Increasing climatic resilience of urban water management system of Hyderabad

India | National Bank for Agriculture and Rural Development (NABARD)

01 December 2016
The Green Climate Fund (GCF) is seeking high-quality projects or programmes.

Accredited entities may choose to submit a concept note, in consultation with the relevant national designated authority, to present the proposed project or programme idea in order to receive early feedback and recommendation.

Project/Programme Title: Increasing climatic resilience of urban water management system of Hyderabad

Country/Region: India

Accredited Entity: NABARD

National Designated Authority: MoEFCC
### A. Project / Programme Information

<table>
<thead>
<tr>
<th>A.1. Project / programme title</th>
<th>Increasing climatic resilience of urban water management system of Hyderabad</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2. Project or programme</td>
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<tr>
<td>A.3. Country (ies) / region</td>
<td>India</td>
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<td>A.4. National designated authority(ies)</td>
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<td>A.5. Accredited entity</td>
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<td>Beneficiary: Urban local bodies/ State Government of Telangana</td>
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<td>A.7. Access modality</td>
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<td>A.8. Project size category (total investment, million USD)</td>
<td>Micro (≤10) ☐ Small (10&lt;x≤50) ☐ Medium (50&lt;x≤250) ● Large (&gt;250) ☐</td>
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<td>A.9. Mitigation / adaptation focus</td>
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<td>A.10. Public or private</td>
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#### A.11. Results areas (mark all that apply)

- Reduced emissions from:
  - ☐ Energy access and power generation
    (E.g. on-grid, micro-grid or off-grid solar, wind, geothermal, etc.)
  - ☐ Low emission transport
    (E.g. high-speed rail, rapid bus system, etc.)
  - ☐ Buildings, cities, industries and appliances
    (E.g. new and retrofitted energy-efficient buildings, energy-efficient equipment for companies and supply chain management, etc.)
  - ☐ Forestry and land use
    (E.g. forest conservation and management, agroforestry, agricultural irrigation, water treatment and management, etc.)

- Increased resilience of:
  - ● Most vulnerable people and communities
    (E.g. mitigation of operational risk associated with climate change – diversification of supply sources and supply chain management, relocation of manufacturing facilities and warehouses, etc.)
  - ● Health and well-being, and food and water security
    (E.g. climate-resilient crops, efficient irrigation systems, etc.)
  - ● Infrastructure and built environment
    (E.g. sea walls, resilient road networks, etc.)
  - ● Ecosystems and ecosystem services
    (E.g. ecosystem conservation and management, ecotourism, etc.)

#### A.12. Project / programme life span

5 years is the life of the GCF Project but the overall project will continue to run beyond that till the life of the infrastructure

#### A.13. Estimated implementation start and end date

Start: April 2017  
End: April 2022

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1 Please use the following naming convention for the file name: “[CN]-[NABARD]-[20160507]-[1]” (e.g. CN-ABC-20150101-1).
B. Project/Programme Details

The Fund requires the following preliminary information in order to promptly assess the eligibility of project/programme investment. These requirements may vary depending on the nature of the project/programme.

**Objective:** The objective of the project is to develop a climate resilient urban water management system for the city of Hyderabad to ensure a comprehensive long term climate resilient and sustainable management plan.

**Overview of the problem statement and propose project activity**

Hyderabad, the capital of newly formed state of Telangana is a land locked city. It is experiencing climate change through:

a. **Rainfall – changes in precipitation, heavy rainfall, water logging and flash floods**
   - Standard deviation in mean rainfall has increased by 21% between 110 year and last 30 years time frame. Climatic models have been run to predict that annual mean rainfall will change, and also the deviation in rainfall projected by different models shows large variation
   - High intensity rain or peeking events have increased in frequency and intensity. It is predicted that rainfall peeking events will rise but the exact rise is unknown

b. **High Temperature, Drought and near drought situations**
   - The temperature of Hyderabad has increased by 0.016°C in the past and climate models predict that the temperature will further increase by in the range of 1.17°C to 3.5°C in next 50 years. The variation in results of temperature is very high. Hyderabad has started experiencing heat waves since late 1990’s and is becoming severe with time. Drought and drought like situations have been on the rise in the recent decades. In the future drought behaviour is not known but rainfall deviations show an increasing trend.

