



Environmental Management Framework for Shigar Town

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Acronyms and Abbreviations

AC	Assistant Commissioner
AKCSP	Aga Khan Cultural Services Pakistan
AKPBS	Aga Khan Planning and Building Services
AKRSP	Aga Khan Rural Support Programme
CHW	Community Health Worker
CKNP	Central Karakoram National Park
EMF	Environmental Management Plan
GIS	Geographical Information Systems
IAQP	Indoor Air Quality Protection
IUCNP	International Union for Conservation of Nature, Pakistan
LHW	Lady Health Worker
LPG	Liquefied Petroleum Gas
NAs	Northern Areas
NGO	Non Governmental Organization
OPD	Out Patient Department
PAEC	Pakistan Atomic Energy Commission
PM	Particulate Matter
RHC	Rural Health Centre
RMO	Resident Medical Officer
STMDS	Shigar Town Management Development Society
SWM	Solid Waste Management
UC	Union Council
WASEP	Water and Sanitation Extension Programme
WCP	Water Course Protection
WHO	World Health Organization

1 Introduction

The International Union for Conservation of Nature, Pakistan (IUCNP) is implementing a project titled, "Improving livelihoods in Shigar through integrated planning and development of the cultural, natural and built environments" in Shigar Town, Baltistan, Northern Areas (NAs), Pakistan. The project is being undertaken in collaboration with Aga Khan Cultural Service Pakistan (AKCSP) and Antea (an Italian NGO). Under the project, IUCNP is required to develop an integrated Environmental Management Framework (EMF) for Shigar Town, amongst other activities. This document provides the EMF outline. Considerable guidance was taken from the GIS maps developed under this initiative in the framework preparation. The guidance from GIS maps would be very helpful in the effective implementation of this framework.

2 Background

Northern Areas: NAs of Pakistan represent a landscape of immense natural beauty and wealth. The Baltistan region in NAs is situated at the confluence of the Karakorum and Himalaya mountain ranges, within latitudes 34° to 45° north and longitudes 75° to 77° east. The area holds immense significance as the watershed for the Indus and its tributaries. It is also an ecologically fragile region and its remoteness has contributed to its under-development.

Shigar Valley: Shigar valley is located in Skardu district, Baltistan. It constitutes 59 villages, divided into 10 Union Councils (UCs), with a population of about 45,000 persons. A landuse map of Shigar Town is provided in Annex 1.

The climate of Shigar can be classified as dry continental Mediterranean. The economy of Shigar is largely natural resource dependent and is traditionally agro-pastoral in nature, though the availability of arable land for agriculture is an issue. Since most of the terrain is too high, steep or rocky to be used for large scale agriculture, most cultivation is practiced on terraced slopes or on alluvial plains. The principal agricultural produce consists of wheat and barley, with buckwheat and millet sown as autumn crops and used as fodder for stall feeding during winters. Apricot is the most abundant tree crop in the area, with over 15 varieties being cultivated in and around Shigar. Dried apricots and apricot kernel are used as barter goods and exchanged for items such as salt. Other cultivated fruits include apple, cherry, grape, mulberry and pear.

The settlement pattern in the area is determined by the availability of water; most of the villages are situated on the alluvial fans of tributary streams. The main source of water for irrigation as well as household use is the mountain streams, which are fed by glacier melt. However, since water is not abundantly available throughout the year, its distribution and usage is closely monitored and regulated through a community based system.

It must be added here that the character and socio-economic situation in Shigar has altered rapidly in the recent past. Improved communication with the outside world, and government sponsored infrastructure development projects of roads has contributed to the transformation from a subsistence-based economy to market economy, thus eroding the traditional pastoral system. An increasing percentage of the population is now being employed in the tourism industry, as well as in government service and commercial activities. The literacy rate has also improved - 16.39% of the total population (24.4% amongst males and 7.3% amongst females). Additionally, people are gradually moving away from the traditional dense, nucleated settlements around the main water channels, to houses constructed from local materials of stone, adobe blocks, wattle, daub and timber.

The major problems at Shigar are the scarcity of safe potable water, girls' school and construction of link road. It has also been found that the area has no arrangement for solid waste management. In other words, the municipal arrangements are in infancy stage, with the will of the community, but a lack of infrastructure.

Shigar Town: Shigar Town is the largest and most significant settlement in Shigar valley, located close to the district headquarters, Skardu. It is divided into 2 UCs, Marappi and Markunja, which contain a total of 21 listed villages / hamlets and has a population of about 10,000 persons.

The rich natural heritage of Shigar Town suffers from a range of environmental problems that are primarily caused by poor land use planning, poor solid waste management, inadequate sanitation facilities and insufficient access to clean water supplies. The traditional architecture of the buildings, which has been adopted due to climatic factors, does not allow for good ventilation. Hence, the population suffers from various respiratory problems. In addition to these, there is a serious shortage of quality health and education services. Most of these issues can be attributed to the inadequate institutional capacity to plan and implement management at a systemic level.

In order to address some of the key environmental issues in Shigar Town, an EMF is being developed to assist the Shigar Town Management and Development Society (STMDS) in effectively addressing the environmental problems in Shigar Town.

3 Environmental Management Framework

As mentioned above, majority of the environmental problems in Shigar Town are urban in nature. Although measures have been taken to address the environmental problems, such as water filtration units, construction of washing areas and provision of twin pit compost latrines in settlements of Shigar Town, the measures taken are not enough to address the major environmental problems in the Town. It is important to address the environmental problems, through a proper EMF.

To avoid preparing another framework which does not get implemented, this framework has been prepared keeping in view the human and financial resource constraints of STMDS, which will be responsible for its implementation. Effort has been made to keep the framework simple to facilitate effective implementation, instead of preparing a very detailed and comprehensive framework. This framework takes guidance from the GIS maps developed under the same initiative.

The framework focuses on three key issues in Shigar Town:

- i. Water Course Protection (WCP)
- ii. Solid Waste Management (SWM)
- iii. Indoor Air Quality Protection (IAQP)

Majority of the environmental problems in Shigar Town can be addressed only if the three issues mentioned above are effectively addressed.

3.1 Goal

To improve the quality of life of people living in Shigar.

3.2 Objectives

- i. To improve general health of the people living in Shigar, through improvement in environmental conditions;
- ii. To improve awareness of the community on environmental issues, with a specific focus on addressing water pollution, SWM and indoor air pollution;
- iii. To strengthen the institutions responsible for environmental management in Shigar; and
- iv. To bring financial sustainability in the environmental management process.

3.3 Methodology

The development of EMF instituted a five-step approach:

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- a. Conduct literature search, to collect secondary data (including library and internet research) pertaining to the development of EMF;
 - b. Hold meetings with relevant stakeholders in Shigar Town, to get better understanding of the issues pertaining to environment in general and the three sectors in particular;
 - c. Conduct site visits, to observe issues pertaining to WCP, SWM and IAQP;
 - d. Prepare EMF based on the findings of the literature search, consultations, GIS maps and field survey;
 - e. Share the EMF with relevant stakeholders in Shigar, for feedback; and
 - f. Finalize EMF based on the feedback received after consultations.

