Guidelines for Climate Resilient Water and Sanitation at Schools

Integrated Development Society Nepal
and
UNDP / GEF / SGP Nepal

Author	:	Sadhuram Khatri
		Keshab Paudel
Editor	:	Mabindra Regmi
		Sushil BK
Reviewer	:	Dr. Dineshchandra Devkota
		Madhukar Upadhaya
		Prabha Pokhrel
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FOREWORD

The Millennium Development Goal (MDG) 7 has set targets for Water, Sanitation and Hygiene (WASH)sector in order to mobilize the global community for collective effort towards achieving sustainable access to drinking-water and sanitation for millions of people around the globe. Many programs have been undertaken to address a number of key concerns, including public health, water quality and quantity, water source protection, drainage, and disease vector control, which has helped improve human well-being in multiple ways. Although Nepal has already surpassed MDG target of 2015 but it still needs to expedite its achievements to meet the set national target of 100% access by 2017. Furthermore, the Fifth Assessment Report of Intergovernmental Panel on Climate Change (SAR IPCC)clearly shows the continuing and serious impacts of climate change on people's livelihood and natural resources, more so for the most vulnerable groups. The least developed, status compounding with people's high dependency on natural resources for livelihood, increases their vulnerability from climate change. Water sources, being highly sensitive to variations in temperature and precipitation, are drying up. Drought or intense rainfall in short period leads to changes in availability of water, both in terms of quantity and quality (e.g. too little, too much, and often polluted) affecting all aspects of life for all groups of people in every sector. Hence, change in climate will have significant impacts on water leading to exposure to hazards, degraded sanitary systems, and hygiene facilities within the school premises too.

In order to address this emerging threat, it is important to plan holistically by promoting water conservation, plantation, recharging and ensuring multiple uses of water, increased effectiveness of sanitation services, along with mass awareness campaigns and education on climate resilient school WATSAN focusing on school and children. Imparting knowledge on importance of source protection, assessment of health/hygiene impacts, and technological improvements to increase water availability and decrease vulnerability of school and students will help not only to address the problem at school but in the long run, the problems of the nation as well. Therefore, Climate Resiliency is anticipated to be a major issue of Nepal, and climate resilient planning is necessary in each sector to mitigate its impact.

IDS-Nepal and UNDP, mobilizing resources from Every Drop Matters Project, developed this "Guideline on Climate Resilient Water and

Sanitation". This guideline is first of its kind incorporating holistically climate change, water and sanitation, and resiliency nexus. This is a general guideline for planning and implementation of climate resilience related adaptation and mitigation activities, water and sanitation (WATSAN) activities, and programs helpful for local schools. We hope this guideline will serve as valuable addition to the sector for all levels, specifically for designing and formulating programs related to climate change induced water and sanitation management at schools.

Finally, we would like to acknowledge the support from Mr. Vijaya Singh, Assistant Country Director UNDP, Mr. Bijay Prasad Kesari, Program Officer, UNDP, Mr. Kamal Raj Sigdel, Communication Analyst, UNDP, and Vivek Sharma, Program Assistant, UNDP/GEF/SGP for their guidance and constructive feedback. We would also like to thank Mr. Ramakanta Sharma, DEO Bhaktapur, and Engineer Giridhar Mishra from DEO Kathmandu for their continued cooperation and support. Our gratitude also goes to Panchakanya Madyamik Vidhyalaya team: Mr. Keshav Prasad Timalsina, School Management Committee chairman, Mr. Santa Ram Dulal, Headmaster, and Mr. Govinda Panthi, English Teacher.The Ecoclub coordinators, students and inhabitants of seven settlements of school catchment also deserve due acknowledgment for their participation, contribution, ownership, and support. We would also like to thank the efforts of the team of experts, specially Mr. Madhukar Upadhaya, Independent Expert; Mr. Sadhuram Khatri, Programme Officer, Mr. Keshav Paudel, Environment Officer, Ms. Sunita Bhattarai, Management Officer, Mr. Sandeep Ghimire, Technical Supervisor and other IDS-Nepal team members during execution of the pilot project and backstopping this guideline development.

Last but not least, we appreciate the inputs, time contributions and feedback from all stakeholders gathered during the school, district, regional, and national workshops, specifically from the community, school, representatives of different stakeholders and the media. We beleve this guidelience will help to educate on climate resilient school WATSAN.

Gopal Sherchan
Country Coordinator
GEF/SGP/UNDP

Prabha Pokhrel
Chair,
IDS Nepal

Acronyms

$_0$C	Degree Centigrade
CBS	Central Bureau of Statistics
DEO	District Education office
ECOSAN	Ecological Sanitation
GCAP	Global Climate Adaptation Partnership
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHGs	Green House Gases
GoN	Government of Nepal
IDS	Integrated Development Society
MDG	Millennium Development Goal
MoEnv	Ministry of Environment
NAPA	National Adaptation Program of Action
NPC	National Planning Commission
ODF	Open Defecation Free
OECD	Organization for Economic Cooperation and Development
O&M	Operation and Maintenance
PAC	Practical Action Consulting
PV	Photo Voltaic
SGP	Small Grants Program
SLTS	School Led Total Sanitation
SMC	School Management Committee
WATSAN	Water and Sanitation
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

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Chapter 1

Introduction

1.1 Background:

This document has been prepared to provide general guidelines for planning and implementation of the climate resilient water and sanitation (WATSAN) activities as part of practical learning for the students in their formative years. It is intended to help Students, School Administrations, School Management Committees, District Education offices (DEO) and other stakeholders for effective implementation of the climate resilient Water and Sanitation activities at the school level. The existence of this guideline was felt necessary while implementing a pilot project to increase resiliency to climate change associated with water and sanitation at Panchakanya Madyamic Vidhalaya, a public community school located in Sudal of Bhaktapur District. The project was jointly implemented by IDS –Nepal and UNDP/Small Grant Project (SGP)/Global Environment Facility (GEF)/Every Drop Matters (EDM) Project to support reduction in climate change vulnerability of school WATSAN. Several gaps have been observed in project planning and implementation currently being conducted to address increasing threats of climate change. This raises questions with regards to sustainability of the project. The guideline, therefore, was prepared to address these shortcomings for Climate Resilient WATSAN at Schools.

It is expected that this guideline will be used by District Education Office (DEO), Schools, School Management Committees (SMC) and other Stakeholders. As mentioned earlier, these are general guidelines, and hence are not restrictive but meant to provide a framework, which the stakeholders can modify to suit the needs and requirement of their contexts. The stakeholders are encouraged to add to, contextualize or modify the provisions mentioned in the guideline according to their area specific conditions or to meet specific needs of their locations and geographical areas in order to sustain WATSAN activities at schools by making them climate resilient.

Need of Water and Sanitation:

The management of water and sanitation is widely accepted as an essential component of social and economic development. The provision of potable water supply and access to affordable sanitation

services are important conditions in addressing some of the crucial needs of the people. Safe drinking water and good sanitation are essential for individuals as well as for community health security. Hence, the policy of the Government of Nepal emphasizes on expanding both the water supply and sanitation services. However, with emerging threats of climate change and its likely impacts on availability of water in existing sources, and increase in frequency and intensity of water induced hazards, water and sanitation sector could face setback in sustaining the achievements already made, if not expanding it to the areas where it has not reached. The need, therefore, is to induce climate resilience measures in water and sanitation infrastructure and services immediately.

