CPGD-WEST BENGAL

DETAILED PROJECT REPORT
FOR
NATIONAL ADAPTATION FUND

RAIN WATER HARVESTING AND SUSTAINABLE WATER SUPPLY TO THE HILLY AREAS IN DARJEELING AS AN ADAPTIVE MEASURE TO POTENTIAL CLIMATE CHANGE IMPACTS

2016 to 2019

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1. Project Background

1.1 Overview of Darjeeling District

The Darjeeling district of West Bengal has been facing water shortage since long. Due to climate change, variation in annual rainfall, increasing mean temperature followed by the increasing level of soil and forest cover erosion and increasing pressure on ecological carrying capacity of the hill zone of the state, it is envisaged that water availability would be a major issue for the sustainable development of the district and the state as a whole. The vulnerability assessment of the State (referring the State Action Plan for CC) mentions that though the northern districts of the state is expected to retain its status of water sufficiency, climate change incidences of sudden heavy rain fall might increase as well. It would be difficult to recharge the ground water table with heavy runoff in a steep terrain as well as there can also be enhancement in the overall water demand in the district (WB-SAPCC 2012). The SAPCC further recommends enhancing activities in terms of rain water harvesting, reducing run-offs by putting up check dams, storage reservoirs etc. This proposed project is therefore, directly addressing the recommendation made in the State Action Plan. Moreover, Darjeeling is also one of the major tourist attractions not only for the State but for the country as a whole. It houses one of the World Heritage site – the Darjeeling Himalayan Railways. Darjeeling's economy depends on two major sectors: tea production and tourism. Given the future impacts of climate change, it is envisaged that if no proper action is taken with immediate effect, district will face economic losses and social degradation. As per ADB study the economic losses could reach up to 3-5% of the district GDP by 2050 if not more. It has been observed that water availability in the district is a major deterring factor for the growth in district's economic activity especially in tourism and its labour market and also improvement of public health. The proposed project is thus contributing towards protection of district's economic activities as well:

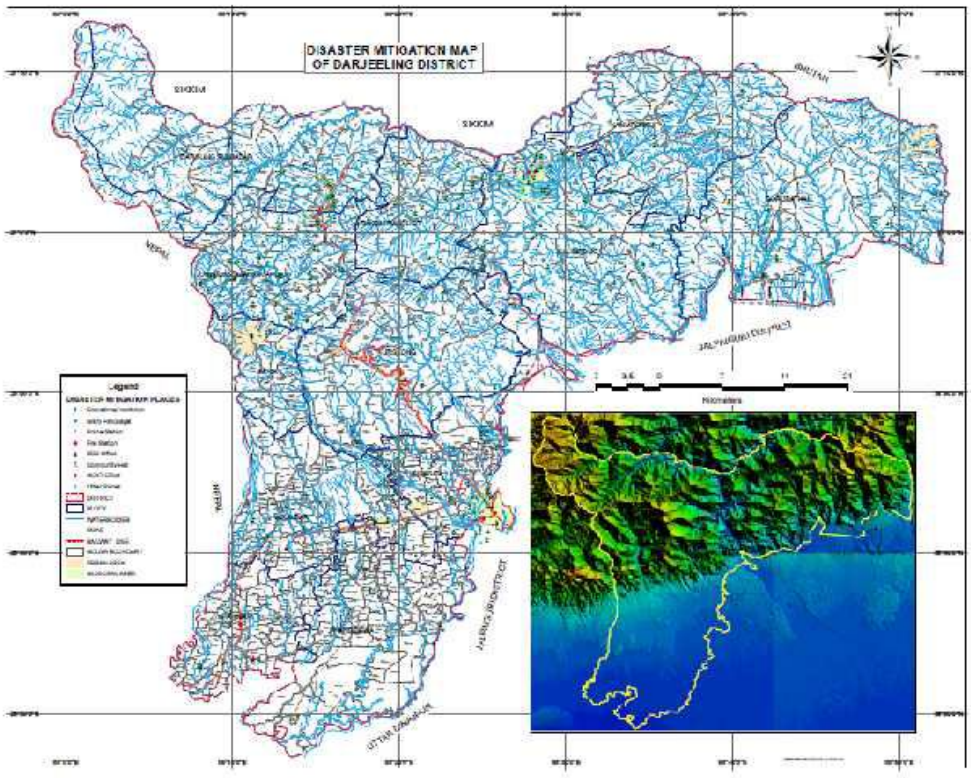

Figure 1-1: Topographic map of Darjeeling District

As Darjeeling is part of the Himalayan region, the proposed project is therefore aligned to the National Mission for Sustaining the Himalayan Ecosystem where one of the major objectives is to provide sustainable livelihood to the people whose livelihood depend on the Himalayan ecosystem and to improve their resilience. Rain water harvesting in the hilly terrain can not only supply water for survival but it can also maintain the micro-ecosystem of the region as a part of the larger ecosystem of the Himalayas. Similarly the project can also be aligned to the National Missions for Water where the main objective is to conserve and protect the water resources under the climate change scenario. The proposed project is contributing towards water resource conservation by harvesting rain water.

1.2 Vulnerability Assessment

The table (Table 2-1) below shows the vulnerability assessment of the district in terms of change in precipitation and corresponding impact on water availability for supply. The Indian economy loses 73 million working days a year due to waterborne diseases, caused by a combination of lack of clean water and inadequate sanitation.[16]Access to sanitation, even more so than water, is a robust indicator of human development due to the complex nature of social, institutional and cultural factors that play a role (http://www.globalwaterforum.org/2012/09/23/water-supply-and-sanitation-in-india-meeting-targets-and-beyond). It is clearly evident from the table that the Darjeeling district is getting major share of water only during four months of monsoon (June, July, August and September) and rest of the months are typically dry. However, the collection of potable water is also not easy task during heavy rain by a resident of a steep terrain. Non availability of required amount of water has several socio-economic impacts on the district. Starting from seasonal migration of working population to increased level of water borne diseases including dehydration are the regular troubles of the district related to water scarcity. Tourism is one of the biggest sources of income of the local population and also multiply the water demand during tourist season.. All these factors create a downward spiral of economic and social down turn of the district and put the entire population in the poverty trap. Water plays a major role in Darjeeling in terms of its vulnerability and thus it's a solution to the district as well.

Due to climate change it is expected that precipitation in total is going to increase in the region if not the wet spell of the year. As a result it is envisaged that the district is going to expect more surface run offs of the water than earlier days. Increased run-offs can create sudden flash flood, land slides and can even cause bursting of lakes and dams. To avoid such climate change impacts, additional water flows can be collected, stored and used over the period of time when water availability is low. Climate curse can thus be converted into opportunity of the region to enhance its adaptation capacity. In this project we proposed to convert climate risk to opportunity and that to the most vulnerable community in the region. As the economic condition of the community is directly linked to its resilience capacity, BPL (Below Poverty Line) community is thus the most vulnerable to climate change. The major goals of this project are as follows:

- Enhancing climate adaptive capacity of the vulnerable BPL households by providing enhanced access to water supply following the WHO guideline mostly during the critical period of water shortage in the year.

In the context of conducting vulnerability assessment of the proposed project area, we have developed the vulnerability matrix based on three indicators like Sensitivity, Exposure and Adaptive capacity which are described hereunder:

Sensitivity indicators: These indicators reflect the extent of impact either because of intensity if a problem or size of the entity begin affected due to climate change. Table 1-1 shows the potential variables under this measuring indicator of vulnerability

Table 1.1: Sensitivity indicators of the project

Variable	Expression/unit
Water availability per lpcd	10-30 lpcd (liter per capita per day)
Water availability /day/ household, assuming 5 people	50-150 lpcd
Water required/day/hh (assuming 5 people/hh)	250 litres/hh/day (assuming 50 litres/capita/day)
Water shortage per household (hh) per day	100-200 lpcd
Lack of access to water by 10 -20% (in litres)	Increases the health risks many fold and make the people more vulnerable to climate stress
Average population density	11392

Exposure Indicators: These indicators deal with various changes in climate parameters relative to baseline scenario, changes in maximum and minimum temperature, rainfall and other relevant indicators related to climate change. Table 1-2 shows the exposure indicators of this project

Table 1.2: Exposure indicators of the project

Variables	Expression/unit
Extreme rainfall events	Likely to increase considerably
Average no. of rainy days	Approx. 126 days/year
Water availability (average rainfall/year)	2781.8 mm
Run-off coefficient for asbestos (assuming asbestos rooftops in households)	0.80
Total water available per house (in litres) with 20 sqm roof per year	5607 liter

Adaptive capacity indicators: These indicators deal with ability of the people to adapt to or cope up the changes caused due to climate change. Adaptive capacity thus mainly depends on people's economic and social condition along with the access to various modern technologies. Table 1-3 below shows the situation of adaptive capacity of the people living within the project boundary under different indicators:

Table 1.3: Adaptive capacity indicators of the project beneficiaries

Variables	Expression/unit
Number of BPL households	4855
Number of BPL people assuming 5 person per year	24275
Total population of Darjeeling municipality as per 2011 census	120414
Average HH income level	30,000[1]
Literacy rate	79.92
Access to electricity	Approx. 50%
Access to water supply	10% (coverage by water supply connections)
Migration	Rural people are migrating to other places in search of better livelihood options[2]

[1]Value calculated from Working Paper No. 205 on Rural Nonfarm Employment and Incomes in the Himalayashttp://icrier.org/pdf/WORKING%20PAPER%20205.pdf

[2] Refer report on Socio-Economic Condition of the People of Darjeeling: Out-Migration as a Survival Strategy, International Journal of Innovative Research and Development, Volume 3 Issue 5 - http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjfto3DjdbKAhVNCI4KHd_9BI0QFgglMAE&url=http%3A%2F%2Fwww.ijird.com%2Findex.php%2Fijird%2Farticle%2Fdownload%2F48954%2F39652&usg=AFQjCNHceb1VMCtYnnLhQFXjRjtz10FzVQ&bvm=bv.113034660,d.c2E

1.3 The project location

The projects location is the Darjeeling Municipality area: 10.57 Square Km with total population of 120414 (as per 2011 census).