3.4 Administrative Setup

The administrative control of the area is with an Assistant Commissioner (AC), whose office is in Shigar Town. The AC also has development funds, which he seldom uses for municipal services such as provision of potable water, SWM etc. Despite the presence of an AC in Shigar, the role of the Government is only figurative and not much attention is being paid to development initiatives in the area. Shigar has not been declared a municipal corporation or committee, because of financial constraints and other administrative reasons. There is no organization, either government or civil society, which can perform municipal functions in Shigar Town. The only organization that comes close to providing any such service is STMDS, a community based organization working for the betterment of Shigar Town. STMDS is considerably active in the area and is also well respected because of its work. It has support of the local administration and the people of the area. However, it is not a replacement of a municipal committee or corporation and can only fulfill part of the responsibilities that a proper municipality can. Despite efforts being made by STMDS and its sincerity in serving people of the area, it has very limited capacity and resources to manage responsibilities in the area. It is therefore imperative for Shigar to be declared a municipality, to improve its infrastructure and other facilities such as health, education and environment.

3.5 Scope

The geographical scope of EMF is the entire Shigar Town. The thematic scope is WCP, SWM and IAQP.

3.6 Situational Analysis

3.6.1 Water Course Protection

Situational Analysis: Water course protection is a major issue in Shigar. A rapid survey was conducted by IUCN team, to assess the situation pertaining to water course protection in Shigar Town. Guidance in this regard was also taken from the GIS maps on landuse, bacteriological quality of water, water channels and soil association in Shigar developed under the same initiative (Annex 1). The main source of water for Shigar Town is glaciers and springs in the upper reach of the Shigar Naullah. The source of water for irrigation and other domestic uses is Shigar Naullah. Since the spring intake lies below pasture and seasonal settlements, the chances of its contamination are quite high. There are three institutions involved in water supply schemes in Shigar Town – NAs Public Works Department, AKCSP and Water and Sanitation Extension Programme (WASEP). According to a study conducted by Freie University, Berlin, the reliability of AKCSP and WASEP systems is better than that of government water supply schemes. The study revealed that of the government installed water taps, 75% were found to be out of order in UC Marapi and 35% in UC Markunja. WASEP installed water scheme provides water for one hour at a specified time and people store water in containers, for their usage. The problem becomes severe during winter season, when due to improper installation of government schemes, pipes freeze and break. On the contrary, AKCSP and WASEP schemes are better planned and provide uninterrupted water, even during winter months. The study by Freie University also found that all taps installed by WASEP and AKCSP work in winter, whereas 78% of government installed taps in UC Markunja and 20% in UC Marapi do not work. When water is not available in installed taps, people revert to water channel and traditional

shallow water pits (*chudongs*), which are normally more contaminated as compared to piped water systems. The study found that in summer some households in Shigar prefer using *chudong* water as compared to tap water, because *chudong* water is cooler and less turbid. Of the people surveyed by Freie University team, 17% still use *chudongs* as their regular or backup source of water.

When water was analyzed for contamination by the Freie University team, all samples tested positive for bacteriological contamination, mainly coliform. The study also noticed that the contamination increases exponentially with increasing distance. Majority of the irrigation canals and sub-canals were found to be heavily contaminated with coliform. The situation becomes worse in summer, because of increased temperatures and consumption of water. Majority of the health cases are of diarrhea, mostly among children of age 5 – 15. The study also found lesser cases of diarrhea in areas served by AKCSP and WASEP water schemes.

According to Antea's report, which reviews health conditions in Shigar Town, the major diseases in Shigar Town are diarrhea and dysentery. They have identified some of the main causes of diarrhea and dysentery to be linked to 'inadequate drinkable water supply' and 'lack of appropriate sanitation'. A GIS based map of bacteriological quality of water in Shigar is provided in Annex 1 which highlights the water contamination issues in Shigar. Washing clothes on the banks of the stream used for consumption by communities in the vicinity and downstream, is a major water contamination problem. All types of clothes are washed in the stream, including home-made children diapers and clothes of sick people. The water channel is also used by domestic animals, further deteriorating quality of the main source of water to Shigar Town. Dumping of solid waste, including waste from slaughter house and poultry shops, on the slopes leading to water channel, has further compounded the problem. A water stream taken out of the main Shigar Naullah passes through the Rural Health Centre. The stream is open, which is susceptible to dumping of infectious hospital waste – intentionally or unintentionally. It is a major hazard and needs to be corrected by getting it covered. Public bathrooms were also noticed on the channel banks, with effluent flowing directly into the channel. The practice of squatting in open areas, especially next to water channel, is common, because of easy availability of water. The waste eventually ends up in water channels through water and air. The possibility of effluent from toilets ending up in water channel is also quite high, because of no attention being paid to the location of toilets. Some other significant sources of pollution are animal grazing around water channels and agricultural run-off. The problem becomes even more severe in winters, when the water flow in the water channel decreases considerably. The main issue behind all the problems identified above is low literacy rate and lack of awareness on basic health and hygiene. There are no checks on any of the activities mentioned above, because that is how they have been living for centuries.

Under this project, AKCSP is constructing three washing spaces, to decrease water contamination from clothes washing and provide a facility to local women for easily washing clothes during summer and winter. Two washing areas, constructed under a separate project, are functional. However, the design of the washing area needs a critical review, because it was observed that washing effluent was getting mixed with the clean water, due to design flaw. With proper design and increase in number of the washing areas, water contamination can be reduced considerably.

3.6.2 Solid Waste Management

Domestic waste: A rapid survey of SWM was conducted of Shigar Town. It was found that there is no proper SWM practiced in Shigar Town or anywhere else in Shigar Valley. Some initiatives have been taken at a small level, such as in Shigar Bazaar, where they hired a sweeper who collects waste from all shops and later dumps it next to Shigar Naullah, or at school level where they collect waste and segregate it into paper and remaining waste. In winter, the waste which is combustible is burnt in local indoor burners / heaters, commonly known as *bukhari*, for heating purposes. In other areas, waste utilization depends upon weather. During winter, all combustible waste,

including paper, plastic, rubber, old shoes, etc. are burnt in *bukhari*, for heating purposes. Whereas, in summer the waste is mostly thrown outside the house or at some locations collected by a sweeper and dumped at a common location, mostly on slopes leading to Shigar Naullah. This practice has created many problems, including water contamination, indoor air pollution, land pollution, etc. The landuse map provided in Annex 1 presents a very detailed picture of landuse in Shigar Town and helps in better understanding of the issues pertaining to solid waste management. In the main Shigar bazaar, shopkeepers arranged for a sweeper to collect waste daily, for a monthly fee of Rs. 20-25. However, the practice was later discontinued, when some shopkeepers did not pay their monthly dues. The shopkeepers like the service and want to resume it, because it helped them keep the bazaar clean and also took care of a problem they do not know how to deal with. Another issue which was highlighted in all meetings was plastic bags and plastic wrappers, which are taken to be a big menace in the area. Plastic bags clog water courses and water channels, and are a threat to domestic animals which consume it and die when it clogs their intestine. The main reason for poor SWM is the absence of municipality in Shigar, which usually performs functions such as SWM, water supply and sanitation.