Need for Guidelines:

Drying and depletion of water sources, and frequent and more intensive water induced hazards have been increasingly reported across the country in the last decade. At the same time, awareness on need for quality water and total sanitation has increased substantially due to strong commitment of the government and development partners. One of reasons for the depletion of water is degradation of natural environment caused by numerous factors including the change in rainfall patterns and temperature regime, both of which could well be the result of changing climate. Too much water and/or its scarcity will have multiple impacts on the living condition of people. They may have to use contaminated water for household uses, managing waste disposal becomes a problem, and toilets become nonfunctional, which collectively affect health and general well-being of the people as well as hinder their prospects for progress. Therefore, there is a need for guidance to make the best out of the situation and yet make sanitation more robust and water sources resilient to the climate impact. The need of guideline in the planning, implementation and project sustainability has become necessary in the water and sanitation sector. Before presenting the detailed guidelines, a brief account of key components of climate resilient water and sanitation is presented in the following sections.

1.1.1 Water, sanitation and hygiene (WASH) Overview:

Health is wealth, as the adage goes, and good sanitation practices are essential to maintain good health. Only healthy society can prosper and progress. Therefore, health is regarded as an important indicator of essential elements measuring quality of life. There are a number of issues that need to be addressed to ensure good health and sanitation. Clean and safe drinking water is one of them. In most of the places, water available is not safe for consumption and even in places where water is safe, practices on use of water often degrade its quality, and hence the quality of health and sanitation suffer.

The water supply, sanitation and hygiene are frequently referred as WASH, and focuses on the level of existing facilities at household and community levels. The implicit emphasis of WASH activities is on improving the health of community members. Therefore, providing access to safe drinking-water and basic sanitation has been regarded as a proven engine driving development and promoting health.

WASH programs are undertaken to address a number of key concerns, including public health, water quality and quantity, water source protection, drainage, and disease vector control, which help improve human well-being in multiple ways. They can decrease the burden of diseases caused by water-borne pathogens, and increase the time people have for other vital tasks, promoting better school attendance and so on.

The Millennium Development Goal (MDG) 7 has set targets for WASH programs in order to mobilize the global community for collective effort towards achieving sustainable access to drinking-water and sanitation for millions of people around the globe. In 2014 total of 116 countries had already met the drinking water target, and 77 have already met the MDG sanitation target (WHO and UNICEF, 2014). According to the 2011 Census, people with access to improved water supply and sanitation facilities in Nepal have reached 85% and 62% respectively in comparison to global level which stand at 89% and 64%. Nepal has already surpassed its MDG target of 2015(NMDG, 2013), but needs to expedite its WASH achievements to meet its national goal

of 100% coverage by 2017.
While WASH programs vary widely, there are few core areas that capture majority of the activities; (Figure 1)

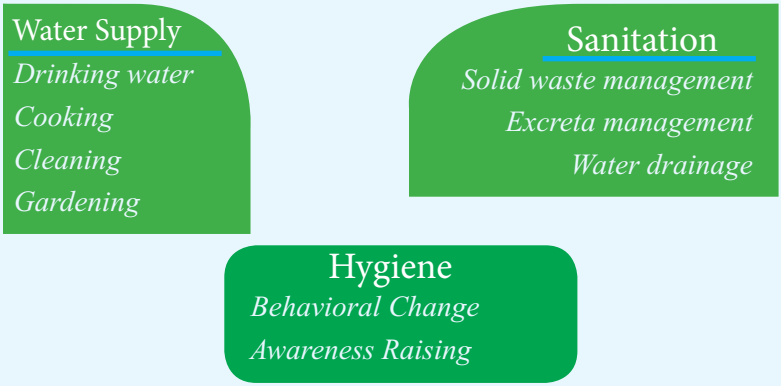

Figure 1: Core areas of WASH Program

One needs to understand that a key component of WASH activity is water, which must be available at the right time and in adequate quantity, and be of acceptable quality to improve WASH condition.

1.1.2 WASH in Nepal:

The national census survey report of Central Bureau of Statistics (CBS 2011), shows that National sanitation coverage has reached 62% from 6% in the last 21 years (1990-2011). Sanitation coverage across development region & ecological belts; (Figure 2) Government of Nepal (GoN) has set a target of achieving 80% improved sanitation coverage by 2015 and 100% by 2017. As such, the rate of increment has to be raised to 4.5% per annum to achieve the 2015 target, whereas, the rate needs to be 6.3% per annum to achieve the 2017 target(Sanitation and Hygiene Master Plan, 2011). The current rate of progress in WASH is 2.67% per annum (NMDG-progress report, 2010). Therefore, there is a need to expedite the current rate of progress to meet the set targets.

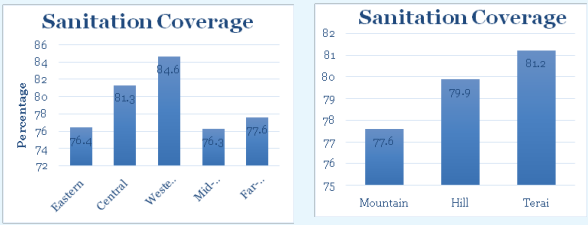

Figure 2: Sanitation Coverage across development regions and ecological belts (Source: CBS, 2011)

The differences in progress achieved in sanitation coverage are distinct within the ecological belts and the administrative regions (Fig 2). Similarly, according to the report published by National Management Information Project (NMIP) and Department of Water Supply and Sewerage (DWSS),the water supply coverage is as indicated below (Fig 3). Western Development Region has the highest water supply coverage (84.6%) and the Eastern and Mid-Western Development Regions have the lowest coverage (76.4% and 76.3%)respectively. Within the geographical region, water supply coverage is highest in Terai (81%). Similarly, sanitation coverage is highest in Western Region (73%) and Hills (76%) and lowest in Far western (48%) and terai regions (50%). Also, according to the progress report of the National MDG (2010) and CBS (2012), the urban sanitation coverage has increased from 80% to 91%, and rural sanitation from 25% to 55% from 2000 to 2011.

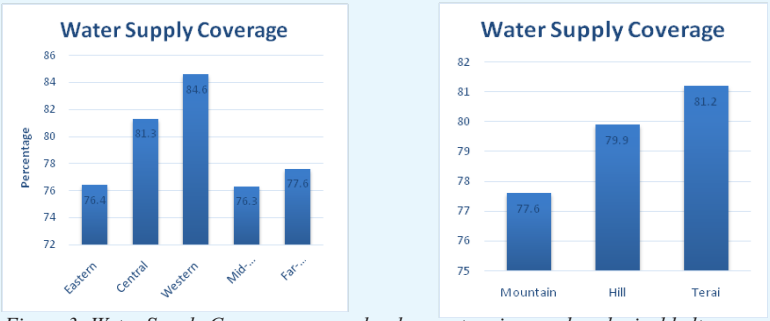

Figure 3: Water Supply Coverage across development regions and ecological belts (Source: NMIP & DWSS, 2011)

In order to improve the rate of improving sanitation and hygiene coverage, the GoN has laid out a Sanitation and Hygiene Master Plan (2011) with the following objectives:

- Create an enabling environment for harmonizing the efforts of stakeholders through unified planning and the implementation process;
- Develop necessary mechanism for maintaining uniformity and standards in approaches and modalities;
- Develop an institutional arrangement at all levels for revitalizing and strengthening the existing structures and introducing new strategic institutions as appropriate; and
- Set national and district level milestones in terms of toilet coverage;

(Source: Sanitation and Hygiene Master Plan,- 2011)

1.1.3 WASH and Schools:

In Nepal, there are about 28 thousand schools, out of which, only 76.8% have water supply facilities. Sanitation and Hygiene Master Plan, 2011 states that 61.9% of schools have at least one toilet facility with 35.9% having access to a common toilet and only 33.9% providing a separate toilet for girls (Sanitation and hygiene Master Plan, 2011). About 80% of the community schools have toilets, and of these, only about 65% have separate toilet facilities for girls (Department of Education, 2011). However, the ratio of toilet to students is 1:127 against the national standard of 1:50. About 93% of the boys and girls use toilets for urinating during the school hours. Majority of the toilets do not have proper sanitary disposal facility. Therefore, due to the lack of basic toilet and sanitation facility, girls face difficulties during the menstruation period, which has increased the number of drop-outs from schools among the girls during puberty. Besides, girls also face harassment in the school while using separate toilets in same block, and this has also led to the high rate of girls drop out from the school. This situation can be diffused through awareness of sanitation and hygiene among the students. The basic requirements for school sanitation are water, sanitation and hygiene education. Schools need to demonstrate it as a place to set example for sanitation so that it can influence the nearby communities and households of catchment areas for learning and cultivating better sanitation and hygiene(Department of Education 2011)behaviors. Some of the concepts and approaches that have been applied to water and sanitation in schools are as follows:

School Led Total Sanitation (SLTS):

An innovative community-based approach to total sanitation was started jointly by UNICEF and the GoN in the beginning of 2006. The pilot program was called the School-Led Total Sanitation (SLTS), based on the achievements of UNICEF's School Sanitation and Hygiene Education (SSHE) program implemented in Nepal since 2000. Advocacy and institutional capacity building was injected at school, community and district levels to trigger and improve proper sanitation behavior. Open Defecation Free (ODF) areas were promoted through intensive social mobilization using participatory approaches.

