fragile erosion areas should be immediately taken care of by using bio-engineering practices. A master plan on land use for the next 10 to 20 years is required to sustain the population density and to protect areas where there is permanent vegetation cover and high flood risk zone in the watershed.

6.5. Immediate Actions

To initiate the activities of watershed management in the watershed area of Sadpara dam, forest department has initiated a project namely "Watershed Management in the Catchment Areas of Satpara Dam". Earlier it has been mentioned that no any governmental or nongovernmental department has paid attention of the watershed management of Sadpara area and forest department has dirverted its attention towards the watershed. The following immediate recommendations are been recommended in the context of forest department and project activities. On the other hand some programs has been suggested which may be implemented by the forest department or any other government department for the sustainable development and management of watershed. These programs are people driven programs which have been identified after multiple discussions with community members, professionals, and consultants.

Following key programs/activities are proposed for a sustainable watershed management in Sadpara catchment area which will reduce dependency of the community on the watershed.

6.5.1 Capacity Buildings Programs

In every sector of the livelihood commonly and watershed management especially good performance will depend upon the ability and capacity of the people and institutions. Their abilities will construct activities to generate livelihood resources and triumph over the barriers hampering the mobility of communities, goods and resources. Strengthening the capacities of the communities and departments/public institutions increases the effectiveness of public and natural resources. Good strengths and scientific knowledge of watershed management activities are important

to develop and manage the watershed area and water and natural resources. Following trainings are recommended for the communities, stakeholders and forest department.

1. Capacity building training for the local community of Sadpara and staff of forest department in sustainable watershed management to sustain ecosystem and watershed services;
2. In services trainings for the staff of forest department in a national institute in land development, soil conservation, slope stabilization and natural forest regeneration.
3. Training in nursery techniques to raise forest plantation and fodder production for the community of watershed and staff of forest department Baltistan circle
4. Conduct community mobilization sessions to sustain ecosystem services from the watershed by mobilizing communities, other stakeholders through a common forum;
5. Provide training to the Sadpara communities by integrating ecosystem service values into DRR and Flood Risk Management (FRM) to reduce risks from climatic change factors especially floods in watershed area.
6. Exposure visit cum training for the staff/leadership of forest department abroad for experience sharing and knowledge imparting from international experiences to local context of Watershed. It is recommended to conduct visit to a mountainous region of any country in Asia.
7. Provide training to the community members/ famers on soil and water conservation techniques among. Some conservation techniques are: bench terrace, planting of fruit trees, fodders, minimum tillage and mulching, grass strip cropping, Sloping Agriculture Land Technology (SALT), Natural Vegetative Strips (NVS) and Slope stabilization etc.
8. Community based controls and user system mechanism to conserve and manage watershed services.

- Capacity Building Programs for income generation (whole community of watershed have the same idea)
- Community affordable fuel wood for energy or alternative energy resources like Hydroelectricity
- Capacity buildings programs for sustainable agriculture farming and cropping practices;
- Community based controls and user system to conserve and manage watershed & natural sources

9. Capacity buildings programs for sustainable agriculture farming and cropping practices. This program can be implemented in collaboration of agricultural department
10. Conduct mobilization sessions for local people of watershed at community level for the development, management and protection of forest and water resources.
11. Capacity Buildings Programs for income generation from the existed available natural, environmental and social resources
12. Developing and strengthening capacity of community based organizations especially conservation committee and other committees by providing institutional, financial, technical resources and advocacy mechanism;
13. Provide training on soil conservation practices and awareness activities for water conservation to the Sadpara community;
14. Promotion horticulture by integration of diversification, value addition, harmonization and strengthening community organizations and CBOs in watershed;
15. Capacity buildings through trainings and micro-credit financing program including technical back-support, if required help can seek from NGOs;
16. Promote agricultural and hygienic products that gives high value and yield by using compost fertilizers and off season crops priority;
17. Provide training to farmers on co-operative finance system at women group and farmers groups for economic empowerment, sustainable development that ultimately reduce poverty by using ecological services in a sustainable and integrated way.
18. Train farmers in honey production and bee farming focusing mainly on women for economic empowerment and sustainable development;
19. Conduct training programmes for small-scale entrepreneurs especially tourism related skills and income generating activities in watershed area
20. Capacity buildings through training programs to implement the financial revenue generation for watershed conservation and management