Figure 1-2: Darjeeling District Map

Demographic detail:

Total Household under the DMC: 21122

Target Household (poorer community only) under the DMC: 4855
Total population covered under the project: 24275

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2. The Proposal

2.1 Introduction

Darjeeling is part of the Himalayan region, the proposed project is therefore aligned to the National Mission for Sustaining the Himalayan Ecosystem where one of the major objectives is to provide sustainable livelihood to the people whose livelihood depend on the Himalayan ecosystem and to build resilience. The pooerer section of Darjeeling town is apprehended to be one of the most vulnerable groups in the Sate and building resilience among these vulnerable group requires improving the public health of the entire community.

Again, ensuring access to stipulated quantity of per capita water supply is one of the pre conditions for improvement of public health. The Darjeeling citizens are historically facing severe water scarcity. Providing sufficient water is one of the major task of the Government but a centralised system may not be able to fulfill targets. Because in many cases the poorer people may not be able to afford the access to the piped water supply. Many households are located in isolated location at a steep terrain or have other difficulties.

In the present case as per the projection available in SAPCC, WB the rainfall is likely to increase and it is likely to increase in the month of October and November. Apparently, this can be viewed as a climate threat because such post monsoon rain enhances the chances of flood. Floods can have catastrophic consequences for centralised water supply. Such damage can take years to repair. On a smaller scale, drinking-water infrastructure can be flooded and put out of commission for days, weeks or months. Non-availability of water may badly affect the overall adaptive capacity of Darjeeling residents. The poorest are expected to be hit hardest. Improvement of individual as well as community resilience is need of the day to cope up with present climate stress and future aggravations.

Resilience needs to be integrated into drinking-water supply system to cope with present climate variability. It will also be critical in controlling adverse impacts of future variability.

A rooftop rainwater harvesting can act as a decentralised water supply support system in the poorer households.

Source: darjeelingtimes.com

Figure 2-1: Water supply situation in Darjeeling

2.2 Project Objectives

The main goal of this project is to internalize the climate change adaptation planning in the mainstream developmental activities at a city level through specific modular intervention. The proposed project is expected to work as a compliment to the existing business as usual water supply

system planning at Urban Local Body (ULB) level by bringing climate adaption intervention. In the above context, the main objectives of this project would be to provide

- To identify the vulnerable poorer community (BPL Card holders) households where the options of rainwater harvesting within the Darjeeling Municipality is essential for building resilience.
- To develop the detail project plan for installation of rain water harvesting and storage structures in the selected sites through preparation of database from a GPS based survey. The survey results shall be used for current the proposal as well as for other similar interventions. Setting up the infrastructure and providing water services to the selected households so that they can adapt to the variations in rainfall pattern due to climate change.
- Building Capacity to cope up with climate stress by awareness generation and training
- Condition of hygiene and acute need for water supply
- Developing and maintaining project monitoring and evaluation protocol and system to ensure long term sustainability of the project.

The project aims to create water availability of 50 litres per day per person for minimum of 45 days by providing:

Roof top based water storage of 1000 litres per household for 3000 households from poorer community (BPL Card holders) and

also community water storage 10,000 liter capacity (@ the rate of 50 litres per day per person for a minimum of45 days) for 200 households from poorer community (BPL Card holders) - in the Darjeeling town.The effective water availability is very likely to be extended to about 100 days from 45 days due to increased rainfall.

2.3 Project detail

The proposed water harvesting project is developed as a climate adaptation module to the proposed large scale municipal water supply infrastructure development project with due consideration to the increasing trend of rainfall in Darjeeling. TheClimate change is not occurring in isolation. However, few challenges, such as changes in water demands from other sectors, may intensify the impacts of climate change.

Climate change is thus best understood as an additional factor in a complex network of interactions. Technologies and planning are needed that can adapt to cope with multiple threats, rather than to climate change alone. This particular project is aimed to convert an otherwise climate risk (increase of rainfall) to climate gain by enhancement of rainwater storage at least in individual households.

Thus the project planning is different from the BAU planning. The following section describes the projects in detail.

2.3.1 Selection of the households and the sites to be considered under this project

Out of the total of 4855 – households identified as BPL card holders, 3200 households will be selected for whom the rainwater harvesting systems will be built. The households for rain water storage will be selected by the Darjeeling Municipality. The criteria for selections are likely to be:

- The poorer economic conditions and least afforadability for conventional piped water supply.
- Difficulty in accessing centralised piped water supply due to location of household in an isolated location at a steep terrain
- Availability of space for roof top storages

- Location of the slum w.r.t. the jhoras/streams –
- Greater distance of the slum from the existing water supply/bodies (lakes/ponds/jhoras) and streams.
- Land availability in the slum to set up rainwater harvesting facilities.
- Geological structure and weight carrying capacity of the ground.
- Out come of the GPS based study of the region.

In addition, any other criteria fixed by municipality on basis of execution level feed backs if situation demands

A detailed project report on centralised water scheme for Darjeeling has been prepared by Municipal Engineering Directorate (MED), which can be used for initial data and information collection related to site selection activity for setting up the water harvesting facilities. Following the overall guidance mentioned in the 2012 State Action Plan for Climate Change, the project implementing agency would first select the sites for rainwater harvesting around the from poorer community (BPL Card holders) - households. The next step would be to identify the capacity of the storage facilities required based on the following criteria:

i) Conglomeration pattern of the poorer community households
ii) Availability of other facilities to set up the rain water harvesting plants (viz. road access etc.)

2.3.2 Setting up the rain water harvesting facilities

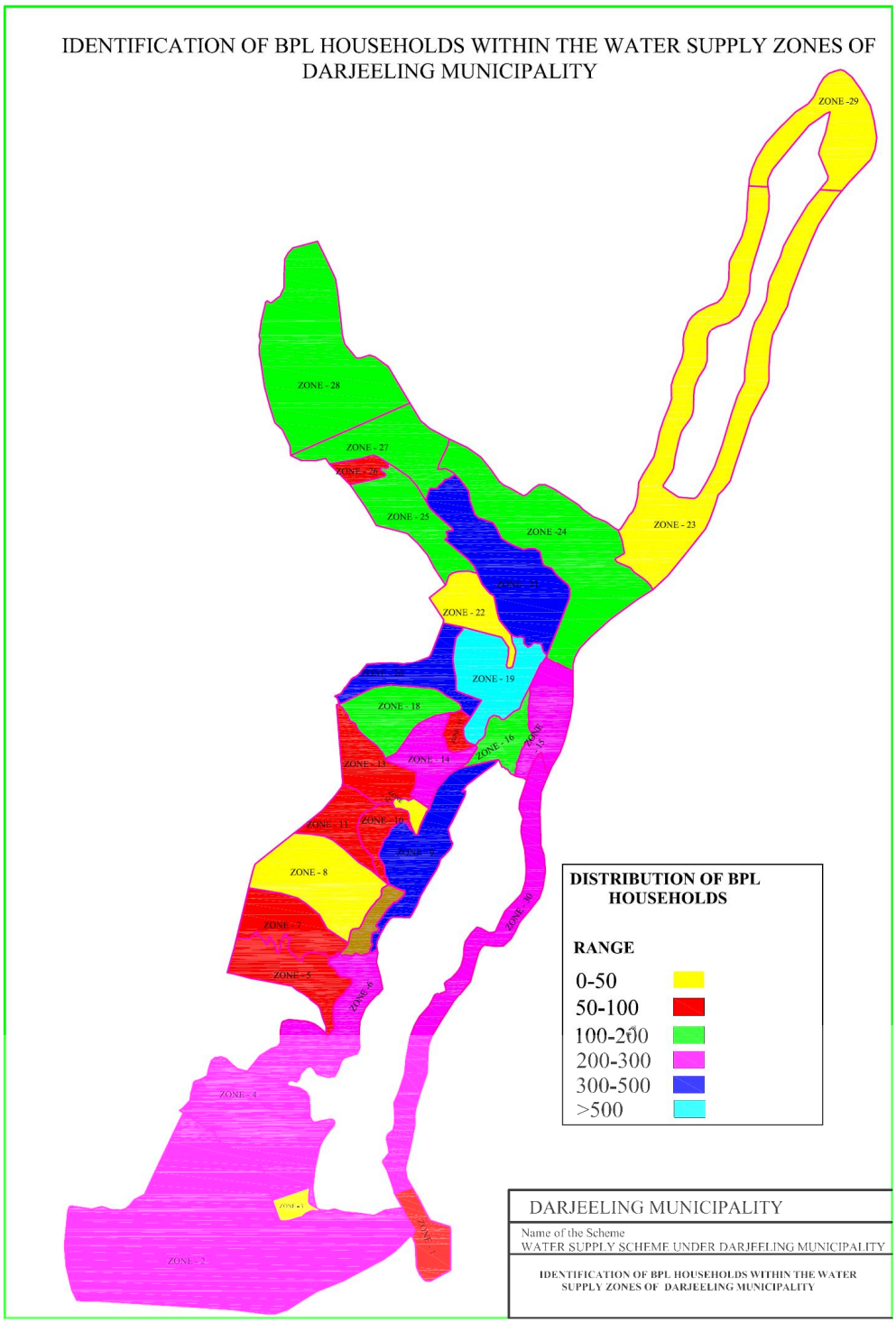
After identification of the sites, the detail engineering project plan for setting up the water harvesting facilities shall be prepared. Under this project, it is proposed to provide individual water storage of 500 or 1000 litres per household for 3000 poorer community households and community storage (where individual storage is not possible) of 50 litres of water per person per day for a period of 45 days which may extend even up to 100 days.