The approach has proven to be effective and is being replicated with following objectives(DWSS 2006):

- develop students and schools as the role model for promoting personal, household and environmental sanitation;
- develop open defecation free communities within school catchments by ensuring that every household has access to latrines;
- promote hand washing with soap in school and communities;
- promote sustainable child friendly and gender friendly Water Supply and Sanitation (WATSAN) facilities in school; and
- manage waste water and solid waste in school.

Though, SLTS focuses on schools, it also extends to the catchment area of the school, which generally comprises four or five settlements or villages. SLTS works with child clubs and empowers them and puts their skills to use alongside community sanitation sub-committees. Together with child clubs, SLTS lead the campaign to educate their parents and neighbors on benefits of improved sanitation and keeping their communities clean.

Ecological Sanitation (ECOSAN):

Ecological Sanitation, which is commonly abbreviated as ECOSAN (also spelled eco-san or Eco San), is an approach rather than a technology or a tool, which is characterized by a desire to "close the loop" (mainly for the nutrients and organic matter) between sanitation and agriculture in safe manner. Esrey et al. (2003) has defined Ecological Sanitation (ECOSAN) as a system that:

- Prevents disease and promotes health;
- Protects the environment and conserves water; and
- Recovers and recycles nutrients and organic matter in the soil.

The idea is based on an overall view of material flow as part of an ecologically and economically sustainable wastewater management system tailored to the needs of the users and to the respective local conditions. It does not favor a specific sanitation technology, but is rather a new philosophy in handling substances that have so far been seen simply as wastewater and water-carried waste for disposal. The important advantages of ECOSAN system are:

- Improvement of health by minimizing the contamination of water sources with pathogens from human excreta

- Promotion of safe and hygienic recovery and use of nutrients, organic matter, trace elements, water and energy
- Improvement of soil fertility
- Contribution to the conservation of resources through reduced water consumption and substitution of chemical fertilizers enhancing agricultural productivity to ensure food security

1.2 Climate Change:

1.2.1 General Concept

Climate change is change in global or regional climatic pattern (i.e. global or regional temperature, precipitation, extreme weather, etc.) over a period of time attributed largely to global warming caused by increased levels of greenhouse gases (GHGs) such as carbon dioxide, methane and a few others in the atmosphere. It has been projected that with the current rate of global warming, the global average temperature will go up by 1^0C to 3.5^0C over the next hundred years, which will have significant impact on rainfall pattern and subsequently, on extreme events such as floods and droughts.

In fact, certain level of GHGs in the atmosphere is necessary as they absorb re-emitted heat radiated from the earth, and trapping warmth. In the process, it keeps the earth warm enough making it habitable. Without the GHGs, the surface temperature of the earth would be around -18^0C instead of current average of 14^0C. However, excessive emission of GHGs due to industries, burning of fossil fuel, deforestation and many other human activities have added more GHGs into the atmosphere making it warmer than usual. This condition of increased warmth is called global warming (Fig 4).

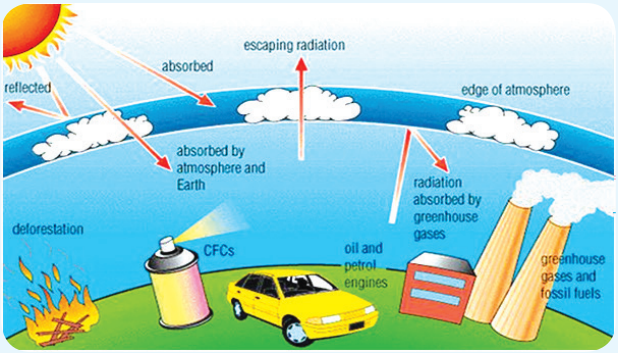

Figure 4: GHGs emission(Source:http://envis.tropmet.res.in/kidscorner/greenhouse.htm)

Climate Change in Nepal:
Nepal possesses an extremely varied and complex climate driven mainly by contrasting terrain and large elevation differences. The altitude of the country varies from the 67 m to 8848 m(Mt Everest), the highest peak in the world, within a span of 200 km, resulting in a wide range of climatic conditions due to variations in the altitude. It has created a complex seasonal weather pattern heavily influenced by the Himalayas and the annual monsoon. Because of a wide variety of physiography, geological, ecological and meteorological factors, Nepal is prone to various types of natural and human-induced hazards, including floods, earthquakes, droughts, landslides, hailstorms, disease epidemics, glacial lake outburst floods, and fires. Hence, any change in the existing climate is going to be felt in multiple ways in different parts of the country.

1.2.2 Observed Impacts in Nepal

Change in temperature:
Temperature in Nepal has increased Significantly over the recent decades in a much faster rate than the global average (IDS-N, PAC, GCAP 2014). Recorded temperature data indicates consistent warming and rise in the maximum temperatures at an annual rate of 0.04 – 0.06°C. Studies also indicate that the observed warming trend is not uniform across the country more pronounced in high altitude regions as compared to Terai and Siwalik. (NAPA, 2010).

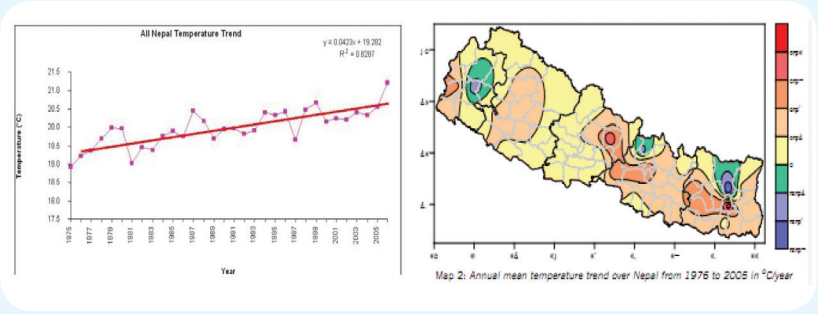

Figure 4: Temperature trend of Nepal (Source: Practical Action 2009)

Change in precipitation:
Although definitely changing, the precipitation trends are more complex and show wide variations across seasons, regions as well as heavy rainfall extremes. The NAPA based on past three decades

between 1971 and 2006 have not found any general nationwide trend, but general decline in pre-monsoon precipitation in far- and mid-western Nepal, with a few pockets of declining rainfall in the western, central and eastern regions(NAPA, 2010) have been felt. Other reports indicate varied trends of change in precipitation. The analysis is complicated and needs to factor in very long cycles in the climate, therefore, needs to focus on trends at the regional and seasonal levels (IDS-Nepal, PAC, GCAP, 2014).