Although it is difficult to estimate the amount of solid waste generated in Shigar Town, approximately 620kg waste is generated daily (12,000 population and 1,242 households, approximately 0.5kg waste is generated per household). This estimate is only meant to assist in planning for a proper SWM plan for Shigar Town. This figure will vary considerably during summer and winter. Since everything people can lay their hands on is burnt in *bukhari* in winters, it is estimated that the waste would reduce by at least half during winter season.

It was realized that general awareness on SWM does not exist in the general population. Similarly, general awareness of what should and should not be burnt in *bukhari* does not exist, which is creating serious health related problems, especially respiratory tract problems, such as asthma and lung cancer.

Hospital waste: Shigar has only one medical facility, which is a Rural Health Centre (RHC). It is a proper health facility with 25 beds. No waste segregation into infectious and non-infectious waste is undertaken in the facility. Majority of the waste is burnt in an open pit behind the hospital. Once the pit is full, it is closed and a new pit is opened. Waste burning was also noticed at another location, which suggests that waste is openly burnt at different locations. The facility has no needle cutter – sharps and non-sharps are all dumped at one location. The laboratory visited did not even have a proper dustbin. A cardboard carton was noticed being used as a dustbin. Developer from the x-ray machine, which is radioactive in nature and needs to be disposed properly, gets disposed like any other waste in the regular dustbin. Normal practice for this is to inform Pakistan Atomic Energy Commission (PAEC), who collects the waste for proper storage. The Resident Medical Officer (RMO) had no such knowledge and informed the surveyor that PAEC did not give them any proper guidelines on how to dispose it off properly. Proper disposal of expired medicines is not taking place either.

Most of the waste generated in the RHC is in the Out Patient Department (OPD), because out of 25 beds mostly 3-4 beds are occupied. According to a rough estimate, around 5–7kg of waste is generated daily by the hospital, out of which around 1kg is infectious. It is estimated that waste quantity increases by one third during winter months, because more people get sick in winter due to extreme cold, diarrhea and inhalation of poisonous gases from waste burning. Although the laboratory is very basic, some waste is still generated, which has to be properly disposed off.

In essence, there is no hospital waste management in RHC, except for burning all the waste, both infectious and non-infectious, in an open pit behind the hospital building within hospital premises. Since the open pit is right behind the general ward and rooms, all the smoke enters the building through windows and poses serious health risk to patients.

3.6.3 Indoor Air Pollution

Indoor air pollution is a major contributor to overall disease burden in developing countries. The overall diseases from indoor air pollution in developing countries are estimated to be more than five times greater than the burden from outdoor air pollution (Smith et al., 2004). Indoor smoke is responsible for an estimated 3.7% of the overall disease burden, making it the most lethal killer after malnutrition, unsafe sex and lack of safe water and sanitation (Smith et al., 2004).

Indoor air pollution is also a serious issue in Shigar. Due to severe cold from November to February, people have to burn wood and other combustible items to stay warm. According to a recent study conducted by Freie University, Berlin, the main energy sources in Shigar Town are wood, animal dung, Liquefied Petroleum Gas (LPG), kerosene, biomass and hydropower. The survey conducted by IUCN for EMF further authenticated the findings of German students in 2008. All the households in Shigar Town (1242) have electricity connection – mainly used for lighting and running electrical appliances. However, only a few households use electricity for heating purposes. The Freie University study found that firewood is still the most common fuel for cooking and heating, and is being used by 99% of the households. The second most used fuel is cow dung, used by 77% of the households. Despite being expensive, LPG is being increasingly used for lighting purposes, but not for heating. Kerosene is also being used for lighting, only when the power is out. At times, people resort to cutting their fruit trees during winter. However, the main source of air pollution is the use of firewood, animal dung, biomass and other materials including plastic and rubber.

The survey conducted by IUCN found that at times people burn plastic, rubber, old shoes and tyres as fuel during winter. However, further investigation and site visits could not authenticate the information provided by villagers. If it does take place, it is not very common and probably takes place only under very adverse circumstances. The burning of plastic, rubber and other synthetic materials results in emission of dangerous gases, such as dioxins, furans, and particulate matter (PM_{2.5} and less).

Another study on indoor air pollution was conducted in 2007, by Aga Khan Planning and Building Services (AKPBS), in Ishkoman Valley, NAs. The study revealed a very high concentration of PM_{2.5} in households where wood was being used for cooking as well as heating during prolonged winter lasting for about 6-8 months. The study observed that a large proportion of the people, especially women and children, are vulnerable to a very high level of air pollutants exposure; for example, the mean concentration of PM_{2.5} was 7.38 mg/cum indoors, with a maximum of up to 206.59 mg/cum during cooking hours. The high levels of PM_{2.5}, when compared to WHO guidelines, are causing adverse health outcomes, such as low birth weight amongst children, and chronic bronchitis, lung cancer and cardiovascular disease amongst adults.

During another survey conducted in October, when the weather is not very cold, majority of the children were found to have chest infection. On inquiry, it was discovered that during winter, respiratory problems increase considerably, especially among children. In an interview with the RMO at the RHC, it was confirmed that respiratory problems increase considerably in winters, especially among children, women and older people.

Most of the houses have *bukharis*, which are not very energy efficient. Due to poor exhaust from *bukharis* and ventilation in houses, smoke and other dangerous gases emitted by burning accumulates in rooms create unhealthy conditions. Inhalation of dangerous, at times poisonous, gases can result in respiratory problems, such as asthma, pneumonia, blood pressure, heart problems, cancer and heart problems. Majority of respiratory problems can be traced to inhalation of poisonous gases from *bukhari*. Children, women and old people are more susceptible to dangerous gases. If gas accumulates in the room, especially when people are asleep at night, it can also

result in death. Since no health survey has been conducted in Shigar Town, to study impacts of indoor air pollution, no statistics are available to support this argument. However, this is a serious issue in Shigar and needs to be paid attention to, to improve health conditions of common people in Shigar Town.

3.7 Key Problems of Environmental Management in Shigar Town

Some of the key problems faced in the implementation of environmental management in Shigar Town are:

3.7.1 Lack of Administrative Setup

As mentioned earlier, Shigar Town has no municipal status, either as a corporation or committee. Since there is no administrative setup, no institution or person is responsible for managing municipal functions in Shigar Town. It is due to this reason that waste collection, water supply and sanitation functions are not performed in Shigar Town. The existing facilities are mainly because of the efforts made by the community through STMDS or by civil society organizations such as AKCSP, Aga Khan Rural Support Programme (AKRSP), WASEP and IUCN. The funding for these initiatives comes from different countries, including Italy, and Norway.