It is assumed that catchment area (rooftops of houses) shall be available for each household for efficient collection of rainwater (Appendix 1-3). For the community water storage, roofs of common buildings in the slum shall be used as catchment areas. All the collected water shall be transported through a network of pipes to the nearby storage tanks. The number and capacity of these tanks will depend upon the size of the slum / BPL community as well as availability of land. These tanks will be placed on the ground in the vicinity of the BPL households. Any excess water collected after filling up of the storage tanks shall be routed to the local drains as surface runoff. One gravity filter shall be provided per household for cleaning the stored water for drinking and other purposes as required.

It has been identified that there could be majorly two different categories of harvesting facilities:

i) Tank with 500 or 1000 L capacity which could be for individual households where the geological condition is not very strong and number of HHs are less and scattered.
ii) Tank with 10,000 L capacity which could be for community water storage with higher House Hold density and geological condition is acceptable for such load.

Operation and maintenance of the rainwater harvesting system shall be done by the Darjeeling Municipality. Figure 2-2 shows the location of BPL hoseholds w.r.t topographical zone map of the Darjeeling Municipality Area.



Thirty (30) wards of Darjeeling Municipality is classified in to 32 zone depending upon topography. The wardwise list of BPL households is re-classified in to 32 zones to give an over all idea about locations of the BPL household at different slope of Darjeeling hills.

2.4 Project financing and budget

The project is divided into three main components starting from site selection following engineeringand seismic detail, construction of facilities at each identified household premises and developing a capacity building program to continue for long for the beneficiaries. In terms of budget

allocation, emphasis is given on construction and creating new assets compared to other non-asset activities. Site selection is allocated with 3% to total budget, while the capacity building activities are allocated with only 2%. Remaining 95% budget is being allocated for construction of facilities. This budget allocation further corroborates the main purpose of this project to enhance adaptive capacity of the vulnerable community by providing facilities which can increase water supply situation over the year.

Table 2-1: Activities and budget allocation of the proposed project

Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (Rs)
1. Selection of poorer community households and site for rainwater harvesting	Selection of poorer community households	Increased resilience of the vulnerable community of Darjeeling Municipal Area	0.75 Cr.
	Preparation of site maps and plans for the selected sites through GPS based surveys		
	Estimates of total water harvesting capacity and design schemes		
2. A) Setting up of individual household rain water harvesting facilities	Setting up of 30 lakh litres (3000 households @ 1000 Liter) of storage tanks and related piping for 3000 households		17.75 Cr Cr.
B) Setting up of community rain water harvesting facilities	Setting up of 15 lakh litres of community storage tanks for 200 households*		2.80 .
	Construction of related pipelines for the community storage		
	Providing gravity filters to all selected households		
3. Capacity Building and knowledge sharing	Capacity building and knowledge sharing (lessons learnt) among the ULBs		0.50 Cr.
	Capacity building of the local communities and beneficiaries		
Project/Programme Formulation cost			0.10 Cr.
Project/Programme Execution cost			1.81 Cr.
Total Project/Programme Cost			23.71 Cr.
Project/Programme Cycle Management Fee charged by the Implementing Entity (@3%)			0.71
Amount of Financing Requested			**24.42 Cr.**

Break up for community storage is provided in Table 3-1

2.5 Projected Calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	March 2016
1st Mid-term Review	February 2017

2nd Interim Review	Februray 2018
Project/Programme Closing	February 2019
Terminal Evaluation	March 2019

3. Project Justification

3.1 Justification of the project activities

In this section we described mainly three important issues: i) what would be the business as usual situation of water supply to the BPL community in Darjeeling district ii) what are the specific adaption related activities covered under this project and finally iii) how these activities under this project can work to enhance climate resilience of the targeted beneficiaries.

3.1.1What is the business as usual situation of water supply in Darjeeling ?

The Municipal water supply system of Darjeeling town is an old system which was laid in 1910-1915 for a population of about fifteen thousand. As per the 2011 census data, population of Darjeeling has increased to 130,399 (urban agglomeration) or 118,805 (Darjeeling municipality).Natural springs in the Senchal Range provide most of Darjeeling's water supply. Water collected is routed through a network of pipes[3]. The lakes called Sinchal North with the capacity of 20 MG and Sinchal South with a capacity of 12.5 MG were built in 1910 and 1932 respectively, from where the water is piped to the town after purification at the Jorebungalow filtration plant. During the dry season, when water supplied by springs is insufficient, water is pumped from KhongKhola, a nearby small perennial stream. There is a steadily widening gap between water supply and demand. Various efforts were made to augment the water supply, including the construction of a third storage reservoir in 1984, but failed to yield the desired results. The total water requirement in the town of Darjeeling was estimated by ATREE in 2013 to be 7.04MLPD (million litres/day). However, the available water was only 2MLPD. In other words, only 30 litres of water per person per day is available against the Government of India standard of 135 litres per person per day.Figure 3-1 below shows the current situation of water supply pipeline network in the Darjeeling district which is in poor condition.

Figure 3-1: Network of pipes transferring water to Darjeeling

[3]Conserve Water, Reduce your Waste by ATREE, Darjeeling Goodwill Centre, DLR Prerna, Darjeeling NGO Network - http://www.darjeelingprerna.org/Conserve%20Water%20Reduce%20Your%20Waste_large%20file.pdf

In addition to natural widening of demand and supply gap of water for consumption, climate change is also envisaged to worsen the situation. Given the findings of SAPCC of West Bengal especially at the Darjeeling district level, water run-offs is expected to increase in the coming years due to enhanced precipitation in a shorter spell. This indicates that within a short period of time in one year high volume of water will flow over surface to near-by rivers and streams without natural recharge and storage. On other hand it is also envisaged that the annual dry spell will also be increased due to climate change. As a result, in one hand Darjeeling is envisaged to face enhanced number of dry days in a year and on the other hand region will face

The water crisis is a result of the drastic fall in the volume of water at natural springs of catchment area due to monoculture plantations, massive deforestation, dramatic increase in population and loss in water during transmission (Darjeeling Municipality, Waterworks Department, 2012). Moreover, there are no nearby potential sources of water to augment the supply.

The pipeline used for distributing water in the town of Darjeeling does not cater to a large population who depends on natural springs and streams for daily water use. There are more than 32 natural springs in the Darjeeling Municipal area and these are under threat of contamination, effects of climate change, population rise and capture of resources. Many of these springs are managed by the Community or Samaj. These involve monetary subscriptions, distribution systems that vary on the time of year and distribution based on use for drinking and washing. Darjeeling has a thriving water business with trucks, hand carts, privately owned springs and retailers selling water either at points or through a web of pipes.

A major project in pipeline for Darjeeling is the Water Supply Scheme for the Darjeeling Municipality under the UIDSSMT Programme. The project includes provision of supplying water to the households in Darjeeling by building water pumping pipelines and reservoirs for the storage of water. The project is implemented by the Municipal Engineering Directorate, Department of Municipal Affairs, Government of West Bengal.

The proposed project under the National Adaptation fund is envisaged to consider the long term water availability situation in climate change context for 3200 poorer community households in the Darjeeling town and plans to enhance adaptive capacity of the vulnerable section of the community (economically backward) by providing access to water supply.