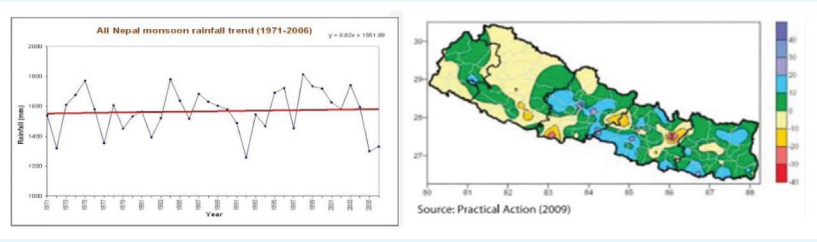

Figure 5: Precipitation trend of Nepal(Source: Practical Action, 2009)

Observed rainfall patterns:

In a separate study carried out by Practical Action, which analyzed data from 166 stations across Nepal from 1976 to 2005, found that there is an increasing trend in annual rainfall in eastern, central, western and far-western Nepal. Seasonal variation in annual precipitation shows a general decline in pre-monsoon precipitation in far and mid-western Nepal, with a few pocket of decreasing rainfall in western, central and eastern regions. On the other hand, in the rest of the country, there is a general trend of increasing pre monsoon precipitation (Practical Action report, 2009).

Observed drought like conditions:

Almost 75% of the population in Nepal derives a major portion of its livelihood directly from agriculture. Although the contribution of agriculture to the national GDP has been decreasing during the recent decades, from more than 50 percent in 1995 to about 35 percent in 2012, it is still one of the highest among South Asian countries. Therefore, agriculture is the main source of livelihood. The incidence of drought has led to the shortening of the maturation period and impacted the production, which is decreasing gradually due to increasing drought events of the last few years (NPC, 2011). The continuous drought event is compelling the local people to migrate from their original

habitat. Most families migrating from the hill districts did so due to water shortage, less agricultural production, and searching for better livelihood opportunity (NPC, 2013). The available information on drought effects in Nepal is very limited, therefore, NAPA used proxy indicator to prioritize drought risk vulnerability districts. The district rank is listed below according to drought risk (Table 1).

Table 1: Prioritized districts for drought risks

Drought Risk/Exposure	Districts
Very High (0.563-1.00)	Saptari, Jajarkot, Siraha, Kalikot, Dailekh, Dadeldhura, Humla, Dhanusha, Jumla, Ramechhap, Achham, Mugu
High (0.348-0.562)	Bajhang, Bajura, Dolakha, Dhading, Doti, Kanchanpur, Sarlahi, Udayapur, Salyan, Darchula, Banke, Baitadi
Moderate (0.24-0.347)	Kathmandu, Kapilvastu, Bardiya, Rolpa, Dolpa, Manang, Rukum, Gorkha, Mustang, Pyuthan, Bhojpur, Lalitpur, Bhaktapur, Arghakhanchi, Rupandehi, Kailali, Dang, Rasuwa, Makwanpur, Mahottari
Low (0.106-0.223)	Rautahat, Panchthar, Sindhuli, Gulmi, Kavreplanchowk, Sunsari, Kaski, Chitwan, Palpa, Illam, Nawalparasi, Nuwakot, Okhaldhunga, Baglung, Surkhet, Tanahu, Morang, Taplejung, Terhathum, Solukhumbu, Myagdi
Very Low (0.000-0.105)	Sankhusabha, Sindhupalchowk, Parbat, Parsa, Khotang, Bara, Lamjung, Dhankuta, Jhapa, Syanga

Source: NAPA 2010

Water Induced Disasters:

Water-induced disasters, one of the major climate related natural hazards in Nepal, has been in an increasing trend indicating a differing distribution of risks across country. According to the Nepal Disaster Report, 2013 (Ministry of Home Affairs, 2013), floods caused 52 deaths and 8 injuries in 2012 only. The Seti river flood in Kaski District in May 2012 alone claimed 41 lives. In the same year, flood related deaths were also recorded in Far Western Terai, Mid Western hills, and Western hills. Human death due to flood were recorded in six districts. Similarly, 265 people lost their lives while 256 have been missing in the flood events in 2014. The economic loss has been estimated at about 17 billion rupees in 2014 alone.

According to the Climate change vulnerability mapping for Nepal (2010), the districts are ranked as Very high, High, Moderate, low and very low in terms of flood risk. This was calculated and ranked from the flood records of the recent years; particularly the frequency of occurrence, number of people dead, number of people injured, and property loss provided by the Ministry of Home Affairs. The prioritized district according to the flood risk are listed below (Table 2).

Table 2: Prioritized district for flood risk

Flood Risk/ Exposure	Districts
Very High (0.766-1.00)	Mahottari
High (0.545-0.765)	Chitwan, Saptari, Rautahat, Sunsari, Siraha
Moderate (0.352-0.544)	Jhapa, Dhanusha, Parsa, Morang, Nawalparasi
Low (0.024-0.351)	Kailali, Sarlahi

Very Low (0.00-0.023)	Kanchanpur, Banke, Rupandehi, Kapilvastu, Bardiya, Kalikot, Jumla, Mugu, Dolpa, Mustang, Pyuthan, Manang, Rukum, Dadeldhura, Humla, Dolakha, Palpa, Lalitpur, Dailekh, Dhankuta, Jajarkot, Bajura, Trehathum, Salyan, Gulmi, Panchthar, Rolpa, surkhet, Achham, Khotang,Dang, Doti, Rasuwa, Arghakanchi, Kathmandu, Illam, Bajhang, Solukhumbu, Baitadi, Sankhuwasabha, Bhaktapur, Dhading, Sindhupalchowk, Bhojpir, Tanahu, Nuwakot, Gorkha, Sindhuli, Taplejung, Syanja, Okhaldhunga, Kavrepalanchowk, Ramechhap, Myagdi, Kaski, Parbat, Makwanpur, Baglung, Lamjung, Darchula, Udayapur

Source: NAPA 2010

Observed landslide events:
Among the natural hazards that occur regularly in Nepal, landslide induces considerable damages too. Landslides claim many human lives every year and cause other damages such as destruction and blockages of highways, and loss of livestock, crops, and agricultural land. Landslides are caused by natural as well as by anthropogenic reasons. Large landslides that kill people or damage important infrastructures are reported and recorded. There are many landslides that do not necessarily kill people or damage important infrastructures such as roads or irrigation canals, but they do damage farms, forests, water supply systems, small bridges, and so on. The number of both the large and small landslide events are also increasing. There could be many reasons such as infrastructure development, land-use change, change in rainfall pattern and mismanagement of land for the increase in perceived impact of landslides, but the impact of climate change on local environment is going to accentuate the occurrence of landslides.

1.2.3 Climate Change Projections for Nepal

Temperature: General Circulation Models run with the SRES B2 scenario for Nepal show that the mean annual temperature will increase by an average of 1.2^{0}C by 2030, 1.7^{0}C by 2050 and 3^{0}C by 2100 compared to a pre-2000 baseline. A recent study that used General and Regional Circulation Models projects the mean annual temperature to

increase by 1.4^{0}C by 2030, 2.8^{0}C by 2060 and 4.7^{0}C by 2090 (MoEnv, 2010). These projections show a higher temperature increments during the winter season as compared to the monsoon season. Rise in temperature will have a serious impact on drought conditions with adverse impacts on water sources such as springs and rivulets which provide water to the communities.

Rainfall: The projection of precipitation data suggests that the winter precipitation will show almost no change in western Nepal and up to 5-10% increase in precipitation in eastern Nepal. The projections indicate an increase in monsoon and post monsoon precipitation as well as increase in the intensity of rainfall and decreased winter precipitation. What this means is that there may be increased events of floods and landslides destroying water supply systems in places where precipitation will increase, whereas, there will be shortage of water where rainfall is expected to decline.