3.7.2 Lack of Financial Resources

Since Shigar Town has no municipal status, it does not get funds through the government for performing municipal functions. Although Shigar Town gets some funds for different schemes through district government, it does not get funding of its own, as a proper municipal committee or corporation would get. Due to Shigar Town's proximity to K2, its economy gets reasonable support from mountaineers and tourists going towards K2.

3.7.3 Lack of Trained Human Resources

Availability of trained human resources is a critical constraint in Shigar Town. Although there are qualified professionals from Shigar Town spread all over Pakistan, not many have stayed in Shigar Town, due to lack of economic opportunities. The study conducted by Freie University found that almost 5% of qualified professionals moved out of Shigar for better economic or educational opportunities, mainly employed by the armed forces. However, there are educated and trained people in Shigar Town who have returned after completing their education or retiring from the armed forces. With minimum training, they can be used for performing different technical municipal functions. One point of major concern is that women are not involved in performing functions other than teaching, despite being educated. Quite a few municipal functions which require interaction with female population can be adequately performed by women, such as training on proper use of *bukhari*, and designing and siting of washing areas.

3.7.4 Lack of Awareness

According to the study conducted by Freie University, the overall literacy rate in Shigar is around 50.7% (male 66.0% and female 33.2%) which is not very different from overall literacy rate of Pakistan (male 67.7%, female 39.6% and overall 54.2%). The low literacy rate is the main source of lack of awareness of major environmental issues in Shigar Town. Not many people were found to be aware of the hazards, such as consuming contaminated water from toilets, clothes washing and animal waste; burning plastics and rubber; and throwing infectious waste openly on land or in water channels. More alarming was the low literacy rate among females, because majority of the functions leading to environmental and health hazards are performed by women. It is the women who wash clothes, cook, or light *bukhari*. If awareness, especially of the women, is improved, it will have a significant impact on environmental and health conditions in Shigar Town. The experience shows that with the improvement in awareness of the general population, environmental problems can be significantly addressed without any financial investments.

3.7.5 Poverty

A socio-economic survey conducted by IUCN in 2007, found that poverty is prevalent in Shigar Town mainly because of very few economic activities, low literacy rate and remoteness of the area. Poverty is one of the main reasons for environmental and health problems in Shigar Town. Due to lack of resources, people resort to burning plastic and rubber (tyres) in *bukhari*, for heating purposes, instead of going for more expensive options such as burning firewood, charcoal or LPG. Similarly, it is poverty which at times discourages people to send their children to school and also to get proper health care when needed.

3.7.6 Lack of Coordination

At the time of EMF development, the STMDS was the only organization in Shigar Town working on environmental management. As mentioned earlier, AC is the administrative head from the government in Shigar Town. Although STMDS is actively working in Shigar Town, its role is mainly advisory or facilitative and does not have any administrative legal authority to enforce or implement any actions. During the survey, it was noticed that there is very little coordination or interaction between the AC's Office and STMDS. It is due to this very reason that some of the good measures taken by STMDS, such as use of washing areas, could not be implemented effectively. To be able to effectively implement the EMF, close coordination between AC's Office and STMDS is very essential.

3.8 Assumptions

There are some key assumptions which were made while developing the EMF for Shigar:

- a. EMF is an important need of the people of Shigar and it has the support of all the relevant stakeholders in Shigar, including the government;
- b. STMDS has the support of the relevant stakeholders of Shigar, including the government, and STMDS is considered to be the custodian and key implementing / executing organization of EMF in Shigar;
- c. The government is the supreme organization in Shigar and its support is imperative for the successful implementation of EMF; and
- d. Funds for the implementation of EMF will be raised by the relevant stakeholders in Shigar.

3.9 Framework

This section will discuss the measures to be taken under the three selected sectors and the implementation mechanisms involved, including administrative and financial.

3.9.1 Water Course Protection

Administrative

Some of the key measures to be taken for water course protection are as follows:

- Washing of clothes should only be allowed in purpose built washing areas. Any washing of clothes on open stream should be banned. Guidance should be taken from the landuse and main channels maps in the selection of washing area sites in Shigar Town.
- Dumping solid waste on slopes leading to water channel should be prohibited. All solid waste should be collected and disposed off at designated locations.
- Setting of latrines, washrooms and bathrooms on water channels should not be allowed. The recommended distance of 70ft should be strictly observed. STMDS should be vigilant to ensure that the new facilities adhere to the 70ft distance guideline.

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- Any bathing and toilet facilities currently located on the water channel should be shifted to a new location, preferably adhering to the recommended distance of 70ft, or to a safer location decided in consultation with STMDS and the owner.
 - No cattle pens should be located next to the water channel. Any new or existing cattle pens should be located at a safe distance, determined by STMDS and the owner.
 - Washing areas should be established at different locations to facilitate women in washing. In this regard, guidance should be taken from GIS based landuse and other relevant maps developed under this initiative. All washing areas should conform to local traditions and should be constructed after consultation with women in the area. Effluents from washing areas should not be discharged into the water channel, agriculture fields or at any location which might create problems for those in the community.
 - Washing of domestic animals on water channel should not be allowed. Any washing of domestic animals should be undertaken at a safe distance of atleast 50ft from the water channel, and the effluent should not flow into the water channel.
 - The length of water channel passing through RHC should be covered, to avoid any potential contamination of water by infectious waste. This measure should be undertaken on an urgent basis.
 - Retaining walls should be constructed where the channel has started to and potentially will erode the land (agricultural, residential, or open areas) downstream. Local communities should also be consulted and advised to not encroach the channel bed, to avoid any mishap in future.
 - Diverting water from channel should be only allowed after taking permission from the relevant authority in Shigar Town. This is essential to maintain flow in the stream and to avoid any potential conflict on water sharing in the community.
 - Piped water supply tanks must be covered properly.
 - Proper maintenance systems to repair leakages and breakage must be in place.
 - Household water handling practices should be improved through hygiene education with the help of CHWs and LHWS.

3.9.2 Solid Waste Management

Some of the key measures to be taken for effective SWM in Shigar Town are as follows:

Domestic Waste

Administrative

- The focal person for solid waste on the Committee should be responsible for the implementation of the solid waste component of EMF. The focal person may engage other people to help him with SWM functions. Any people engaged should be paid, to ensure their continued commitment. Preferably, two people should be engaged – one for domestic waste and one for hospital waste.
- For effective SWM, Shigar Town should be divided into different administrative zones, preferably administrative units which already exist, such as UCs (UC Markunja and UC Marapi).
- To avoid any conflict with the community, the community should be consulted for identification of disposal bins in each locality and final disposal area or landfill.

Segregation

- Although segregation is a function of SWM already being performed quite effectively in Shigar Town, it is important to further reinforce and remind people of its importance.
- STMDS should arrange for janitors to collect waste from households on alternate days. However, considering lack of financial resources, it may also be considered to designate a drop point at a central location from where the waste gets picked up by the Waste Management Committee.