The climatic variability and climate change in Hyderabad has been studied by various researcher and international organizations, who indicate that the climate change will impact Hyderabad’s water availability and increase urban flooding and water logging. What researches suggest is also experienced by Hyderabad as:

- The rainfall variations and drought in recent times have resulted Hyderabad’s water availability reaching critical levels. It is projected that the water requirement will increase and despite governments current plan to meet the water requirement the gap will increase several folds. It is expected to be 3 times by 2051.
- Existing sewers are designed for 12mm/hr rainfall capacity where as the average rainfall intensity has increased to 23mm/hour and peak is 52mm/hour in the recent decades. Over burden of drainage system is leading to increase in flash flood and water logging events. 351 incidences of water logging occurred in the city in 2010–2011 alone (MoUDSLB 2010). In August 2000, Hyderabad received 240 mm of rainfall in a 24 hr period which resulted in very severe flooding and impacted 77 slum areas in the city.
- Natural drainage systems like lakes are not functioning optimally which is adding to the climate induced problem of water logging due to increase hourly precipitation. Increased storm runoff, which increases loads of pathogens, nutrients, and suspended sediment finding its way to rivers, lakes & GW
- Over exploitation of ground water in Hyderabad is only exasperating the situation. The ground water table shows correlation with declining rainfall in last decades. Possibly drier conditions will increase pollutant concentrations. As indicated by IPCC AR4 report, this is a concern especially for groundwater sources that are already of low quality (IPCC).
- Evaporation from surface water bodies is also increasing due to prolonged summers with higher temperatures

A world bank report on “The impact of climate change on India” also found that water security and health will be impacted due to climate change. (http://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts)

To address the problem in short term and long term, the GCF project proposes a combination of
soft and hard infrastructure through the below mentioned three interventions:
- **Water saving** by recycling of treated wastewater and supply of saved fresh water
- **Creating flood control measures** through infrastructure and natural control systems using local topography and also creating natural ground water recharge
- **Strengthening institutional mechanism and providing long term measures to adapt to Climate Change** by introducing adequate data generation tools, systems, monitoring mechanisms, human and resource capacity, policy framework

**The key impacts of the project will be:**
1. 28% of the wastewater treated under the project i.e. 164 MLD will be recycled to identified users and an equivalent amount of fresh water will be available for supply to the 2.2 million vulnerable population of Hyderabad living in slums. The project will add 70lpcd of fresh water supply to the slums.
2. To fulfil additional water requirement of the city government has planned phase wise drawl of water from Godavari river. In Phase II, a pipeline to draw 172 MGD of water will be laid down. The additional fresh water available due to recycling will contribute and support about 15-20% of the water projected to be drawn under the Godavari Phase II water supply project.
3. Out of 169 lakes in Hyderabad, 19 lakes are proposed to be rejuvenated initially. These lakes together will be able to create an additional 22mcm of water storage capacity and a ground water recharge potential of about 1-2 meter per annum2. The natural drainage system coupled with infrastructure created as result of water recycling system will support as flood control system

4. **Institutional strengthening** will be brought about by capacity building, training and knowledge sharing, comprehensive water database for Hyderabad in public domain for better monitoring and management of water resources and development of a climate resilient framework for the city up till the year 2050. All these activities will be mainstreamed into the functioning of various departments concerned with the project.

**Background of Hyderabad**

Hyderabad is the capital of the newly formed state of Telangana. Hyderabad is a land-locked riverine city located 548m above mean sea level and the sixth largest urban agglomeration in India, with a metropolitan population of 7.753 million. It has evolved into a hub of information technology and has witnessed rapid expansion due to an industrial boom and increased trade opportunities. 32% of this population lives in slums. The city population has in the last decades grown at a rate of 30% and its slum population has increased from 17% in 2001 to 32% in 2011. It houses second largest number of people per household after Kolkata among major cities in India.