21. Capacity development programs for local NGOs and CBOs especially institutions working for watershed, forest, and natural resource conservation and management

6.5.2. Infrastructure development for forest development, soil conservation, land development and reduce sediment

Irrigation and protective infrastructure is mainstay for the communities of watershed and to reduce sediment of the Sadpara dam. Geography of the watershed is mountainous comprised of loss soil, snow capped mountains and seasonal and permanent water streams. In the watershed area water is conveyed from streams to agricultural land through open channels. High flow of water and floods usually erupts these water channels and cause disruption of water supply for the agricultural and domestic activities. Furthermore, these floods usually devastate agricultural land, fruit and forest trees as well as living infrastructure. Recent disasters in watershed area has divested hundreds of acres of agricultural land, thousands of forest and fruit trees, hundreds of living infrastructures and dozens of projects of social services. Moreover, these disasters and floods cause highly sedimentation in the Sadpara dam. Expected life of the Sadpara dam is threatened because of high sedimentation. PMCC has identified some urgent requirements of infrastructure to protect watershed and siltation through participatory rural appraisal method.

1. Construction of water channel in Skillzong (Darmiyana Gawo) for land development as irrigation and plantation. The area has batter scope for agriculture and plantation while has reasonable water resources. The detail survey and maps of the channel are in annexure;
2. Construction of protective walls, recommended guided walls in Melpin, Skillzong, Mirakh and Daripa to protect soil erosion and silting. Most urgent sites have already been identified in consultation with communities. Design of the protective and guided walls are attached in annexure;

3. Construction of check dam in the left Nallah of Melpin village to reduce flood impacts and manage floods and siltation. Design of the check dam is attached in annexure
4. Rehabilitation of flood effected irrigation channels in Melpin, Mirakh and Choghozong for rehabilitation of agricultural land and forest and fruit trees;
5. Mobilizing community of watershed at community level for the development, management and protection of forest resources;
6. Private forest nursery practices can be introduce to develop and utilize forest of watershed areas in order to maintain ecosystem services for supporting, provisioning, regulating and fulfilling human needs especially energy requirements
7. Reducing high pressure on natural forests and forest products especially fuel wood and fodder by initiating programmmes like plantation of suitable species, silvi-cultural operation, alternative energy source, improved cooking stoves and livestock improvements to meet local people's need;
8. Circumvent jumbled exploitation of sediment loads and pebbles, sands, gravel by strictly making the EIA (Environmental Impact Assessment) and (IEE) Initial Environmental Examination mandatory;
9. Discouraging all types of constructions inside the high flood risk zones especially at the bank of streams and water source (Sadpara Dam) areas by massive plantation in flood zones, banks of streams, barren slope lands and by conducting awareness programs on sensitive ecosystem and importance of watershed;
10. Promoting ecotourism (trek track), NTFPs and agro-forestry in the slope lands;
11. Minimizing pollution (especially water pollution) and making waste management effective by promoting water recycle plants before discharging it into rivers, construction of especially cloth washing areas in all the villages for communities.
12. Discourage communities to wash their cloths, animals, and domestic items at the streams of watershed area, they can be provided indoor wastes treatment plant or community based waste treatment plants to the all sub villages of Sadpara valley.