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- All households should be encouraged to separate recyclable and non-recyclable waste. Recyclable waste includes paper, plastics, metal and rubber items. These items should be collected separately at a location by those responsible for SWM in Shigar Town, and sold to vendors.
 - Plastic, rubber and other synthetic material should not be burned for heating purposes, because of the potential health hazards from their smoke. Also, these items can contribute towards earning additional income.
 - Organic waste, such as vegetable, fruit leaves and peelings, should either be fed to domestic animals or stored separately for collection by SWM people. Although composting might not be a very practical option in Shigar, due to the small quantity of waste generated and long extreme winters, it should be explored as an option under this framework.
 - Markets should segregate their waste at source. Due to a high percentage of recyclable waste, all shops should combine their waste and sell or give it to a vendor. Non-recyclable waste, such as hair from barber shops, should be disposed off at a designated waste dumping site. Likewise, waste from the slaughter house should be sold to a vendor for further processing.
 - Schools should segregate their waste and sell the recyclable waste to a vendor.
 - Shigar Fort Residence in Shigar, which generates considerably more waste than any other facility in Shigar, should segregate its waste, to set an example for other businesses and facilities in Shigar.
 - STMDS should arrange for a covered shed or room, to store recyclable material and sell to a vendor once a week.

Collection

- The focal person for SWM on the EMF Committee should designate staff for collection in the designated zones. Hiring of janitorial services may be required to effectively carry out the collection process.
- Collection should only be undertaken on alternate days. On the days waste is not collected, people should keep the waste inside their house. Any waste which is not in a dustbin should not be collected.
- Janitors should be provided wheelbarrows for waste collection.
- Recyclable waste should only be collected once a week, either on Friday or Saturday. If people are interested in getting rid of the recyclable waste earlier, they should take the waste to a designated collection point in Shigar Town.
- All residents of the Shigar should participate in SWM.
- Waste collection from the bazaar should be on a daily basis. All shopkeepers must participate in SWM in the bazaar area.
- Waste from Shigar fort should be collected on a daily basis. Considering Shigar Fort is the biggest business in Shigar Town, it should pay proportionally for waste collection and disposal.
- All shopkeepers must pay a monthly fee for their SWM. The fee should be decided in consultation with shopkeepers.
- Slaughterhouse waste should also be collected daily. Due to the nature of slaughterhouse waste, the fee should be different from other shopkeepers. However, it is at the discretion of EMF Implementation Committee to decide on the collection fee.
- Initially, no fee should be charged for collection. Later, the option of charging a small fee from the residents should be considered, to cover costs involved in SWM.
- Dumping of waste in water bodies or slopes leading to water bodies should be completely banned. Anyone found in violation should be fined. The fine should be decided by the Committee, in consultation with the community.

Storage

- All zones should preferably have a waste storage point, where all the waste from that particular area is brought before transportation to the final disposal site. The site should be selected in consultation with the community. The storage site should not be located close to the water channel, to avoid any contamination from solid

waste leachate. The storage site should have a boundary and provision to cover it before snow or rain, to prevent runoff which contaminates water bodies.

- Depending on the amount of waste generated, it is also possible to have a combined storage site for some areas. The option of having a single storage site for the entire UC should also be explored. However, this issue needs to be decided by the Committee, in consultation with the community.
- Waste from the storage site should be transported to the final disposal site on the same day, to avoid rotting and problem of rodents and insects (e.g. flies and mosquitoes).

Transportation

- Transportation of the waste from storage sites to the final disposal site requires atleast one vehicle, either dedicated or hired twice a week, to carry out this function.
- Due to shortage of funds, it is better to hire a vehicle twice a week, for a couple of hours to transport waste. Later, when funds are available, the option can be explored to buy a dedicated vehicle for this purpose, or atleast buy a tractor cart which can be attached to a hired tractor. Trolley should be covered, to avoid spillage of waste during transportation.

Disposal Site / Landfill

- The final disposal site or landfill should be located away from residential and agriculture areas, preferably downstream, to avoid contamination of water bodies and underground water and smell. The site should also be at a safe distance (70ft) from water bodies, to avoid contamination. The siting of landfill site should take guidance from the GIS maps developed under this initiative.
- Due to funding constraints, a designed landfill is not a very practical option. However, a simple design should be considered to avoid dogs, rodents and insects related issues. Regular spraying of the area would keep such problems to a minimum.
- The government should be requested to provide land for the landfill site.

Hospital Waste

Segregation

- In hospital waste management, segregation is the single most important function which if performed effectively can help in avoiding major issues later. Since RHC is the only hospital serving Shigar Town, it handles a significant number of patients daily.
- All areas of the hospital (OPD, operation theatre, laboratory, general ward and rooms) should practice segregation of infectious and non-infectious material. Normally, the two waste bins are color coded – green for non-infectious and red for infectious. In addition, separation of sharps and non-sharps (needles) is also very essential. Each area should have three bins – green for non-infectious, red for infectious and yellow for sharps.
- All areas of hospital should have needle cutters. Any needle used should not be used for another patient and should be discarded immediately. However, before discarding the needle, it should be cut by a needle cutter to avoid reuse of that needle.
- A senior hospital staff should be dedicated to handle hospital waste management. Regular visits should be performed to ensure that proper segregation is taking place.
- X-ray machine developer should be handled as per guidelines issued by PAEC. The replaced developer should be stored at RHC premises until transfer to PAEC, Islamabad for proper storage / disposal.

Collection

- The hospital should designate staff responsible for collecting hospital waste.

- The collection staff should be provided proper safety gear, such as masks and proper gloves, for their safety.
- The collection staff should be provided proper training on how to handle hospital waste.
- Everyday, infectious waste should be collected separately and stored in a closed room in the hospital, preferably in the outer side of the hospital. The room should be locked and only authorized personnel should be allowed to access it.
- Non-infectious waste should be collected separately and not allowed to be mixed with the infectious waste. The non-infectious waste should be collected by a designated person on the collection day and taken to the storage site.
- Sharps should also be collected separately in puncture resistant bags, to avoid hurting the collecting personnel. Moreover, sharps should be stored with the infectious waste.
- X-ray developer should be collected as per PAEC guidelines.

Disposal

- Infectious waste and sharps should be incinerated ideally. However, due to non-availability of an incinerator in the area, it is better to burn them to avoid any further problems. Although not the ideal solution, burning the waste is better as compared to throwing it out to be recycled or become a source of disease due to dogs, cats or other scavengers.
- A waste pit should be constructed within the hospital premises to burn the infectious waste. The pit should be preferably of RCC with a cover. The waste should be burnt on alternate days or daily, depending on the amount of the waste. Kerosene oil should be used to ensure proper burning. The cover should have a chimney, to help take the smoke to a higher elevation for proper dispersion. Preferably, burning should be at night, when people are indoors.
- X-ray developer should be transferred to PAEC Islamabad, for proper storage disposal.