Table 3: Rainfall projection by model

Year	Annual mean		Monsoon rainfall	
	Multi-model mean %	Range %	Multi-model mean %	Range %
2030_s	+0	-34-+22	+2	-40-+143
2060_s	+4	-36-+67	+7	-40-+143
2090_s	+8	-43-+80	+16	-52-+135

Source: NCVST (2009) cited from NAPA 2011

Impacts of Climate change:

Nepal's climate is already changing. Temperatures have increased rapidly over the recent decades at much faster rate than the global average. In addition, there have been perceived changes in precipitation albeit with wide variations in trends across the country. This is making the agriculture sector highly sensitive to rainfall extremes; for example, the direct cost of 2006 and 2009 droughts in terms of lost agriculture output was 1.9% and 0.4% respectively (IDS-Nepal, PAC and GCAP (2014).

Similarly, Nepal is increasingly affected by frequent water induced

disasters, notably floods (in the plains) and landslides (in the hills) associated with the summer monsoon. The increased frequency has led to loss of life, affected livelihood and caused major damage to property, agriculture, infrastructure and commerce. The DWIDP data reports an average annual fatalities of 283/year, 8000 homes destroyed/year, and 29000 families affected/year. On an average, the direct cost of these events is estimated to be equivalent to 1.5% of current GDP/year. The overall direct annual economic costs of climate change due to water induced disasters at the national level were estimated to be an additional US$ 100-200 million/year by mid-century (current prices, undiscounted), equivalent to 0.6-1.1% of current GDP per year, with an upper estimate of almost 3% of GDP per year (IDS-Nepal, PAC and GCAP, 2014). The return period of flood of certain magnitude has reduced significantly, and impact estimation of expected additional average direct cost could be equivalent to 0.6-1.1 %of GDP by midcentury.

1.2.4 Impacts of Climate Change on WASH

Freshwater resources are highly vulnerable to climate change impacts. However, predicting impacts on the availability and quality of freshwater resources, and more so on water-dependent services, remains difficult at this stage. Changes could be gradual or dramatic, but with the potential to jeopardize water security over the long term, making it more costly over time for governments to adjust to changing circumstances (Elliot et al, 2011; OECD, 2013).

Availability of freshwater is the main channel through which climate change impacts will be felt by people, ecosystems and economies (Bates et al, 2008).Changes in availability of water, both in quantity and quality (e.g. too little, too much, and often polluted) is of serious concern for water managers. As such, water sources are highly sensitive to variations in temperature and precipitation. With climate change, there may be variations in total flows, changes in high or low flow conditions, and alteration in seasonal runoff regimes as well as groundwater-surface water interactions. Water sector is likely to be significantly affected by climate change over the course of coming decades. Hence, there is now a general consensus that the climate will have significant impacts on Water and Sanitation as well. A brief summary of the impacts of Climate Change on water source is given in Table 4.

Table 4: Climate Change Impact on Water Source

Climate Variability	*Impacts on water sources*	*Impacts on sanitation/hygiene/health*
More hotter days /fewer colder days	More depletion of snow/ low snow fall /higher rates evaporation	Spread of disease/ decreased colder waves Prominent problem of solid waste/ decrease air quality
Dry spell	Increase water demand/ decreased water quantity and quality	Outbreak of diseases, allergies/ risk of heat related diseases
Heavy precipitation/ wet spell (Landslide and Flooding)	Contamination of surface and ground water. (Landslides and flooding)	Injuries, deaths, outbreak of diseases allergies etc. Due to contaminated water and food shortage
Drought	Sever water shortages	Decline in food production, scarcity of water for domestic as well as agriculture use, wild fires, risk of water borne.

The climate change impact in WASH sector has already become visible as a large area across the country has begun to face increased water scarcity which has affected O&M of sanitary systems and hygiene facilities. In order to address the issue, it is important to promote water conserving techniques and conduct mass awareness campaigns at local level. Awareness on importance of source protection, assessment, cooperation & maintenance of health/hygiene impacts, and technological improvements will help address the problem at user's level. Regular research and development activities will help select appropriate techniques to adapt to the climate change impacts in sanitation and hygiene sector.

1.2.5 Resilience to Climate Change:

Resilience is defined as the ability to survive, recover from, and even thrive in changing climatic conditions. It is the capacity of a system/ people/community to respond to perturbation or disturbance by resisting damage and recovering quickly. It includes the ability to understand the potential impacts and to take appropriate actions before, during, and after particular events like flood, landslide and drought have occurred. Thus, resilience to climate change is the capacity of an individual, community, institution or system to dynamically and effectively respond to shifting climate impacts while continuing to function and prosper.

1.2.6 Importance of Climate Resilient WASH Programme

As such, climate risks cannot be eliminated, but its negative impacts can be reduced or managed. Climate-resilient development approach helps minimize the climate impacts so that they do not hinder development programs in achieving their goals. We can achieve this by adding consideration of climate impacts and opportunities while decision-making in order to improve development outcomes, which, in turn, helps to cope with current climatic variability, as well as adapting to future climate change, preserving development gains, and minimizing damages.

Why we need climate resilient planning?
With the climate change impacts as mentioned above, it is clear that water is at the center of climate change phenomenon, and it is also the first thing that will impact everyday life. Therefore, it is important to minimize the threat by making development programs climate resilient. The following points will clarify the benefits of pursuing climate resilient planning further.

Future Plan:
Climate resilient planning helps to reduce the risks of climate change impact on current and future WASH programmes. This is important for WASH sector in particular because this is where climate impacts are felt more strongly.

Reduce Vulnerability:
The climate resilient planning effectively helps reduce the vulnerability caused by climate change. While making resilient WASH programmes, we need to consider questions like who, how, and where, to identify the vulnerability and take appropriate measures to reduce the vulnerability. Appropriate Actions decreases the vulnerabilities helping people to adjust to the changing climate, by reducing exposure, increasing coping capacity,and creating multiple options, all of which help reduce vulnerability to changing climate.

Evaluation:
Climate change is a continuous process, rather than one time event,and hence, our knowledge and responses to climate change threats also need to be developed correspondingly. Thus, while formulating plans of WASH programmes,we should integrate plans for evaluation of the actions and outcomes so that our responses are based on informed decisions and match the ongoing needs.

Chapter 2

Goal and Objectives

2.1 Goals:

The goal of this guideline is to support a climate resilient WASH program by "Developing School-based Climate Resilient WATSAN"

2.2 Objectives:

The objectives of this guideline are to:

- Assess the sectorial vulnerability in water and sanitation of schools
- Develop and implement adaptation plan for water and sanitation
- Increase awareness about the climate resilient WATSAN among students, teachers and local people, and
- Integrate resilient WATSAN plan with in the ongoing development works

Chapter 3

Planning Climate Resilient WATSAN in Schools

3.1 Step I

Identification of Scope:

The scope of climate resilient WATSAN comprises framing of WATSAN activity that are important to schools and communities as well as identifying necessary interventions. This also includes exploring different parameters which directly and indirectly affect the health and sanitation of the students and analyzing climatic and non-climatic factors that affect WATSAN activities.

The climatic variables like temperature and precipitation are very important to identify and evaluate the scope of climate resilient WATSAN. Evaluating the impact of these factors on WATSAN activities helps to set the priorities while working for climate resilient WATSAN. The non-climatic factors also play a crucial role in setting the scope of the work. The students, teachers and members of the school management committee have their own interests and obligations, and hence, they must also be considered while studying the scope of the project. Both climatic and non-climatic factors may combine and create new challenges to the project.

Adapting to the adverse effects of climate change is vital to reduce vulnerability. For that, it is necessary to minimize the threats to life, human health, livelihoods, food security, assets, amenities, ecosystems and sustainable development. This can be achieved by building resilience of ecologies, social systems, and economic sectors to present and future adverse effects of climate. Lack of information and understanding about the changing climate at local level is often a major obstacle in mainstreaming adaptation in the planning process. The complexity is compounded by diverse terrain and latitudinal position that offers varieties of climatic conditions from subtropical to alpine, and from semi-arid to humid.