3.1.2 What are the specific adaptation activities to be implemented to reduce the climate change vulnerability?

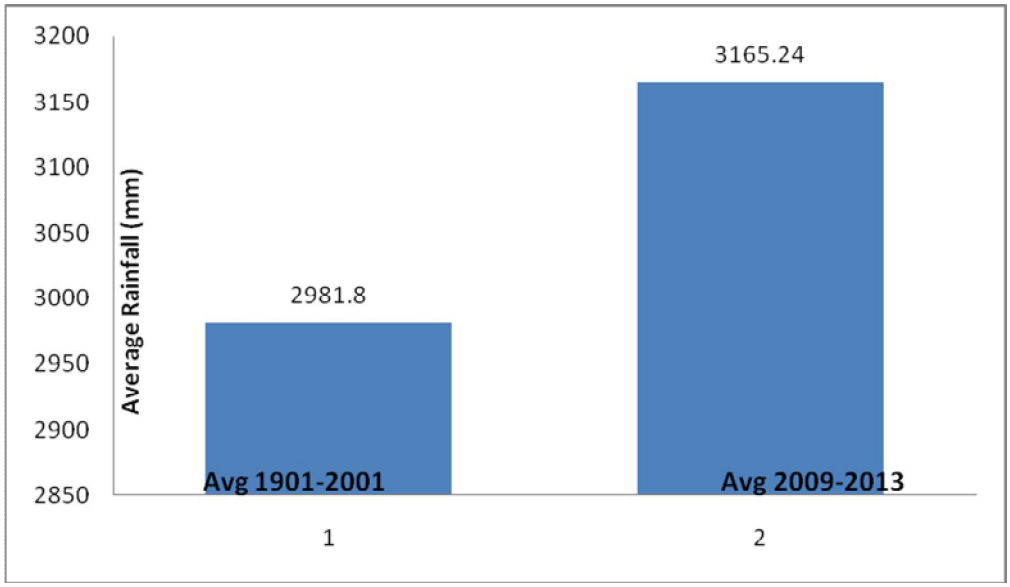
The Climate Change Context:

Current Observations

The rainfall is already showing increasind trend. Figure 3-2 shows the changes in average annual rainfall in Darjeeling between 1900-2001 and 2009-2013. It clearly indicates that annual precipitation is steadily increasing in the region over last several decades. SAPCC, WB, 2012 and Xu et al. (2009)[4] raised specific concerns regarding cascading effects of climate change on 59 water, biodiversity and livelihood in the Himalayas. The increased warming in the Himalayan 60 region, resulting in the loss of ice and snow, would lead to huge effects on global sea level rise.

[4] (Xu, J., Grumbine, R.E., Shrestha, A.B., Eriksson, M., Yang, X., Wang, Y. and Wilkes, 476 A. 2009 The melting Himalayas: Cascading effects of climate change on water, biodiversity, and 477 livelihoods. *Conservation Biology.* **23,** 520–530)

Figure 3-2: Average annual rainfall pattern in Darjeeling over last 100 years vis-a-vis 2009-2013



Future projections

For the state of West Bengal, the regional climate model PRECIS (Providing Regional Climate for Impact Studies) is used to obtain the Climate projections for 2050s and 2100. PRECIS simulation datasets are provided by the Indian Institute of Tropical Meteorology, Pune. The climate change scenarios are driven by the GHG emission scenarios -IPCC A1B which assumes a future world of very rapid economic growth, a global population that peaks in mid-century and declines thereafter, and assumes rapid introduction of new and more efficient technologies. A SWAT model was run for baseline (1961-90) as well as GHG scenarios near term (2021-50) and long term (2071-98) to obtain the projections of freshwater components i.e., blue water flow (water yield - quantified rain fall plus deep aquifer recharge), green water flow (actual evapotranspiration), and green water storage (soil water) at a sub basin level with daily weather data for all river basins of India.

As per the SAPCC, considering the impacts of climate change in terms of changes in rain fall, temperature, blue water flow, green water flow and green water storage, it was found that in the northern part of West Bengalis likely to remain water replete. During mid-century, the post monsoon rain fall during October-November is likely to increase but will decrease in Jan-February period with respect to the base line.

This observation is also corroborated by the research paper of Chaturvedi et.al in 2012. Chaturvedi et al (2012) followed climate projections as per the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), which are made using the newly developed representative concentration pathways (RCPs) under the Coupled Model Inter-comparison Project 5 (CMIP5). The work by Chaturvedi et al (2012)[5] provides multi-model and multi-scenario temperature and precipitation projections for India for the period 1860–2099 based on the new climate data. It is found that CMIP5 ensemble mean climate closer to observed climate than any individual model and it also indicates the increasing trend of rainfall in Himalayas.

[5] Rajiv Kumar Chaturvedi1, Jaideep Joshi2, Mathangi Jayaraman1, G. Bala and N. H. Ravindranath (2012), Multi-model climate change projections for India under representative concentration Pathways, CURRENT SCIENCE, VOL. 103, NO. 7, 10 OCTOBER 2012

Increase in intensity of rain fall is also a possibility therefore retaining that water for ground water recharge will be a challenge. In the present situation the water received as precipitation in Darjeeling flows away due to the gradient towards the plains. This water can be retained to a certain extent through recharging of natural reservoirs/jhoras through water harvesting techniques.

The specific adaptation activity of this project is to harness rain water and other surface water run-offs in artificially created storage reservoirs for the purpose of meeting the water demand for the economically backward climate vulnerable community of the Darjeeling Municipality. Water scarcity in the region is also making people more vulnerable to climate change due to loss of productive time for water fetching and income loss, loss of jobs in the tourism industry due to lack of tourist flow, water borne diseases due to consumption of impure water from unknown sources etc. The project would thus convert the future risk of increased precipitation levels in the region to economic, social and environmental benefits for the local population by storing the rainwater and enhancing resilience to climate change through provision of better access to safe water resources even at economically backward household level.

Here we describe how derive the adaptation benefits of doing this project for the most vulnerable community of the district. First, we estimated the rainfall intensity and the amount of water that can be utilized for rainwater harvesting for one slum in Darjeeling based on five year rainfall data from Indian Meteorological Department. Second, we upscale that estimate to the project level where 3000 households will be covered. Finally, we derived the economic benefit of this project compared to the BAU activities. Table 3-1 displays the community level measurement of project activities.

Table 3-1: Community level estimate of project activities

Unit level estimates	Quantity	Unit
No. of households in one slum	20	Assumed
No. of people per household	5	Persons
Total population per slum	100	Persons
Proposed water provided from the rainwater harvester/person/day	50	Litres
Water storage	30	Days
Total tank capacity	150000	litres

Table 3-2 below shows the performance of all major indicators required to estimate the costs and benefits of this adaptation project. The major findings of this table are as follows:

i) Monthly average rainfall in the district are very high during monsoon season (between June and September)
ii) Per day rainfall is also high during monsoon season only.
iii) Average number of rainy days in a month is also very high during monsoon season only.
iv) Per capita and per household water demand remains same throughout the year.
v) Total collectable water from roof tops also remains high only during monsoon season.
vi) Excess water available per month is only during four months of monsoon.

Advantages of decentralised roof top based rain water multiple storages over centralised water supply

This indicates that storage of water is mandatory to enhance the average water supply per capita for the community and to enhance the adaptive capacity too. As described earlier that non-availability of water is a source of climate vulnerability, thus water harvesting and storage followed by decentralized supply will be an important adaptation measure for the community. In addition to that while conducting the benefit cost analysis of the proposed system compared to the standard municipal water supply system, we identified the risk hedging benefit as well. Standard centralised municipal water supply system proposes single large size overhead storages with distribution network attached to it. In the hilly areas like Darjeeling, such system could be more vulnerable to natural disaster and livelihood of the beneficiaries. Breakage of the storage tank or the distribution pipelines due to flood, landslides etc. could entirely down the water supply network for the region. In this context, having decentralized storage facilities with relatively smaller pipeline network can enhance the resilience of the system indeed. Even if there is natural disaster now all the households will be suffering due to non-supply of water during and after the disaster. From the disaster risk mitigation context, we found this project more robust and efficient.