Hyderabad historically had a large network of interconnected natural and manmade lakes which support the hydrology of the city. Currently, Hyderabad has 169 lakes which are not operating optimally due to climate change and urban sprawl. It has a rolling terrain and it is estimated that more than 90% of the water in Hyderabad rolls towards river Musi by gravity. The catchment of Hyderabad is divided into various basins the main ones being Central basin, North west basin, South west basin, and North east basin.

The Musi River, which carries most of the city's treated and untreated sewage, runs about 20 kms within the city limits, and passes downstream through a length of about 150 kms before joining the River Krishna. Musi is not a large perennial river. In Hyderabad, only 55% of the city is covered by the sewerage network. Due to the limited sewerage treatment facilities, the rest of the waste is discharged untreated into the river4. This mixed wastewater is used by of the area in and around Hyderabad for cultivation5. As per the study conducted in major cities in India, this is the largest area under sewerage cultivation. However, wastewater recycling is only 3%. Currently, the recycled wastewater is used primarily by only one bulk consumer (i.e. Rajiv Gandhi International Airport). This leads to fresh water

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2 GW recharge potential through infiltration about 1.2 to 1.4 mm/day of the area of lake that is covered with water for the year
3 Census 2011
5 Urban wastewater: Livelihoods, health and environmental impacts in India by Winrock International published in association with Institute for studies and transformation Jadavpur University
being used for nearly all the activities in the city of Hyderabad. Considering, that Hyderabad is located in semi arid region and in one of the 9 most water stressed states in India there is severe pressure on fresh water resources available to Hyderabad. 70 to 80% of the city water is being sourced from rivers like Krishna and Godavari which is located more than 100 km away from the city.

Baseline and Projected Climate scenario
The Intergovernmental Panel on Climate Change (IPCC) estimates that the Indian subcontinent will experience more intense rains over fewer days, triggering an increase in monsoon floods while at the same time the country is projected to suffer an overall decrease in rainfall. Projections also suggest that India will experience significant water stress by 2025. The water availability in India will fall by 40% in 40 years. Such circumstances create the potential for a cascading chain of impacts on vital resources such as water supply, for which public officials must prepare, especially in light of projected increases in water demand.

Hyderabad faces two major climatic challenges elaborated below:

Rainfall – changes in precipitation, heavy rainfall, water logging and flash floods
1. The national disaster management guideline for urban flood management issued in 2010 mentions that there has been an increase in the average annual rainfall of Hyderabad from 806 mm in 1988 to 840 mm in 2002. The standard deviation in mean rainfall has increased by -21% between a 110 year and last 30 year time frame (i.e. mean rainfall deviation has changed from 162mm to 197 mm).

Models (models have been run by Indian Institute of Tropical Meteorology) so far predict that annual mean rainfall will change, and also the deviation in rainfall projected by different models shows large variation. Results of model are as below:

2. High intensity rain or peeking events have increased in frequency and intensity. The average rainfall intensity has increased to 23mm/hour and peak is 52mm/Hour in the recent decades. This high intensity and short duration rainfall events are likely to further increase in the future. For example: Rainfall of 237mm recorded during 8-10 August 2008 i.e. half of monthly rainfall for Aug. Such high rainfall events lead to flooding, excess water runoff and not recharge. Similarly, high intensity rainfall events of 20mm/hr and 40mm/hr have increased from 23 events to 36 events and 4 events to 12 events, respectively, between a short span of 8 years i.e. 2000 to 2008. The drainage system in Hyderabad is designed for 12mm/hr of rainfall while the climatic trend is rapidly changing.