Training / Awareness Raising

- An awareness raising seminar or workshop should be held for hospital staff, to educate them on hospital waste management. Regular refresher courses should be held for staff, to keep them current and aware of the principles of hospital waste management.
- Posters should be prepared and posted at all concerned points in the hospital, to remind the staff of the functions that have to be performed under proper hospital waste management.

3.9.3 Indoor Air Pollution

As mentioned earlier, it is one of the most critical health hazards in Shigar, especially during winter. Due to lack of awareness on the use of fuels and ventilation, people in Shigar are getting sick, and it is also severely affecting them economically. It is also a time bomb, because regular exposure to poisonous gases can potentially lead to cancer and other acute health problems, such as heart attack. It is therefore of utmost important to educate people on how to address indoor air pollution, mainly through better fuel use and ventilation. Some of the key measures are suggested below:

- Undertake an indoor air pollution study, to assess the levels of indoor air pollution in Shigar. The study should also assess impacts of indoor air pollution on the health of Shigar residents. Study results will influence locals to take appropriate actions for reducing indoor air pollution.
- Raise awareness of the people on the hazards of burning plastic bags, rubber and other synthetic material in *bukhari*. If people are aware of the hazards of burning the hazardous items, it would solve the problem by atleast 50%.
- Improve the design of local heaters. At the moment, the heater or locally called *bukhari* is an energy inefficient instrument / device. If the design of the *bukhari* can be improved for better efficiency, it will bring the fuel cost of people down by atleast 10 to 20%. It is therefore suggested to explore more efficient heaters elsewhere in

the region and if possible get them manufactured locally. In one project, energy efficient heaters were introduced; these are going to be disseminated through CKNP in Shigar. STMDS should get in touch with the relevant people and arrange for a demonstration and later, if it is feasible, introduce it in Shigar.

- Improve exhaust and ventilation facilities in houses. If the ventilation is improved it will result in better indoor air quality.
- Explore alternative fuels, so that people are not forced to use plastic bags, rubber and other synthetic material for burning.
- Explore possibility of growing trees good for firewood. However, before introducing any new specie, it should be properly investigated so that it is not self propagating and thus invasive. Help should be sought from the forest department and other relevant experts.
- Improve medical care at RHC, to deal with impacts of indoor air pollution.
- Prepare awareness raising material, to make people aware of the hazards of air pollution.

3.10 Administration

Although STMDS is run by devoted and competent people who have the ability and devotion to implement EMF effectively, the role of government in EMF is essential, considering enforcement constraints of STMDS. Therefore, it is recommended that the existing Health Committee under STMDS be made responsible for the implementation of EMF. It is quite pertinent to review the existing structure of the Committee and add new members to facilitate effective implementation of EMF. It is proposed to establish an EMF Task Force under the Committee. The Task Force should have technical, administrative and financial people to cover all the relevant aspects of EMF. In the Task Force, focal points should be appointed for water, solid waste, indoor air and financial matters. It is important to keep the Task Force small, for better management. If any additional expertise is needed, the Task Force should co-opt new members or invite them as guests for the meeting. The Task Force should meet monthly, to discuss and review performance of the last month and set targets for the coming month. It would be very prudent if women are also given representation in the Task Force. The Terms of Reference of the Task Force should be prepared and agreed upon by all relevant stakeholders (Annex 2: Draft Terms of Reference of EMF Task Force). The focal persons should also be given some budget, to be able to perform their functions effectively. Raising of funds for EMF implementation should be one of the key responsibilities of the Task Force.