13. Maintaining habitat of birds and wildlife by making nests in forest zones and community based conservation of wildlife.
14. Develop disaster preparedness plans by incorporating watershed conservation and drainage management programs and income generating activities, early warning system and awareness creation in the watershed.
15. Develop capacity of women of watershed communities by involving them in conservation practices particularly livestock management in a sustainable manner and other income generating activities at local level;
16. Plantation of native plants for protection against erosion, bank cutting and forest generation because mostly communities mentioned that plants from down country could not grow in the watershed area therefore private nurseries can be developed to provide native plants.
17. Severity analysis of major landslides for controlling mass movement and promoting stability of the land surface which should be immediately carried out so that bio-engineering works can be adopted in the region;
18. Construction of small ponds at community level for irrigation waste water at the lower part of each village to minimize pollution and make waste management effective in order to maintain water quality of Sadpara dam.
19. Construction of new water channels and rehabilitation of disaster affected water channels in different locations of watershed area to increase cash crops production by promoting irrigation facilities; (Designs are attached in annexure)
20. bio-engineering and level terracing works in bank cutting regions on both sides of the all streams of watershed area
21. Development of nurseries both forest and fruit, agricultural, floriculture, and mushroom in watershed to economic empowerment and sustainable development
22. Agricultural department may promote of vegetable and herbal developments by providing subsidy for inputs, and trainings on Green House Making;
23. Integration of indigenous knowledge, Community decision making to promote sustainable consumption of water, forest and natural resources.

24. Construction of composed pits (agriculture department) for farmers to produce composed fertilizers for production of hygienic Agri products;
25. Development of fruit nurseries in collaboration of communities and farmers to provide high yielding fruit trees for poverty alleviation
26. Promotion of mushroom farming practices to the communities of watershed as watershed area is most feasible for mushroom growth (community members have reported). Mushroom production may reduce poverty and pressure on water and natural resources.
27. Picnic spot can be developed to promote village tourism by developing greenery in open and barren lands to increase the local economy by preserving the existing landscape and enhancing tourist attraction sites
28. Improvement of infrastructures facilities particularly water supply, sewerage management and toilet facilities with eco-friendly approach in Sadpara and Deosai range;
29. Development of foot-trails and not heavy motor-able roads throughout the uphill sites of the watershed in Skillzong, Choghozong, Melpin and other possible sites, a detail study can be conducted prior to construction, the tracks must be at a glance distance of fresh water streams.
30. Preparation of Tourism Management Plan addressing potentiality of tourism in watershed area
31. A special feasibility study is recommended to find out whether tourism development is suitable in the Sadpara Area or not as well as scope of tourism and tourists attractions sites development.
32. Develop valley level development plan in collaborative approach to promote Non-Timber Forest Products NTFPs in Sadpara valley ensuring the needs of poorest people and communities of Sadpara valley
33. Developing identifying indictors for watershed monitoring system. (For this, a study is required to develop the possible indicators which are suitable for the Sadpara watershed to monitor the watershed in integrated relationships including institutional development indicators, social and

economical indicators, natural resource use indicators, environmental importance indicators, water improvement indicators etc[5]).

6.6. Recommendation for Sustainability of the Sadpara Watershed Management through Developing Financial Mechanism

6.6.1. Introduction:

Financial Mechanisms for Conservation

In this section some possible finance generation mechanisms will be discussed considering geopolitical position of Gilgit Baltistan and especially cultural and indigenous traditions of Sadpara valley Skardu in the view of global and South Asian experiences of financial mechanisms. As this study suggests a view of financial schemes and implementation mechanism in current situation of natural resources and available required data however, prior to implement on ground a detail economic, financial and institutional study is recommended strongly.

6.6.2. Payment for Echo System Services (PES)

Watershed services are often considered a public good, meaning that nobody can refuse to use them even if they do not pay for its conservation and people are often reluctant to pay if it is not mandatory[6]. In such type of situations, to protect watershed services, government may initiate a public fund in collaboration of Sadpara community. A watershed management committee or conservation committee consisted upon three members from government forest department and one member from one sub villages. Two members from private institutions especially NGOs, working in watershed area on conservation and development. A detail mechanism for committee devise, fund collection, utilization and overall management can be developed through government or consultant.