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7 Study on Urban Hydrology, Groundwater Quality, Pollution & Management of Hussainsagar Catchment Area, Hyderabad Dr. K. Venugopal1, Ramesh Kumar1, RD Prasad1, K Mahesh Kumar1, Md Idrees1, D Suneel Babu1, VVS Gurunadha Rao, year May 2014 (Pg no 1, 13, 23, 24)
3. A study shows that by 2081-2100 the frequency of high intensity rainfall events will increase as given in the graph.

4. The city receives 603mm of rainfall and the pattern of extreme precipitation events from 1910 to 2000 has shown an increasing trend. In August 2000, unprecedented floods were experienced in Hyderabad, due to 24cm of rainfall in 24 hours, i.e. around half of the annual precipitation in single day. 77 slums in the city were affected due to these floods. The flood frequency is affected by changes in the year to year variability in precipitation, and by changes in short-term rainfall properties. 28.1% of houses in Hyderabad’s urban areas are highly vulnerable to flood hazards, and 7.9% of city houses are vulnerable to wind hazards (Census of India 2011).

High Temperature, Drought and near drought situations

Hyderabad faces heat waves and it is projected that the average number of days per year with night temperatures above 27°C will approximately triple until 2050 (Matthias et al. 2009). High temperature, temperature deviations, drought and near drought situations are also showing a change. Temperature increase has been 0.016°C so far and it is likely to be 1.7°C to 3.5°C in future. In the last few years Hyderabad has experienced drought and drought like situations which had brought Hyderabad’s Osman Sagar and Himayat sagar and Manjeera reservoir on extremely critical levels. Creating risk for large population of Hyderabad.

Other studies carried by international organizations like like Potsdam Institute of climate impact research and by the Rockefeller Foundation also predict:

- The mean annual temperature will develop monotonously in time and with a stronger trend in the high emission scenario up to +5°C, which would definitely alter the natural water balance towards increased dryness.

- There is deviation in annual precipitation by +4% to +17% from normal values that will result in an increase in total annual precipitation

- Potentially reduced intra-annual water availability. Drought events have the potential to rigorously reduce the availability of quality water for residents, agriculture and industry by either contaminating existing water resources or generating severe surface and ground water scarcity.

- The annual losses from urban flooding are now much greater than the annual economic losses due to other disasters.

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8 Assessment of Climate Change-Induced Vulnerability to Floods in Hyderabad, India, Using Remote Sensing Data Oleksandr Kit, Matthias Lüdeke, and Diana Reckien
9 Asian cities climate resilience, working paper series 8, 2014 by IIED, Rockefeller foundation, ACCCRN and IRAD – Vulnerability of Hyderabad
Impacts other than flooding: While on one side the peeking events are leading to flooding, the city also reeled under tremendous water crisis. The large water reservoirs of the city like Manjeera, Singur, and Osman Sagar have all dried up due to continuous drought for last two to three years. The current water deficit is about 300MLD. Under water augmentation scheme to meet the water requirements of city 172MGD of water supply system from river Godavari is under construction and will be implemented by July 2016. Under Phase II another 172 MGD of water supply system is proposed to be established for the city. Despite this, it is projected that the city will face about 600MGD of water deficit by 2051 in a business as usual scenario.

Impact on hydrology is significant. Climate change has the potential to create reduced intra-annual water availability. Drought events have the potential to rigorously reduce the availability of quality water for residents, agriculture and industry by either contaminating existing water resources or generating severe surface and -ground water scarcity. For example: Ground water departments statistics indicates that the decadal fall in ground water level for the year 1998 to 2005 has been 0.64mbelow ground level(mbgl) and for the year 2006 to 2015 has been 3.84mbgl\(^{11}\). At the same time, the ground water level in Hyderabad in the month of May 2014 fell by 4m over the decadal mean for May 2004 to 2013\(^ {12}\). This indicates that the ground water depletion in the drought years is very high during peak water requirement seasons. The trend observed in Hyderabad indicates that rainfall variation increase and depletion in Groundwater are correlating even with similar decadal population growth rate. As a result, IPCC suggests that possibly drier conditions will increase pollutant concentrations. This is a concern especially for groundwater sources that are already of low quality like over exploited and critical water reservoirs in Hyderabad.