Table 3-2: Historic trends of parametric values of different indicators and estimates

Monthly Rainfall Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	0.0	0.0	12.9	147.0	398.4	350.4	765.2	759.8	265.8	307.3	0.5	1.8
2010	0.0	3.4	6.8	73.3	304.3	635.5	981.4	913.7	468.7	136.3	15.2	0.0
2011	3.7	8.2	20.2	98.7	233.0	620.2	1070.3	644.6	589.0	30.0	16.4	4.2
2012	7.2	2.8	2.2	141.7	152.4	627.5	902.1	478.8	587.8	67.0	0.0	0.0
2013	7.2	24.5	28.5	83.6	441.6	540.7	727.1	537.0	348.2	224.0	6.0	1.4
Average rainfall from 2009-13 / month(in mm)	3.6	7.8	14.1	108.9	305.9	554.9	889.2	666.8	451.9	152.9	7.6	1.5
Avg. no. of rainy days	1.5	2.4	3.6	7.1	13.9	20.6	25.0	24.4	17.0	4.3	0.8	0.7
Average rainfall/day (in mm) for 2013	0.1	0.3	0.5	3.6	10.2	18.5	29.6	22.2	15.1	5.1	0.3	0.0
Area of each household (As per Govt. of India norm in sq. m)	25	25	25	25	25	25	25	25	25	25	25	25
Run-off coefficient for asbestos (assuming asbestos rooftops in households)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Total collectable water per house (in m3)	0.0024	0.0052	0.0094	0.0726	0.2040	0.3699	0.5928	0.4445	0.3013	0.1019	0.0051	0.0010
Total collectable water per house (in litres)	2.4	5.2	9.4	72.6	204.0	369.9	592.8	444.5	301.3	101.9	5.1	1.0
Water required/day/hh (assuming 5 people/hh)	250	250	250	250	250	250	250	250	250	250	250	250
Excess water available per month (in litres)	0	0	0	0	0	71944	205688	116712	30760	0	0	0

3.1.3 Costs and benefits of the project

The following section describes in detail the estimates of costs and benefits of the proposed project for individual storage for 3000 households in the Darjeeling Municipal Corporation area.

Table 3-3: Costing detail of individual storage tank based RWH

Costing for Individual Rainwater Storage Tank / Household	Value	Unit
Cost of storage tank of 1000l capacity	*6110*	INR
Cost of sand & gravel pack filter	*5950*	INR
Cost of 20mm dia pipe (10 mtr) including stop cock and bib cock	*530*	INR
Cost of 45mm dia MDPE (10 mtr avg. pipe)	*1620*	INR
Cost of 25mm dia pipe (70 mtr avg. pipe)	*4500*	INR
Rain water gutter @ 1011/mtr for 30 mtr length	*30330*	INR
2.4m x 1.2m RCC platform over brick foundation for resting of storage tank and sand packed filter	*10115*	INR
Total cost of 1000 litre storage tank / household	*59155*	INR
Total no. of households covered under the project	*3000*	Households
Total cost of the project	**17.75**	**Cr. INR**

Costing for Community Rainwater Storage Tanks		
No. of households in one slum	*20*	*Assumed*
No. of people per household	*5*	*persons*
Total population in one slum	*100*	*persons*
Required water/person/day	*135*	*litres*
Available water/person/day	*30*	*litres*
Proposed water provided from the rainwater harvester/person/day	*50*	*litres*
Time duration of water supply	*30*	*days*
Total water provided from project per slum of 20 HH	*1,50,000*	*litres*
Project Costs		
Total no. of storage tanks required (of 10,000 litres capacity) per slum	*15*	*Nos.*
Cost of one 10,000l tank	*1,00,000*	*INR*

(including cost of foundation, iron cage - Rs.25000/tank)		
Total tank cost/slum	*15,00,000*	*INR/slum*
Piping required per slum (20 households)	*700*	*M*
Piping cost/running meter	*1800*	*INR*
Total piping cost/slum	*12,60,000*	*INR/slum*
Cost of one gravity filter	*2,000*	*INR/Household*
Cost of gravity filter per slum	*40,000*	*INR/Slum*
Total implementation cost for 1 slum consisting of 20 households (cost of tank, catchment area, piping and gravity filter)	*28,00,000*	*INR/slum*
	0.28	*Crores*
Total no. of households considered under the project	*200*	*households*
Total no. of slums with 20 hh each	*10*	*slums*
Total cost of community rainwater storage scheme	***2.80***	***Crores***
Project Benefits		
5 Water availability for longer duration.		
6 Improved living conditions of the poorer community		
7 Saving in time spent earlier for getting water from far away sources		
8 Savings in cost – As per a report by the Darjeeling NGO network, people of Darjeeling spend about 25-30 paise/litre to buy water. If 50 litres of water storage is provided per person for 30 days, each household will save about Rs. 2000 by not buying the outside water till the stored water is available (i.e. 30 days).		

In the context of benefits of this project we have identified certain areas of improvement in lifestyle and household economics of the beneficiaries which are mentioned in the Table 3-4 below.

Table 3-4: Benefits of RHW at household level in Darjeeling

Potential benefits of the project	Description
Water availability for longer duration for household activities	The project aims to increase the regularity in water availability for the households by about 3 months per year..
Individual and community health benefit	Due to improved quantity and quality of water supply individual and community may be able to avoid consumption of unhygienic water fetched from some unknown sources. Quite often during winter and summer the Darjeeling district people suffer from various water borne diseases. As a result the region suffers huge economic losses due to loss of productive hours of the working people.
Improved living condition	Due to longer period of water supply at household level, people especially women and children can have more productive time per day. Women can get engaged in various economic activities like weaving, sewing and running small shops while children can go to school without difficulty. Otherwise, they are engaged in water fetching activities from long distance leaving other jobs including study and household activities.
Improved economic condition	Quite often people in Darjeeling buy water for regular use and consumption during summer and winter season. As per Darjeeling NGO Network report, on average people spend 25-30 paise/litter for buying water. Under this project we would be able to supply additional 50litters of water per day for additional 45 days in a year, which is agin likely to increase in 100 days. Therefore, every household can save upto INR 3375 for this 45 days of additional supply which is a significant support to their livelihood.

As climate change affects rainfall patterns and increases surface temperatures, many ecosystem services will be more vulnerable and fragile. Rainwater harvesting is one of the ways to adapt to these increased changes in water supply and rainfall variability in the future, and, at the same time, enhance ecosystem services.

Rain water harvesting and subsequent supply of water to the community on a regular basis can improve the resilience capacity of the community which are vulnerable to climate change. As this technology is simple to install and operate, local people can be easily trained to implement it and construction materials are usually readily available.

Rainwater harvesting is convenient because it provides water at the point of use and farmers have full control of their own systems. Use of rainwater harvesting technology promotes self-sufficiency and has minimal environmental impact. Running costs are reasonably low. Construction, operation and

maintenance are not labour-intensive. Water collected is of acceptable quality for agricultural purposes. Continued and quality water supply to the poorer community can enhance their livelihood generation capacity by reducing the number of days of illness due to consumption of poor quality water, by reducing number of earning days due to extra time spent for water fetching from far off locations, by allowing children to spend more time in studying and school etc.

Other benefits include increasing soil moisture levels and increasing the groundwater table via artificial recharge. All these benefits put together enhance the resilience of the vulnerable community and can help fighting the negative impacts of climate change. Table 3-5 summarises the key benefits of RWH at a larger scale in the district.

Table 3-5: Overview of benefits derived out of RWH

Components/ Activities	Key Benefits (Direct)		
	Social	Economic	Environmental
Rain water harvesting and sustainable water supply to the poorer community households in the hilly areas of Darjeeling	• Enhanced working time for women • Enhanced time availability for children for study / schooling • Better health conditions	• Savings in availing water • Enhanced income generation opportunity • Improved water supply infrastructure • Improved livelihoods due to regular water supply	• Water conservation • Reduction of soil erosion by reducing surface water runoff • Recharging of existing streams and jhoras • Protection of surrounding micro-ecosystem

3.1.4 Sustainability of the proposed project

Municipal Engineering Directorate personnel will be responsible for setting up the water collection, purification and distribution systems under this project. Darjeeling Municipality will take the responsibility of identification of 3200 households and liability for the operation and maintenance of the rainwater harvesting systems.

In terms of daily operation and maintenance, since the cost of maintaining these types of projects are very low it is expected that it can continue without much difficulty even after the life term of the project funding. Capacity building of the beneficiaries is essential in this case to ensure sustained use of these installations. Nevertheless, Water User Association (WUA) will be formed in initial stage and awareness shall be generated for judicious use of water and basic technicality of the equipment. Though the maintenance of the Community Water Storage Structure is the responsibility of Darjeeling Municipality, but the WUA should own the project from the beginning.

3.1.5 Analysis of the cost-effectiveness of the proposed project

The rainwater harvesting project is more cost effective compared to the alternative project as the project size is smaller and the project duration is shorter in comparison.It will start supplying water to the vulnerable communities immediately after its implementation. Also, the O&M costs of such systems are very low compared to the pumped water supply systems. Table 3-6 below describes various benefits of the project which are further used to assess the cost effectiveness of the project in total.

Table 3-6: Comprehensive benefits of proposed RWH project in Darjeeling

Activity proposed under NAF	Proposed Alternatives	Benefits
Conservation of water by construction of rainwater harvesting facility in Darjeeling for 3200 households of poorer section (viz: BPL card holders)	An alternative to the project proposed under NAF can be the Darjeeling Municipality water supply project which will pump and provide continuous supply of water to these households.	The benefits of the rainwater harvesting project compared to the alternative project are as follows: 1. The rainwater harvesting project will conserve the natural rainwater and reduce surface run-off. 2. It is a climate adaptation project that converts the future climate risk of increased precipitation to future gain by providing water storage to the local vulnerable communities. 3. The rainwater harvesting project will supply 500L/1000L water storage to 3000 poorer community households and 10,000 Litre community water storage (50 L/person/day) for 200 similar households. 4. The Centralised Darjeeling Municipality scheme of supplying pumped water to Darjeeling households is in the pipeline. However, the project will finish only by 2045. But this conventional scheme is designed on "whole town" approach and providing household connections to each and every house is beyond its scope. 5. The rainwater harvesting project will provide a sustainable supply of water to the households even if the pumped water is not available.