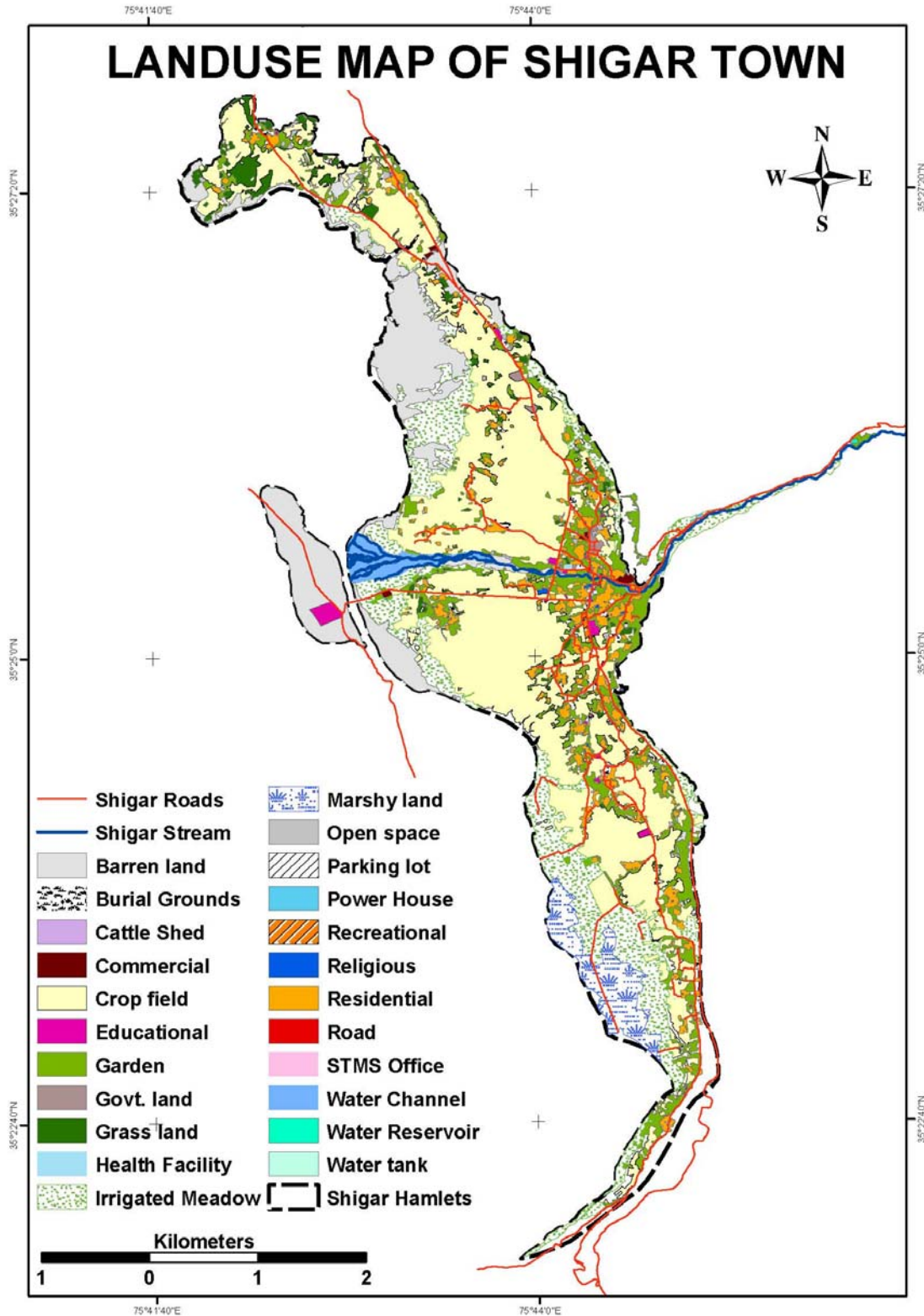
3.11 Financial Sustainability

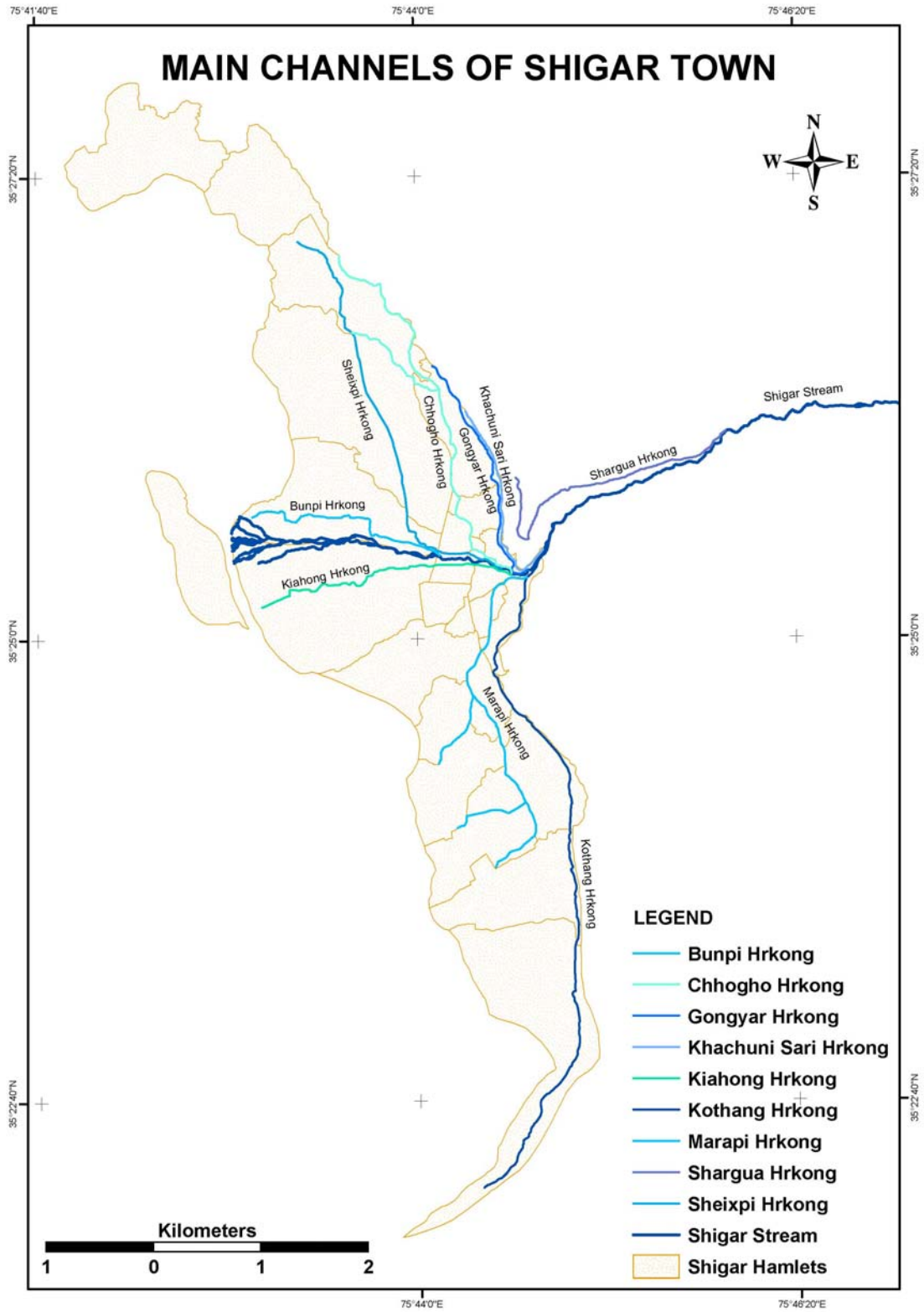
The initiatives discussed in this report will only be successful if they are financially sustainable. Although some measures discussed in this report can be implemented without any significant financial implications, it is important that financial mechanisms are available to undertake initiatives which require construction, regular maintenance and consumables. Therefore, four potential options are discussed below:

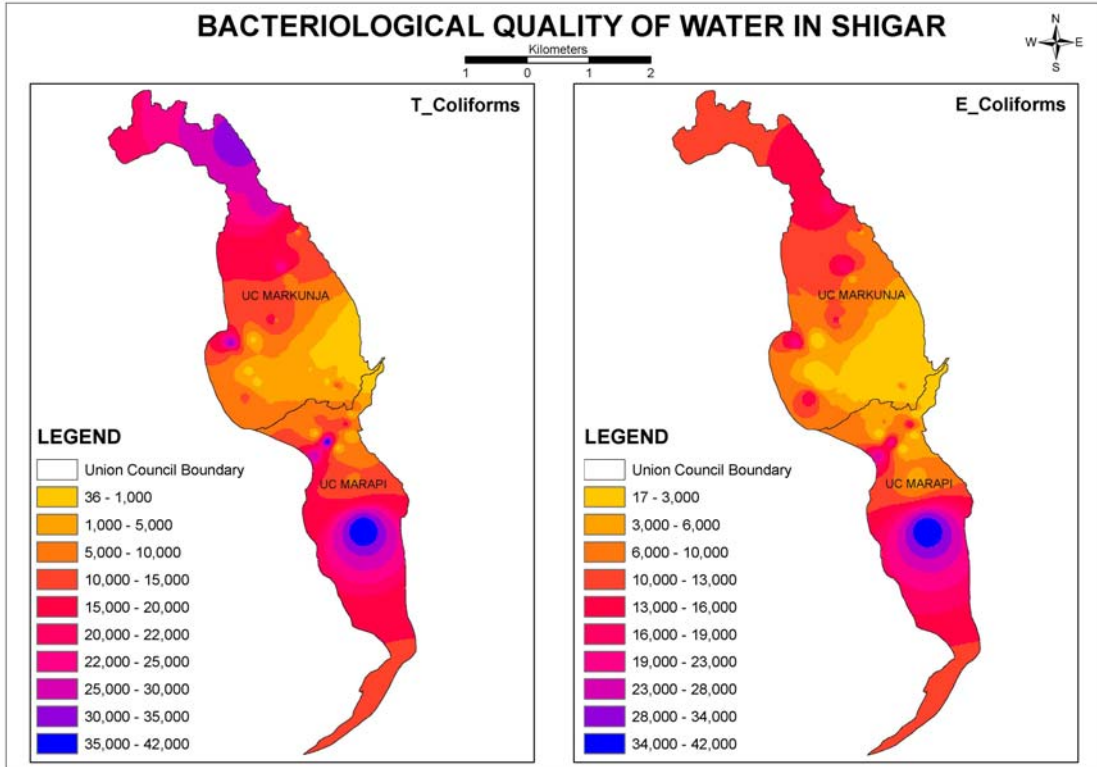
- A Northern Areas Sustainable Development Fund was established under Northern Areas Strategy for Sustainable Development. This fund was started by a contribution of Pak Rs. 2 million by Swiss Agency for International Development and Royal Norwegian Embassy, which was matched by a Rs. 3 million contribution by the Northern Areas Administration. The purpose of the fund was to support smaller community based organizations, such as STMDS, in their sustainable development initiatives. This fund can be tapped, to undertake some of the initiatives under EMF. In addition, Water Management Directorate could also be approached for funding of water related interventions under EMF;
- The other option is to explore funding from the private sector, such as telecommunication companies who have erected antennas in Shigar and Shigar Fort Residence. These companies have a stake in Shigar and might be willing to provide financial support in the implementation of EMF;