Project details

Several projects are underway or have been completed in Hyderabad funded by government or funding agency on ground water, lakes and other water related aspects. The objective of this GCF project is to move beyond the one of projects and design and implement a comprehensive integrated water management system for Hyderabad. Project recognizes the need to implement the low handing fruits or the immediate needs to bring about climate adaptation and integrate them with long term climate resilient plan. The project intends to achieve this through 5 outcomes:

**Outcome 1: Comprehensive water database for Hyderabad in public domain for better monitoring and management of water resources**

Outcome 1 is aligned with the National water mission and national water policy. It strives to bring together the data being collected on water and climate parameter by various departments, assess them and identify the critical missing data for climate resilient decision process and strive for it. This outcome also intends to analyze the data on real time and make essential information available on public domain while providing more specific data to the respective users.

Immediate data gaps that outcome 1 will integrate are GIS based real time mapping of all the 169 lakes in Greater Hyderabad Municipal Council (GHMC) area. These 169 lakes have been identified for protection and conservation. Notification has been issued to restrict activity in a 30m buffer zone around water bodies and basic ground level data collection has already been initiated by concerned departments. The project would draw from their data to set up this system.

Ground water department has several stations for monitoring ground water table and quality across the state. These have been setup under various projects. Under Hydrology Project the GWD has installed about 50 piezometric stations in Hyderabad. About 10% of which are telemetry stations. It is proposed that Hyderabad is covered through gridded Telemetry station for real-time groundwater table monitoring to identify hotspots in ground water. The department realizes that in view of the fast deteriorating ground water situation in Hyderabad a gridded system for water level and quality metering is a must, in order to check water withdrawals and provide solution for recharge and management. With this in view 150 piezometers and 150 digital water level recorders are proposed to be installed as a part of the data generation and management process.

The database will also include a system to provide early warning on flash flood or flood like situations

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\(^{11}\) Ground water department of Telangana records

\(^{12}\) Ground water year book 2014-2015, Pg no. 63-64
to the urban population of Hyderabad through various mediums (also following the guidelines of NDMA and all relevant authorities) like digital displays, sms services and other eservice mechanisms etc.

Several software and data analytics options are available for database management and interpretation the best suited systems would be deployed for this purpose.

While the above steps are aligned to the national water mission’s objectives, it is important to raise awareness among the ULBs and departments on the importance of such a data system and increase their capacity in recording these data. Several other capacity building exercises will be carried out as a part of the process.

**Outcome 2: Development of a Climate Resilient Framework for the City**

Infrastructure services can be subject to multiple stresses, which include climate related stress. Extreme weather events associated with climate change will increase disruptions to infrastructure services, and infrastructure which is already stressed by age and/or by demand levels that exceed their design capacity will be particularly susceptible to damage by climate impacts (McKinsey and Company 2009). Many impacts of climate change do not create new risks but increase risk levels to existing vulnerable populations and systems. Further, even in normal situations, inadequate or absent appropriate infrastructure can slowly reduce the coping capacity of the community to a major hazard, and may itself become a hazard. For example, inadequate sanitation facilities can turn into a major hazard by causing epidemics when floods occur and spread waste.

The resilience framework intends to address not just the risks that are evident, but it would identify both hard and soft infrastructure improvement measures that should be undertaken for Hyderabad in a long term so that the water management of Hyderabad is climate resilient.