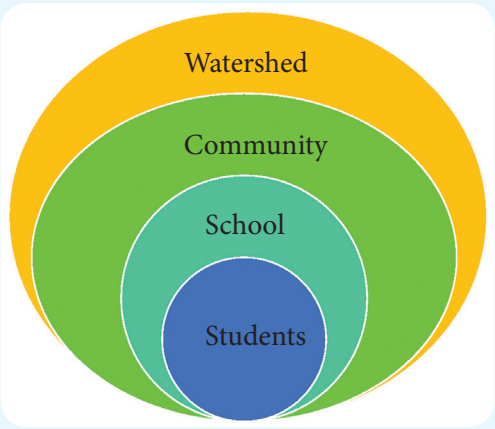

Figure 6: Knowledge sharing scheme in watershed level through child centered intervention

The process starts with assessing the scope of the project by collecting information on geographical area, watershed, community, and landscape. Increasing awareness on resilient WATSAN is also crucial to share knowledge about the concept within the watershed at various levels (Figure 6). The other key activity while scoping is to identify existing prominent stakeholders of the area. The primary stakeholders are generally those who would directly benefit from the project, and the secondary stakeholders are those who would indirectly benefit from the project. The following diagram (Figure 7) depicts knowledge flow channel in the project area, different level of stakeholders as well as the priorities of the project.

The project will mainly focus on school, the community and the watershed level stakeholders to ensure effective implementation of climate resilient WATSAN in schools, as well as aim to promote climate resilient WATSAN at the community and watershed level too.

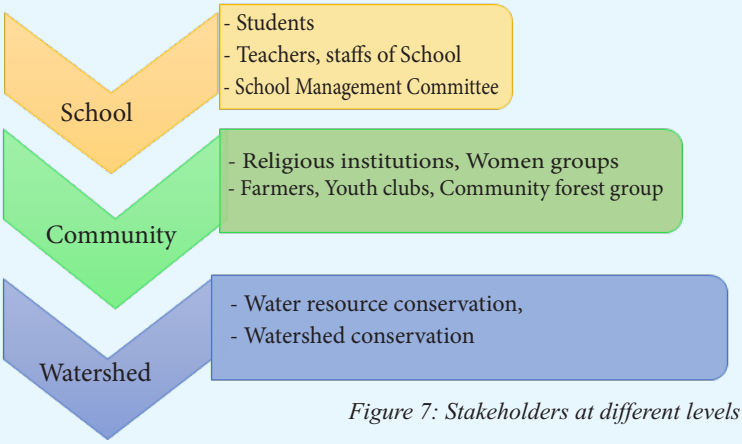

Figure 7: Stakeholders at different levels

3.2 Step II

Gap Analysis:

Following the scoping of the project, a gap analysis needs to be conducted to help prioritize the issues. This exercise may include collecting information on the following points:

- What is the water availability situation?
- What is the condition of water quality and quantity?
- How much do the climatic factors affect the water quality and availability?
- How is Solid Waste Management being carried out
- Is water safe enough for drinking purpose?
- What is the status of Existing sanitation facilities
- Type of toilets for girls and boys (Separate toilets for boys and girls, in different blocks)
- Is there proper sanitation facility in the toilets with soap station?
- What is the awareness level among the various stakeholders?

Emphasis should be laid on the major problems of the school such as shortage of water, solid waste management,waste water management, sanitation facility etc. Some of the probable gaps are given in the figure 8.

Gap Identification
Identify significant Problems
Identify problems related to water and sanitation
Identify situation of solid waste management
Identify condition of waste water management
Identify risk

Figure 8: Gap Analysis

3.3 Step III

Vulnerability Assessment:

Step III provides a detailed assessment of the vulnerability on key sectors in which gaps have been found. This stage also deals with the potential impacts or advantages caused by climate change. The assessment provides information for designing and implementing project strategies, and help integrate the development activities in accordance to the changing climate.

When poor sanitation facility are used with contaminated water, the water and sanitation scenario becomes more vulnerable. The water sector is mostly affected by increasing temperature and changing and irregular rainfall pattern, which makes young students in schools even more vulnerable as many of them are using common toilets and water from the same source, increasing chances of contamination and spread of vector diseases.

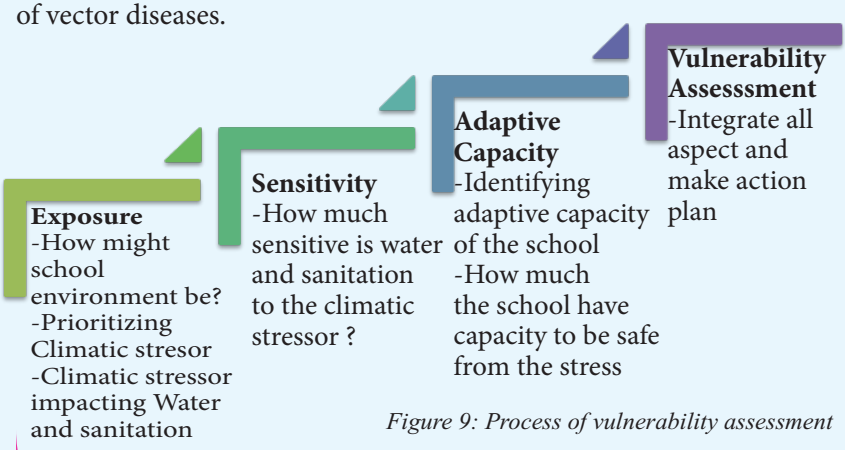

Figure 9: Process of vulnerability assessment

Status of local water sources:

Since the overall temperature study of Nepal from 1957 to 2006 show san increasing trend, it is important to examine if there are cases of drying springs or ponds in the area. The rise in temperature often impacts the water availability in the watershed which provides water to the school, and water is a key factor in sanitation.

Precipitation Trend:

The precipitation trend of Nepal from 1971 to 2006 showed decreasing trend which ultimately affects the water availability in the schools. The study needs to examine if the rainfall in the area is increasing or decreasing. Often, there is rainfall variation within a small area within the watershed not picked up by weather stations, but nonetheless, the local water sources are impacted seriously, which ultimately affects the sanitation facility in the school. Therefore, it is important to check if the rainfall within the watershed is increasing or decreasing.

School location:

The geographical location of the school is also important. It is an indicator of possible landslide, soil erosion, flooding etc, which ultimately affects the school building and its provision for sanitation.

Conduct Assessment:

This phase consists of two main objectives: planning and performing of the vulnerability assessment(VA). The planning component will include gathering all relevant information, defining the scope of activities, defining roles and responsibilities, and making others aware through change management process. The method for performing the VA will include interviewing system administrators, reviewing appropriate policies and procedures, and of course, security scanning.

In this step, we should identify the exposure factor and address it to minimize the vulnerability caused due to the changing environment. We need to identify the sectorial (WATSAN) vulnerability caused by the climate change. After analyzing the temperature and precipitation trend, we analyze their impact on water and sanitation sectors and identify the vulnerabilities. The geographic location should also be taken into account as it influences the vulnerability. The assessment should be focused on the source of water and toilet facility for the students in general, and with special consideration for girls and differently - abled

students. In addition, child friendly features should be included while considering water taps, knobs, toilet doors, and windows at appropriate height. Features for differently -abled students should include sufficient space for wheel-chair, hand railing in the passage and within the toilet cubicles, appropriate type of seating arrangement, and support system in the toilet with accessible water taps and soap stations. Gender friendly feature should include appropriate, safe and secure location of the toilet. The doors, windows and ventilation should be maintained regularly for safeguarding and maintaining privacy. The toilet should have menstrual hygiene facility and they should be properly managed. The toilet block should be separate for the boys and the girls, so that the girls would not face harassment. Systems of water conservation, waste water use, and ground water recharge should be considered. A broad and indicative framework for vulnerability assessment is shown in figure 9.