Table 3.7: Comparison of RWH based water supply with Conventional water supply project

1	**Project cost**	About Rs. 12844/ Person	About Rs. 17011/ Person	WS 1 is much cost effective than WS 2
2	**O & M**	Rs. 25/Person	About Rs. 115/ Person	WS 1 is much cost effective than WS 2
3	**Risk**	Due to less involvement technical appurtenances risk is very low	Risk is moderate to high due to involvement of lot of technical details	WS 12 is less risk prone
4	**Cost/Benefit Ratio**	0.3	0.7	WS 1 is more acceptable
5	**Treatment**	Rain water needs no such treatment usually. Options of simple gravity filter and chlorination is considered.	Dedicated treatment Plant is necessary	WS 1 needs less treatment
6	**Environtal Impact Assessment (EIA)**	RWH is an entirely green process having no Environmental impact	Environmental impact is moderate	WS 1 is more eco friendly

Further we have estimated the per capita project cost for two alternatives i.e conventional municipal water supply and RWH based decentralized individual household supply. It has been estimated that the RWH based system is around 21% cheaper than the centralized system (Table 3-). In this estimate we have however, not considered any other indirect benefits.

3.1.6 Alignment with the National and State Action Plans and other Policies / Programmes

Darjeeling being part of the Himalayan region the proposed project is therefore, aligned to National Mission for Sustaining the Himalayan Ecosystem where one of the major objectives is to provide sustainable livelihood to the people whose livelihood depends on Himalayan ecosystem and improvement of their adaiptive capacity. Rain water harvesting in the hilly terrain can not only supply water for survival but it can also maintain the micro-ecosystem of the region as a part of the larger ecosystem of the Himalaya. Similarly the project can also be aligned to the National Missions for Water where the main objective is to conserve and protect the water resources under the climate change scenario. The proposed project is contributing towards water resource conservation by harvesting rain water.

3.1.7 Replicability Potential

The coverage of this project is limited to 3200 household because of upper ceiling in NAF. This simple model have a huge replicability potential as all other poorer house holds outside Darjeeling Municipality and remaining BPL households may also have similar structure if adequate support is arranged from other source. Even people from higher income groups may also feel motivated to conserve rainwater on their own by following these examples.

3.1.8 Weighting of project activities

In the proposed project we have emphasised majorly on construction and setting up the RWH facility at each selected household. Some portion of the budget is kept for capacity building and knowledge sharing among the beneficiaries and for project management as well.

Table 3-4: Distribution of budget among various categories of work in the project

Type of Activity	List of Activities	Funding Requirement
Investment activities	1. Site identification and preparation	0.75 Cr.
	2. Installation of the water harvesting structures	20.55 Cr.
Capacity building activities	1. Capacity building of the ULB people	0.50 Cr.
	2. Capacity building of the beneficiaries	
Project management activities	1. Project management (by NABARD and the implementing entity i.e. Municipal Engineering Directorate)	2.62 Cr.

3.1.9 Component-wise Technical Standards

Activity	Applicable Standard	Application to project
Water Supply	CPHEEO	Applicable
Ensuring Water Quality	BIS, CPHEEO	Applicable
Structural Stability	IS Code	Applicable

3.1.10 Complementarity check of the project

In this section we describe the project's legitimacy for Darjeeling district by discussing the complementarity of the project along with existing municipal water supply project.

Table 3-5: Complementarity check of the proposed project

Project	Objectives	Complementarity	Geographical Coverage/Agency
Water Supply Scheme for the Darjeeling Municipality under the UIDSSMT Programme	The project includes provision of supplying water to the households in Darjeeling by building water pipelines and reservoirs for the storage of water.	The existing project is not very useful for the poorer community households that are unable to pay for the pipeline connection cost from the reservoir to their households. Also, buying water from local vendors is a major financial burden. The proposed project under NAF for rainwater harvesting in Darjeeling town provides sustainable supply of water to these households and will also recharge the jhoras/streams in case of excess water availability.	Geographical coverage: Darjeeling town. The project is implemented by the Municipal Engineering Directorate, Department of Municipal Affairs, Government of West Bengal.

3.1.11 Learning and knowledge management

i) Capacity building and knowledge sharing workshops and sessions will be held for the ULBs to capture and disseminate the lessons learnt during the project implementation phase. During these workshops, the ULBs will also be prepared for the operation and maintenance of the installed systems. The sessions will also empower the ULBs to replicate similar project in other areas.

ii) Capacity building sessions will also be held for the beneficiaries - local communities and poorer community households (viz. BPL card holders) – so that the installed systems can be used in an efficient manner.

3.1.12 Details on Stakeholder Consultation

Municipal Engineering Directorate, Govt. of W.B., and Darjeeling Municipality are the primary stakeholders for the following Roof top based RWH project. The additional chief engineer north of MEDte is the nodal officer for the north Bengal. Under his control, the Superintending Engineer (North Circle); Executive Engineer, Siliguri Division; Assistant Engineer, Darjeeling Sub-division with sufficient numbers of Sub-assistant Engineers etc. are working for the Darjeeling Town. Assistant Engineer and Sub-assistant Engineers of Darjeeling Municipality are also committed to the developmental works taking place in the town. Officials from these departments have been regularly visiting the field area since the inception of the project. The project related issues raised from the in situ locations have been discussed thoroughly and sorted out in the district level as well as state level.

Stakeholder consultations were performed to gauge the ground level information regarding the access to water supply in the Darjeeling district. The report of this consultation was shared by MED and is also available with the GOI. As per this report, the Darjeeling Municipality confirmed that stakeholder consultations at various levels were done in connection to overall water scarcity problems during the

main Darjeeling water supply project consideration. These consultations were done by involving all stakeholders at the zonal level. The per capita water supply was recorded as 10 lcpd only (against the Ministry of Urban Development recommendation of 135 lcpd). The citizens of Darjeeling appreciated the suggestions and innovations discussed during this exercise.

3.1.13 Overview of the Environmental and Social impacts

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	The project will comply with all the existing laws	
Access and Equity	NA	
Marginalized and Vulnerable Groups	Provides water to the vulnerable poorer sections of community	
Human Rights	NA	
Gender Equity and Women's Empowerment	Water availability will help women to save time and invest in other activities.	
Core Labour Rights	NA	
Indigenous People	The project is aimed to benefit the indigenous people of Darjeeling	
Involuntary Resettlement	NA	
Protection of Natural Habitats	NA	
Conservation of Biological Diversity	NA	
Climate Change	Addresses the risk imposed by climate change	
Pollution Prevention and Resource Efficiency	Increases resource efficiency by efficiently utilizing the rainwater	
Public Health	Increases public health by providing water supply to poorer community households	
Physical and Cultural Heritage	NA	
Lands and Soil Conservation	Conserves the soil by reducing surface water runoff	

4. Implementation Arrangements

4.1Arrangements for Project implementation

Municipal Engineering Directorate, Govt. of West Bengal will implement the project. They are responsible for the following activities in the State and thus capable of handling this project.

- Preparation of Base Maps and Contour Maps for the ULBs which are newly created and annexed with added area.
- Planning of Urban Water Supply, Drainage, Solid Waste Management and other Environmental Improvement including Sewerage Schemes for the ULBs.
- Planning of other municipal development schemes including Survey undertaken within the ULBs including those situated within KMA.
- Planning& monitoring of various programmes launched by the State Government.
- Preparation of Master Plan, short & long terms Development Plan.
- Preparation of Land Use Map for the Non-KMA ULBs.
- Preparation of Solid Waste Management Plan for the ULBs.
- To act as Town Planners for the ULBs and new Growth Centres.
- To render all types of technical assistance to ULBs.
- To approve all development schemes above the estimated value of Rs.5.00 lakhs.
- Execution of all new Fire Station buildings of DFS.
- Maintenance of those Fire Station Buildings of DFS which are not in the books of accounts of PWD.

Since last five years, as per the Government of West Bengal order, all water related projects for urban areas are being implemented by MED. Since all the selected sites under this project fall under the Darjeeling Municipality, MED can be the only implementing entity for the proposed project.One major developing activity of the targeted water sector in the Darjeeling area is the project on Water Supply Scheme for the Darjeeling Municipality under the UIDSSMT Programme. The project will supply water to the households in Darjeeling by pumping water and building reservoirs for the storage of water.

The proposed project for setting up rainwater harvesting facilities is complimenting but mutually exclusive to the existing project of the state government. This is because though both the projects aim at providing continuous water supply to the households in Darjeeling, development of either of the projects is independent of the other one i.e. both projects can function independently but will serve the same objective at different scales.