As IUCN has suggested that government provides the institutional foundation for the conservation programs and directly invests in it and also through the fund

[5] IUCN Nepal, Deepak Paudel, Consultant, 2012

[6] IUCN, Watershed Manual

generated by some type of fee or tax[7]. But here we will not suggest any type of direct or in direct tax on community in the context of Gilgit Baltistan. Some alternative sources are suggested under here:

- Government may allocate fund from the municipality budget of Skardu Municipal Corporation as the watershed provides drinking water, water for agriculture, domestic and commercial use to whole municipal area of Skardu.
- Furthermore, tourists and tourism industry is alternative source for fund generation as the area already attracts thousands of the tourists annually.
- Government may allocate 2% or any other amount of revenue generated from electricity provided to consumers of Skardu district as WAPDA generates electricity from the Dam and supplies to Gilgit Baltistan Water & Power Department for distribution. GB Water & Power Department collects revenue from the consumers.
- Government may collect a minimum amount of conservation fee from the hotels, vehicles' service stations, and construction companies as water users.
- Herbal and medicinal plants of watershed may be auctioned from time to time to collect revenue.
- A sum of trophy hunting fund may also be utilized for conservation of watershed.

Payment for Echo system or Environment is a very common practice in developed countries as well as in developing countries with appropriate contextual amendments. Many countries around the globe are implementing different schemes for collecting payments to finance watershed protection. Some examples are mentioned here under:

- Japan has been charging water users to compensate upstream land owners successfully for over 100 years[8].
- Cauca Valley Columbia, where downstream farmers pay additional water fees for the watershed protection to ensure minimum dry season water flow[9].
- A hydropower company pays US$ 10 per ha/year to a local conservation NGO for hydrological service in the Peñas Blancas watershed. In the city of Heredia,

[7] IUCN
[8] Richards, 2000
[9] Echevarria, 2002

the drinking water company earmarks a portion of water sales revenue for reforestation and forest conservation.

- In Brazil, where a water utility in Sao Paulo pays 1% of total revenues for the restoration and conservation of the Corumbatai watershed. The funds collected are used to establish tree nurseries and to support reforestation along riverbanks.
- In Ecuador, where municipal water companies in Quito, Cuenca and Pimampiro impose levies on water sales, which are invested in the conservation of upstream areas and payments to forest owners.
- In Lao PDR, where The Phou Khao Khouay Protected Area currently receives 1 percent of the gross revenues from a downstream hydropower dam, and the proposed Nam Theun 2 hydropower project is expected to pay over US$1 million per year for the management of the Nakai-Nam Theun Protected Area.

PES requires an equitable compensation and rewards mechanism for environmental services. There are generally four important dimensions for effective, efficient, inclusive, and sustainable conservation of watershed.

6.6.3. General Criteria for PES

There are four important dimensions for effective, efficient, sustainable as well as equitable compensation and reward mechanism for environmental services, viz. realistic, voluntary, conditional and pro-poor[10]

They are briefly described below:

Realistic: The basis for payment mechanism should be a real cause-effect relationship between land use changes upstream and the environmental services under trade. Many of the current PES schemes are based on correlations (e.g. between existing forest and provision of water) or assumed relations rather than on true cause-effect relationships or unproven relationships between ecosystem conservation efforts and the actual provision of valuable environmental services.

Voluntary: One of the important requirements of PES is that it should be a voluntary agreement between buyers and sellers. However, some local organizations often play intermediary role to facilitate the process. Buyers and

[10] Van Noordwijk et al., 2007

sellers negotiate and agree on the nature and level of deliverables in reward agreements.

Conditional: The delivery of services and payment for these services should be logically related in the transaction, i.e., payments are made conditional on realization of agreed level of targeted services. In practice, many schemes rely on perceptions of services and good faith between the contracting parties. There needs to be a strong monitoring mechanism with clearly defined indicators to measure the actual supply of environmental services and determine has met if it the set conditions. For examples payments can be made per m3 of clean water derived from a watershed.

Pro-poor: Though the main aim of PES is watershed conservation, it has to play another role of supporting the poor in the developing world where upland people are usually poor. Though, benefit to poor doesn't come automatically through PES it has to be planned meticulously. Ethical principles suggest that respect, tangible benefits to poor stakeholders engaged in such schemes, social justice, gender, welfare and intergenerational equity need to be considered in any rural development activity. Attention should be given to ensure additional portion of the value going to the seller where there are poor smallholders. An example of pro-poor mechanism could be to offer employment.

This is a general criteria however, a detail criteria in the context of Sadpara watershed area can be development in consultation with stakeholders.

References

Annexes