3.4 Step IV

Design plans for resilient facilities:
Step IV focuses on identifying, evaluating, and selecting the interventions to reduce the impact of climate change on WASH sector. This helps in the reduction of the impact and supports in the climate resilience planning. This stage emphasizes on reducing the impact and taking advantage of the changing climate and help to cope with the unavoidable impact of climate change. While designing resilient facility, we should consider water and sanitation facility from the child, differently-a bled people, and gender prospective. Mitigation and adaptation activities must be considered within the design phase.

Potential mitigation activities in WATSAN:
Even though the opportunities for mitigation are low, Nepal is committed to support the global effort in mitigating climate change impacts, and hence, it is essential to look for any opportunity, wherever possible, to introduce mitigation activities in development plans if it is going to help adaptation. In this respect, Nepal has to follow low carbon path of development and reduce the dependency on the unsustainable fossil fuel. Hence, the development plans should focus on technologies that are energy efficient, green energy like PV cells, wind energy, biomass energy etc. A schematic diagram in figure 10 shows how mitigation and

adaptation can be linked with water and sanitation sector. One of the potential areas to support mitigation under WATSAN is the use of solar energy to pump water from lower elevations to water scarce areas located at higher elevations.

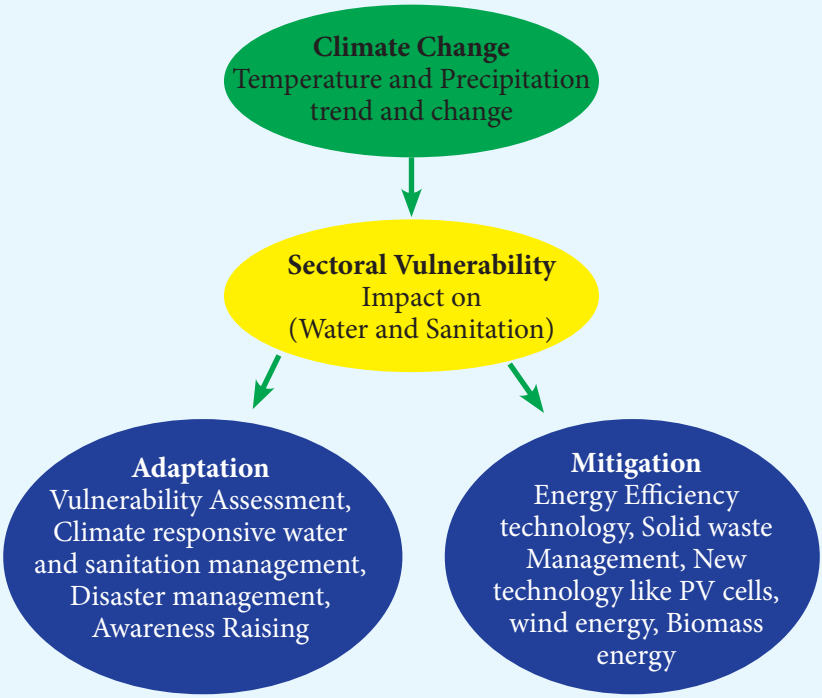

Figure 10: Schematic diagram to achieve climate resilient WATSAN

Adaptive activities in WATSAN

The proposed adaptation measure should be both structural and non-structural in nature. We can only have retrofitting for the constructed structures. Retrofitting is reinforcement or upgrading of existing structures to make it more resistant and resilient to the damaging effects of climate hazards. The structural measure is any physical construction or application of engineering techniques to reduce or avoid possible impacts of hazard, or to achieve hazard resistance and resilience. And non-structural measures are those which do not involve physical construction, but uses knowledge, practice or agreement to reduce risks and impacts of climate change. This can be achieved through

policies and laws, raising public awareness, training and education. Adaptation measures anticipate the adverse effects of climate change and take appropriate actions to prevent or minimize the damage they cause, or take advantage of opportunities that may arise. Therefore, use of WATSAN guideline is an appropriate way of maintaining improved sanitation and health despite water scarcity in schools. Well planned, early adaptation actions like WATSAN helps to address the hardship associated with water scarcity in maintaining sanitation.

3.5 Step V

Implement/Procedures and Duties:

This stage focuses on the implementation of the plan which has been prioritized during the design phase. It is also necessary to focus on the responsibility about who should implement the project and on fixing the working modality of the planned activities. It is important to verify and analyze the procedure of the implementation of the project to examine if there are any areas that require extra attention.

3.6 Step VI

Monitoring and Evaluation

Monitoring

Monitoring and evaluation are important components of any project implementation. It provides the window of opportunity to analyze the performance and identify areas for improvement of the services over time.

Internal-Monitoring:

This is a self-monitoring procedure where the members of the project team evaluate the implementation of the project. This stage analyses the implemented project to see if the project is implemented well or if there are gaps in the project planning, and provide suggestions for the improvement. In the school WATSAN project, the internal monitoring should be conducted by the School Management Committee and Local people.

External Monitoring:

It is a monitoring carried out by a third party independent monitoring

team. External monitoring is done after the implementation of the project is complete. The purpose of the external monitoring is to see whether the project is addressing the problems, or is there a need to improve some activity. The external monitoring of the project should be carried out by the VWASH-CC.

Some key Sectors to be monitored are as follows:

- Must have child, gender and differently -abled friendly water, toilet and hand washing facility.
- Must have separate and user friendly toilets for boys and girls with proper soap facility
- Must have proper solid waste management facility, including menstrual hygiene facilities
- Maintaining personnel hygiene (regular bathing, cloth washing, tooth brushing, combing, nail cutting)
- Regular cleaning of class rooms, yards, school field etc
- Proper facility of bins/pits to collect waste

Evaluation

Evaluation focuses on assessing the results of strategy, program or project implementation to improve performance, ensure accountability and promoting learning. There should be direct feedback to the implementation stage to improve outputs and outcomes of any project.

Figure 11: Flow chart of Climate Resilient School WATSAN.

Activities to Ensure Climatic Resilient WATSAN:

Water Conservation:

Conservation of water can be done in two ways: increasing the volume of water in the natural or artificial storage by source conservation and by reducing the leakages.

Source conservation:

Conserving water for sanitation purpose is very important. It can be done by using engineering structures such as conservation pond, check dams, small dams etc. to conserve the source of water. There are also other ways to increase amount of water in the reservoirs if such structures are being use systematically. In a reservoir, several steps can be taken to increase the volume of water stored. They are: raising the dam wall height, increasing canal size, removing sediment from reservoirs, Increased greenery and so on.

Leakage Reduction:

There are many ways by which losses of water from the system can be reduced. It must be emphasized that reducing leakages is more efficient than conserving source of water. Leakages can be reduced by installing canal linings, changing location of water intakes, using closed conduits instead of open channels, integrating separate reservoirs into a single system, and using artificial recharge to reduce evaporation.

Agricultural land Management:

Water losses from agriculture can be reduced by using night time irrigation, lining irrigation canals, using closed instead of open conduits, efficient application of water, and use of wastewater effluent.

Wastewater Management:

Managing wastewater is another way of reducing consumption. Examples of managing wastewater include using water efficient toilets, low-flow toilets, low-flow showers, re-use of cooking water, ground water recharge point, kitchen garden irrigation, use of more efficient appliance, and leak repair.

Solid Waste Management:

Though not directly linked with water, improved habits also help enhance sanitation. For example, properly managing the waste released from the classrooms and the canteen, creating plastic-free environment, managing organic waste through the vermin composting or by pit composting. Above all, a culture of using the 3R (Reuse, Recycle and Reduce) principle is helpful in improving sanitation.