4.2Selection of beneficiaries

The proposed project is critical in terms of selecting beneficiaries with low income category within the municipality area. Within the project we are planning to cover 3000 BPL category households and the selection of the households will be done primarily based on following criteria:

i) **Terrain of the households**: Terrain will determine the remoteness of the households to reach and to set up the RWH facilities. To set up the facility minimum accessibility to the place is required.

ii) Seismic activities: Entire north and north eastern part of India is under high seismic activities. As a result, while selecting the households it is important to evaluate the seismic condition of the terrain especially the location of underground fault line.

iii) Proximity to municipal water supply point. : This is also an important indicator in terms of selecting households not having proximity to any municipal water supply network and community water dispenser. This is to provide additional benefits to the households who spend long time in fetching water.

iv) Hygienic condition of the households. This is also an important criterion for selecting the beneficiary household under this project. Hygiene includes individual person's general health and quality of water the household is using before the project is implemented.

v) Any other criteria selected by MED

However, the basic objective is to maintain equality in terms of providing benefits derived out of this project.

4.3Description of the measures and project risk management

Risk	Rating (High / Medium / Low, etc.)	Mitigation Measure
Financial	Medium (project implementation stopped in the middle of construction due to natural calamity like flood, land slide)	Timely completion of construction And having prior database about landslide prone zone to minimise the risk
Environmental	Low (minimum impacts of micro ecosystem for building harvesting tanks for 80 KL capacity OR sudden seismic activities occurred)	- Setting up the tank in a relatively less ecologically active areas - Conducting proper seismic analysis and follow seismic resistant construction technique

4.4Monitoring and Evaluation Plan

Monitoring by Executing Entity

Monitoring and evaluation plan Activity	Responsible person	Yr. I	Yr. II	Yr. III	Total	Timeframe
1. Evaluation of selection of poorer community households as per criteria given in the Section 1.4	Darjeeling Municipality	40 visits	-	-	4 lakhs (10,000/visit)	3 months
2. Quarterly evaluation if construction of Rainwater harvesting facilities is as per	Superintending Engineer, MED	2 visits	4 visits	4 visits	1 lakh (10,000/visit)	2.5 years

schedule						
3. Half yearly evaluation of training and capacity building activities.	Additional Chief Engineer, MED	1 visit	2 visits	2 visits	1 lakh (20,000/visit)	2 years
4. Final project evaluation in terms of: • Households covered • Expenses incurred • Harvesting capacity added • Completion of audit formalities	Chief Engineer, MED	-	-	1 time	1.25 lakh	1 month
5. Overall project monitoring by the State Government and the National Implementing Entity i.e. NABARD	Project Nodal Officer – to review the relevant project reports	-	-	-	- (Separate budget is allocated for the NIE to Monitor the project)	*

*Monitoring and Evaluation by State Government and NIE

- One evaluation shall be done at State Government level on half yearly basis
- One evaluation shall be done by NABARD on half yearly basis

4.5 Organizational Responsibility

Following table shows the list of acting agencies and their corresponding roles in the entire project period which will be the guiding principles of monitoring and evaluation of the same.

Acting agency	Role
NABARD as National Implementing Agency	Project financing and monitoring of progress of implementation
Municipal Engineering Directorate as Executing agency	All project implementation related activities
Dept. of Environment., Govt. of West Bengal	- Co ordination and facilitation if situation demands
Water User Association	Daily operation and maintenance of the facilities and ensuring users' access and responsibility towards the facilities.

4.6 Detailed Budget

Budget Plan for Implementing Entity (MED) Management Fee Use	
Activity (for entire project duration of 3 years)	Amount
Monitoring & evaluation cost	7.25 lakhs
Salary component	100 lakhs
Transport expenses	50 lakhs
Stakeholder consultation expenses	8 lakhs
Third party audit expenses (if required)	0.5 lakhs
Contingency (computers, preparation of bid document etc.)	15 lakhs
TOTAL	180.75 lakhs = 1.8 Cr.

Breakdown of Project Execution Cost			
Project/Programme Components	**Outputs**	**Amount (INR)**	**Total Amount (INR)**
1. Selection of poorer community households and site for rainwater harvesting	Selection of suitable poorer community households through GPS monitoring	0.50 Cr.	0.75 Cr.
	Preparation of site maps and plans for the selected sites	0.15 Cr.	
	Estimates of total water harvesting capacity and design schemes	0.10 Cr.	
2. Setting up the rain water harvesting facilities	Setting up of 30 lakh litres of individual storage tanks and related pipelines for 3000 households	17.75 Cr.	20.55 Cr.
	Setting up of 15 lakh litres of community storage tanks	1.50 Cr.	
	Construction of 7 km of pipeline for community storage	1.26 Cr.	
	Providing gravity filters to all selected households	0.04 Cr.	
3. Capacity Building and knowledge sharing	Capacity building and knowledge sharing (lessons learnt) among the ULBs	0.25 Cr.	0.5 Cr.
	Capacity building of the local communities and beneficiaries	0.25 Cr.	

Note: To estimate the consolidated costs mentioned above, the costing has been estimated as follows:

- The costing for different categories of harvesting tank installation which are used is mentioned below:
  - Category-I: 1000 L Capacity Syntex Tank: Rs. 59,155 / tank (with sand and gravel filter and all related piping)
  - Category–II: 10,000 L Capacity Syntex Tank: Rs. 1,00,000 / tank
-
- Piping cost per running meter is taken as Rs. 1800 for a 100 mm diameter pipe.
- Cost of gravity filter is taken as Rs. 2000. One filter will be distributed per household for community rainwater storage scheme.

4.7 Disbursement Schedule

Total Funds to be disbursed = INR 24,41,76,950 = 24.42 Cr.

Instalment	Percentage	Amount (in INR)	Year	Milestones
First	5%	1,22,08,848	November, 2015	Project Initiation, Site selection
Second	30%	7,32,53,085	February, 2016	Project construction start
Third	30%	7,32,53,085	January, 2017	35% household (1120 no. of households) covered under the project
Fourth	30%	7,32,53,085	December, 2017	70% household (2240 no. of households) covered under the project
Fifth	5%	1,22,08,848	December, 2019	Project completion - 100% household (3200 no. of households) covered under the project
TOTAL		24,41,76,950		

PART IV- Endorsement by Government and Certification by the Implementing Entity

Letter is attached to this DPR.

Details of Project Executing Entity

Provided in section 4.

Available technical manpower for the proposed project implementation

Six technical person from the level of Additional Chief Engineer to Sub-Assisstant Engineer and five engineers from vendor agency side followed by adequate number of supporting staff for installation of Rain water storage structures.

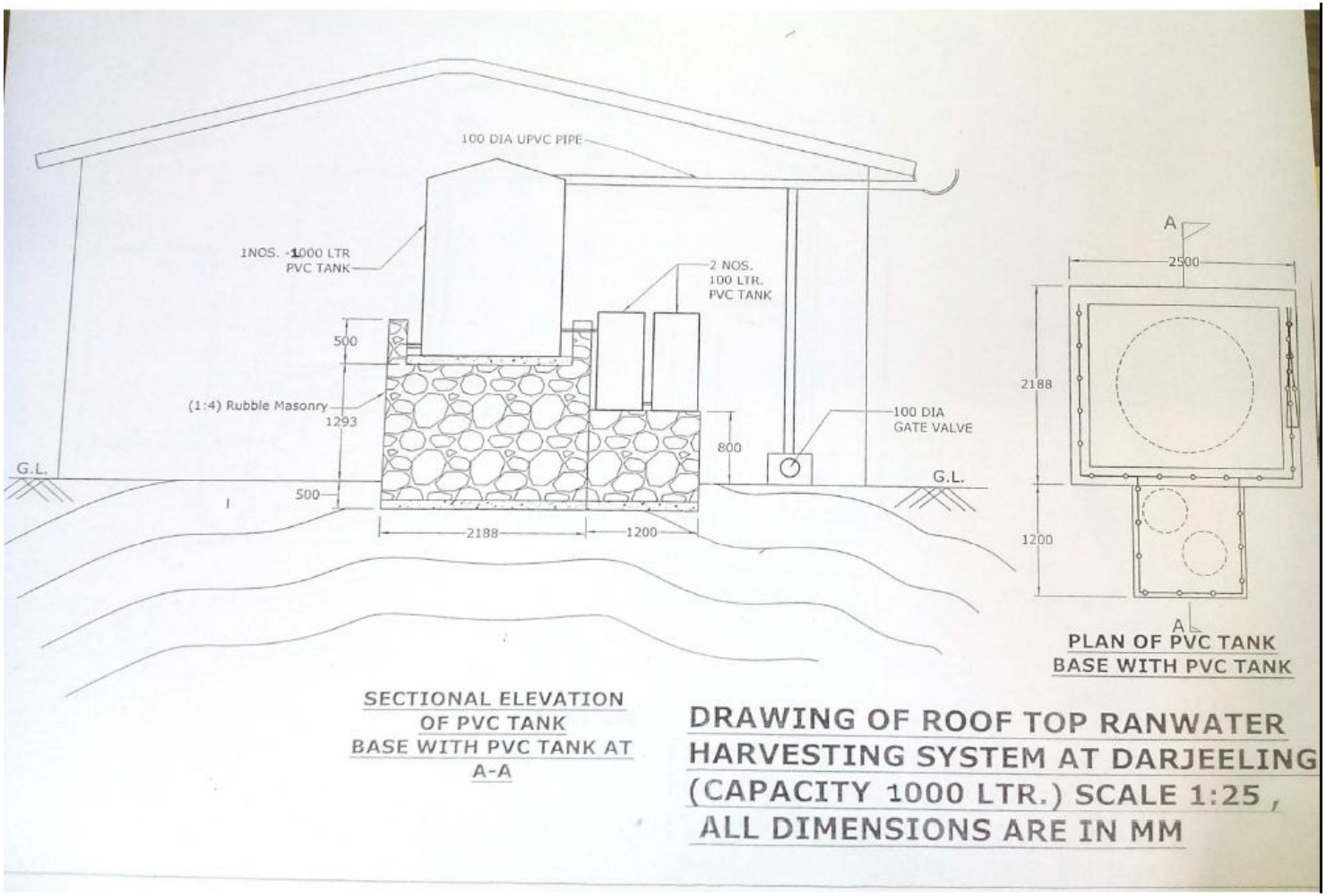
Rain water harvesting and sustainable water supply to the hilly areas in Darjeeling as an adaptive measure to potential climate change impacts. : Result Framework