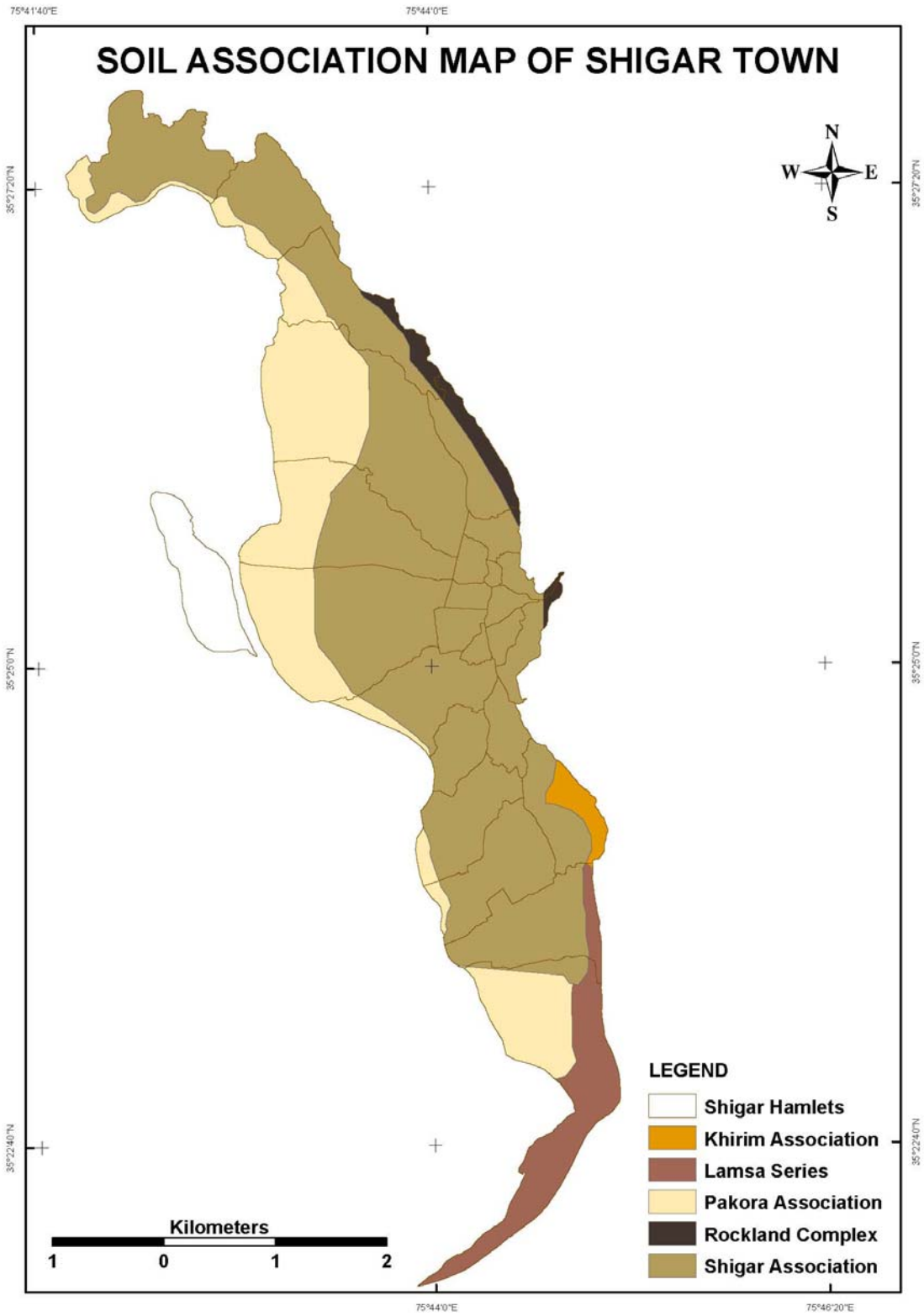
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- EMF can be included in the Annual Development Plan of NAs. Although this option is somewhat difficult, considering a small amount to be distributed among several areas, it is worth exploring, through the elected representatives of the area and district administration; and
 - Residents of Shigar Town can be requested to pay either a monthly, quarterly, biannual or annual fee, to run some of the key initiatives. The capital investment for the initiatives might be raised from any of the three options discussed above.

Annex 1
GIS Maps of Shigar Town
Landuse Map of Shigar Town
Main Channels of Shigar Town
Bacteriological Quality of Water in Shigar
Soil Association Map of Shigar Town









Annex 2

Environmental Management Framework Implementation Task Force Terms of Reference

A multi-disciplinary Environmental Management Framework Implementation Task Force, under the Health Committee, is proposed to facilitate implementation of EMF. The Task Force is to be headed by the AC, Shigar Tehsil / District. The other proposed members are President STMDS, Incharge Medical Officer (RHC), Representative of AKCSP, Manager Shigar Fort Residence, and Representative of Shigar Bazaar Association. The Task Force should meet monthly to discuss implementation status of EMF.

Responsibilities

1. Develop an action plan to facilitate implementation of EMF;
 2. Develop 'Code of Conduct' for the Task Force members;
 3. Work towards the improvement of quality of life of Shigar Town residents;
 4. Meet monthly to review implementation status of EMF;
 5. Work closely with the relevant stakeholders, especially government institutions, for effective implementation of EMF;
 6. Raise funds to support EMF implementation;
 7. Purchase equipment required for the implementation of activities under EMF;
 8. Maintain transparency in all financial and other matters of the Task Force;
 9. Maintain accounts of all expenses made by the Task Force;
 10. Brief residents of Shigar Town and other stakeholders regularly on Task Force's performance;
 11. Make efforts to raise awareness of the residents of Shigar Town on environmental issues;
 12. Improve capacity of the Shigar Town residents on environmental management;
 13. Ensure effective gender balance in the Task Force and also in all matters pertaining to the Task Force;
 14. Screen any development initiatives undertaken in Shigar Town for environment, health and safety compliance; and
- Share experiences of EMF implementation at relevant forums.

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