Sanitation Facility:

Sanitation facility like soap and water supply should be ensured. There should be separate toilets for boys and girls in separate blocks. At least, 40 liters of clean water per person per day is required for drinking and domestic use like bathing, cleaning, and other daily purposes.

Awareness about Sanitation:

Awareness-raising programs needs to be implemented to increase peoples' awareness about the importance of sanitation. It can be done by using hoarding boards, distributing posters, and conducting street dramas to raise awareness of people about personnel and household hygiene practices, hand washing practice, behavioral change, solid waste management and excreta disposal.

Rainwater Harvesting:

Rainwater is also a main source of water. Therefore, Rainwater Harvesting is recommended as an effective way of adapting to water scarcity. The harvested rain water can be used for different purposes like drinking (after disinfection), cooking, bathing, gardening etc. It can also be used in recharging ground water sources.

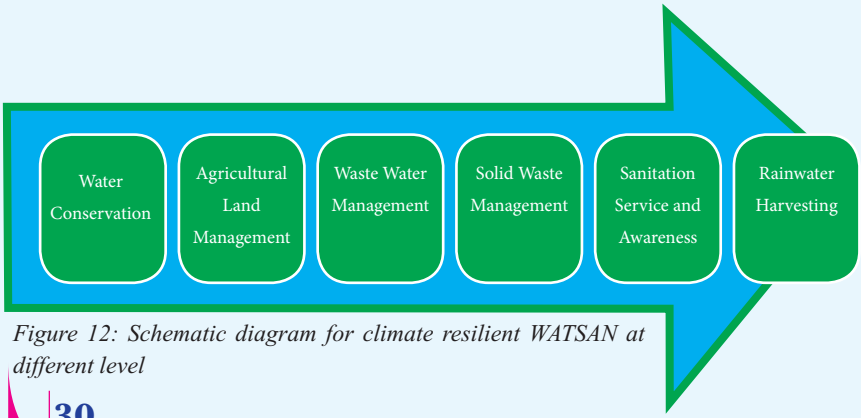

Figure 12: Schematic diagram for climate resilient WATSAN at different level

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Annex: 1 Glossary of technical terms

Atmosphere	Atmosphere is the blanket of moving air that surrounds the earth, both horizontally and vertically. This movement of the air causes variations in weather and climate. The moderate climate experienced on Earth is due to the absorption of the energy from the Sun by the atmosphere. This Energy from the Sun helps in recycling of water and chemicals with its electromagnetic forces.
Weather	Weather is day-to-day state of the atmosphere with general variations in temperature, humidity, precipitation, cloudiness, visibility and wind movement. Weather is also the present-day atmospheric condition in a given place. Anyone looking outside can see if it is raining, windy, sunny or cloudy and can find out how hot it is by checking a thermometer or just feeling it. Weather is what is happening now, or is likely to happen in the near future.

Climate	Statistically, climate is an "average" of weather conditions of a given place or region for a given period of time. It defines the typical weather conditions of an area based on long-term averages. It is a statistical information, a synthesis of weather variation, focusing on a specific area for a specified interval. Climate is usually based on the weather conditions of one locality averaged for at least 30 years. Thus, climate is the sum of all statistical weather information that helps describe a place or region.
Greenhouse Gases (GHGs) and its effect:	Greenhouse gases are a natural part of the atmosphere which trap the sun's warmth and maintain the earth's temperature through a natural process called the greenhouse effect. The atmospheric concentrations of key greenhouse gases comprise of carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), Hydrofloro Carbon (HFCs), Perfloro Carbon (PFCs), Sulphur Hexafloride (SF6) and Ozone (O3). Greenhouse effect is considered as the result of human (fossil fuel burning, forest fire, forest land degradation, industrialization) as well as natural activities (volcano, wildfire) that have increased the atmospheric concentrations of greenhouse gases and aerosols.
Climatic Variability:	The climate of a location varies every year from the average to a certain extent. Some years, the temperature or precipitation or rainfall is below average, and in some years it is above average. This Climatic Variability refers to the climatic parameter of a region varying from its long-term mean or average. Therefore, climatic variability refers to variations in the mean state and other climate statistics (anomaly standard deviations, the occurrence of extremes, etc.) On all temporal and spatial scales beyond those of individual weather events.

Climate Change:	Climate change is attributed to both natural variability and human activities. Variation in climate parameters is generally attributed to natural causes. However, because of the changes in the Earth's climate since the onset of the industrial era, some of these changes are now attributed to human activities. In a nutshell, climate change refers to any change in climate over time, whether due to natural variability or anthropogenic forces.

Annex: 2. Policies and mechanisms:

Climate Change Policy, 2011:
This policy incorporates climate adaptation and disaster risk reduction measures. The policy advocates for the adoption of low carbon development path by encouraging use of renewable energy and increasing carbon sequestration through proper management of forests. Bridges, dams, river flood control system and other infrastructures would be made resilient to climate change. Drought and flood resistant crop varieties would be developed and disseminated. A Climate Change Fund would be established and at least 80% of this fund would be allocated to program implementation at community level.

NAPA:
In 2010, the Government of Nepal approved National Adaptation Programme of Action (NAPA). NAPA was developed as a requirement under the UNFCCC to access funding for the most urgent and immediate adaptation needs from the Least Developed Countries Fund (LDCF). In Nepal, NAPA developed with these three fold objectives: Preparation and dissemination of NAPA document, development and maintenance of Nepal Climate Change Knowledge Management Centre (NCCKMC) and development of Multi-Stakeholder Climate Change Initiative Coordination Committee (MCCICC).
In NAPA, nine integrated projects have been identified as urgent and immediate national adaptation priority. They are:

1. Promoting community-based adaptation through integrated management of agriculture, water, forest and biodiversity.
2. Building and enhancing adaptive capacity of vulnerable

communities through improved system and access to service for agricultural development
3. Community –based disaster management for facilitating climate adaptation
4. Glacial Lake Outburst Flood (GLOF) monitoring and disaster risk reduction
5. Forest and ecosystem management in supporting climate –led adaptation innovations.
6. Adaptation to climate challenges in public health
7. Ecosystem management for climate adaptation.
8. Empowering vulnerable communities through sustainable management of water resource and clean energy supply
9. Promoting climate smart urban settlement

NAPA's implementation framework envisages that the operating cost will be kept to a minimum, and at least 80% of the available financial resources will reach the local level to fund the activities there. Stakeholders in Nepal have also started discussing National Adaptation Plans (NAPs), which is a medium and long term adaptation plan for the country as decided by UNFCCC.

Annex 3: Guide to calculate amount of water collected using rainwater harvesting technique

Calculation of water requirement of a school

Number of students	Per capita water for drinking and hand washing in liters	Water for drinking daily in liters (a)	Number of students using toilet (assuming 10% of students)	Per capita water for toilets	Water required for toilet in liters (b)	Water for drinking, hand washing, and toilet in liters (c)	Total amount of water required for 48 days [c*48]	
							In liters	In meter cube
50	3	150	8	5	40	190	9120	9
100	3	300	15	5	75	375	18000	18
150	3	450	23	5	115	565	27120	27
200	3	600	30	5	150	750	36000	36
250	3	750	38	5	190	940	45120	45

It is assumed that we collect rainwater to be used for a maximum period of two months when there is no rain. Deducting the holidays, the school will open for 48 days. The above calculation shows that for a school with 50 students we need a tank with a capacity of 9 m^3 to collect rain water while for a school of 250 students we need a tank with a capacity of 45 m^3. The following table shows amount of rainwater collected for different rainfall amount and roof top area.

Calculation volume of water collection (m^3) for different rainfall & roof top area.

Area (m2)	Total rainfall (mm)			
	400	800	1200	1600
40	16	32	48	64
80	32	64	96	128
120	48	96	144	192