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
Component 1: Selection of BPL households and sites for setting up rainwater harvesting facilities					
Outcome 1 : Identification of BPL Households and Site Selection for RWH structure construction					
Output 1.1: Selection of BPL households	List of households selected	0	3200 households	Quarterly progress report	***Assumptions*****:** *List of selected households will be available* ***Risks:*** *No. of beneficiaries might be changed/replaced from the planning to the implementation phase.*
Output 1.2: Preparation of site maps and plans for the selected sites	Site implementation plan	0 0	3000 10	Quarterly progress report	***Assumptions*** **:** *The site selection will be based on number of beneficiaries selected/identified subject to availability of space for construction* ***Risks: 1.*** *No. of sites for construction of RWHs might change/replaced from the planning to the implementation phase.* *2. Ambiguity in design of the site map*
Component 2: Setting up of rainwater harvesting facilities					
Outcome 2:	Construction of Water Harvesting Infrastructure				
Output 2.1: Construction of catchment rooftops	Catchment rooftop	0	3000 No of catchment rooftops	Quarterly progress report & physical verification	***Assumptions:* 1.** *3200 HHs will be available upstream of the existing jhoras.* *2. There will be rainfall every year* *3. The construction will be as per the design and completion as per the time line* ***Risks: 1.*** *Occurrence of landslides and earthquakes can damage the structure.* *2. Occurrence of torrential rain or any other natural calamities during construction period* *3. Financial risk due to delay in construction or change in design* *4. Political risk & labour Risk* *5. The quality of construction may decide the structural sustainability.*
	Community Storage Tank	0	10 Community Storage Tank		
Output 2.2: Setting up of storage tanks	Cumulative capacity of storage tanks	0	45 lakh litres of storage capacity	Quarterly progress report & physical	

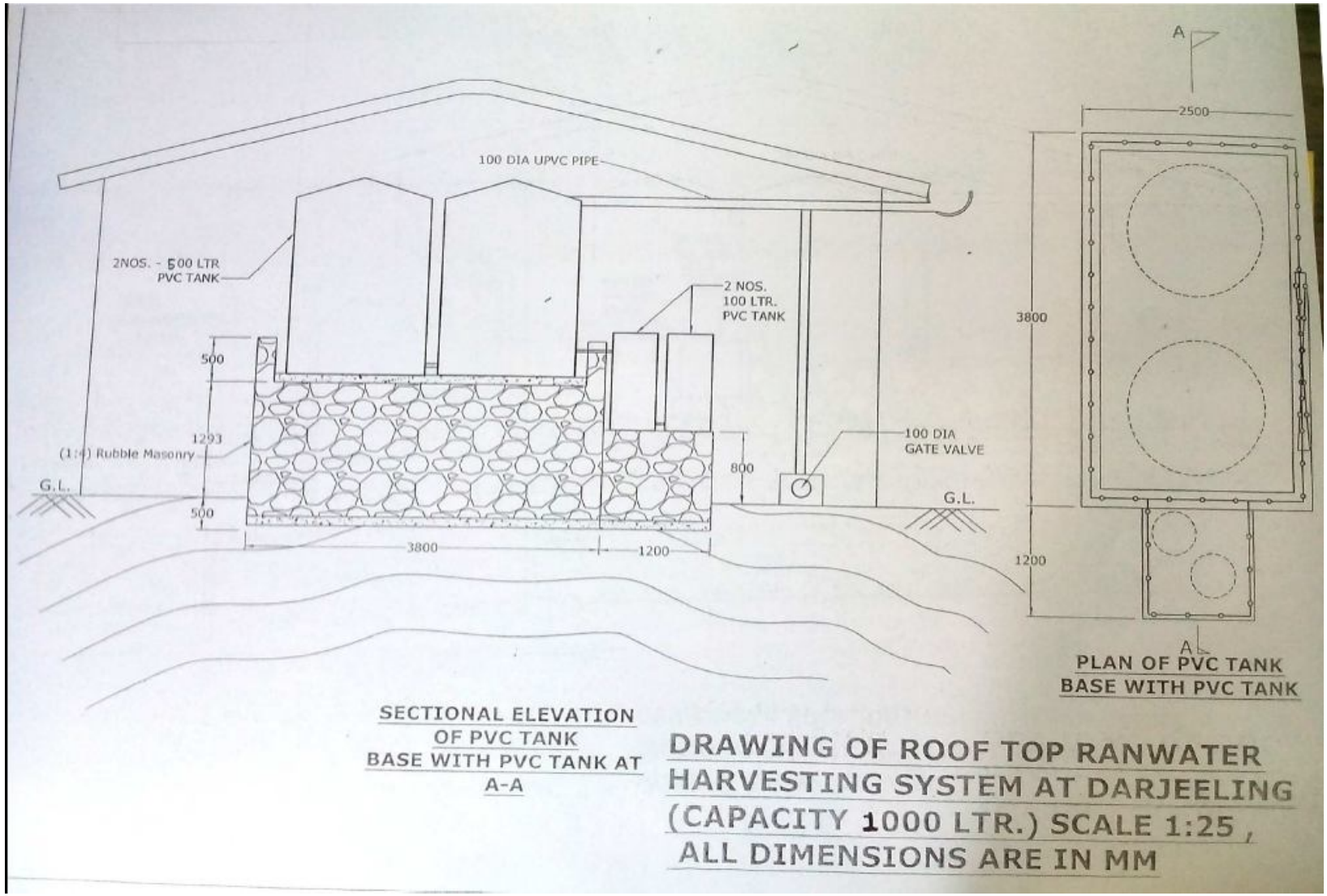
Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
				verification	
Output 2.3: Pipelines for transportation of excess water to the local jhoras	Meters of pipelined installed	0	0. 7 km	Quarterly progress report	**Assumption** : *1. Approximate length of pipeline of 7kms* **Risk** : *1. The cost will vary depending upon actual length of pipe line* *2. Deviation against assumption may lead to cost escalation*
Output 2.4: Providing gravity filters to all selected households	Numbers of gravity filters provided	Zero	3010	Quarterly progress report	**Assumption**:*1. Quality Gravity Filters will be procured in time.* **Risk**: *1. Policy/Taxation Risk – Enhancing Taxes or levying new taxes* *2. Procurement risk*
Component 3: Capacity building and knowledge sharing					
Outcome 3:	Knowledge management in water conservation and utilisation				
Output 3.1: Capacity building and knowledge sharing (lessons learnt) among the ULBs	No. of Capacity BldgTrng	0	6	Training Completion Report	**Assumption** 1. *02 Training programmes @25 participants per programme covering officials of Political representatives (Ward members), ULBs, District Administration etc* **Risk** 1. *The concerned officials/representatives may not continue in the same desk for 03 years period. Discontinuity may affect the spirit in implementation of the programme.*
Output 3.2: Capacity building of the local communities	No. of Capacity BldgTrng	0	180	Training Completion Report	**Assumption** 1. *60 Training programmes @ 50 participants per programme covering 3000 HHs for Individual RWH for 03 years [60*3 = 180]* **Risk** 1. *100% participation for capacity building may not happen due to poor*

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
and beneficiaries					*economic condition (BPL categories)*
		0	12 (10 WUAs)		**Assumption** 1. *04 Training programmes @50 participants per programme covering 200 HHs for Community storage structure for 03 years [4*3=12]* **Risk** 1. *100% participation for capacity building due to poor economic condition (BPL categories)*

Appendix 1: Detailed engineering design drawing of one 1000 litre RWH tank



Appendix 2 Detailed engineering design drawing of two 500 litre water harvesting tanks



Appendix 3 Detailed engineering design drawing of 10,000 litre RWH tank