Hard infrastructure resilience would include some of the measures like recycling and reuse system, storm water management system for ground water augmentation, revival of existing system, supply side and demand side water management systems, water metering. Soft component would be need for capacity building water budgeting, water pricing and policy enablers for successful management

The key aspects of this would be:
1. Exposure assessment through climato-hydrological model which may require primary data collection.
2. Development of a dynamic model for continuous study of climato hydrological parameters
3. Impact assessment on built infrastructure, health each disease wise, vulnerable population with forecasted impacts till 2050 with economic impacts
4. Development/deployment of system to monitor the impact
5. Assessing resilience of system in current scenario and future development
6. Development of vulnerability scenarios for 2020 and 2050, adaptation plan and creating policy framework and implementation plan for the city taking into account the city natural growth
7. Preparation of technical and commercial feasibility report for major implementation items of adaptation and revisiting the existing report for up gradation
8. Creation of incubation fund for promoting green technologies in treatment of water and wastewater systems
9. Stakeholder capacity building through continuous support system

**Critical output: Development of a blue print for the water and an integrated and climate resilient wastewater management plan of city for today, then 15 years hence and 30 year hence projections with implementation plan, policy interventions and financing plan**

**Outcome 3: Creation of infrastructure to save fresh water/ augment fresh water requirement and create flood control system**

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13 Asian cities climate resilience, working paper series 8, 2014 by IIED, Rockefeller foundation, ACCCRN and IRAD
**Outcome 3a: Fresh water saving/augmentation by implementation of water recycling system**

Study suggests that there are gaps in the city's infrastructure provision which need to be addressed for both development and climate adaptation purposes, particularly bearing in mind the city's population growth. In particular, there are large inadequacies in water availability in the city today and these are projected to increase three fold by 2050. Considering the land locked situation of Hyderabad with over exploited ground water level and depleted surface water resources which are continuously impacted by increasing climatic variations alternate or non conventional water supply sources need to be taken up at large scale immediately.

The project intends to augment the water supply through non-conventional means, supported by National Water Mission and Policy i.e. by creating wastewater recycling system for recycling 28% of the 580MLD of wastewater generated in the city. In this project it is proposed that 28% of the 580MLD of wastewater is treated and recycled to industries and institutions, so that an equivalent amount which to start with will be 164 MLD is made available to vulnerable population.

The cities coverage of sewerage networks and storm water drains system and mechanism to recycle will need to be set up. *For this purpose the project proposes to undertake:*

- The construction of conveying mains, I&D structures, sewerage treatment plans and pumping station. In addition a waste water recycling/transportation system would also be developed under the project.
- A prefeasibility of the wastewater recycling system has been developed. It is proposed that the recycled water will primarily be sold to bulk/industrial consumers and for gardening purposes. The detailed recycling mechanism and pricing will be developed at the detailed project documentation stage.
- Detailed project reports for treatment of waste water have been developed and will be ready for implementation after a quick reconciliation before implementation.
- Capacity building and awareness raising is an integral part of this component which will be guided by the findings of outcome 5.

**Outline of the wastewater recycling plan is presented below (this will be formalized in the detailed project report stage).**

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<th>Sl.No</th>
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<th>Capacity of Treatment plant in MLD</th>
<th>Proposed quantity for Recycling and reuse in MLD</th>
<th>Proposed consumers and location</th>
<th>Distance from STP in Kms</th>
<th>Length of Distribution Network in Kms</th>
<th>Total length of pipe line required in Kms</th>
<th>Cost of laying of pipe line along with Appurtenances in Cr</th>
<th>Cost of Tanks, Sumps and other civil works in Cr</th>
<th>Cost of Pumps and Motors and other</th>
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Outcome 3b: Flood Control and Ground water recharge through Lake Rejuvenation

It is also predicted that climate change will decrease overall rainfall while increasing its intensity in South India. This greater intensity of rainfall will increase run-off and decrease groundwater recharge rates. This coupled with informal settlement colonies which have emerged in the cities, and the lack of proper planning of these means they lack drainage systems, make the city particularly vulnerable to flood hazards. **By restoring urban water bodies, the risk of flooding can be reduced as they act as natural moderators.** Hyderabad has a unique system of 169 lakes which can not only avoid risk of flooding but also act as ground water recharge system. Thus, restoration of lakes should be considered as an important climate adaptation measure for Hyderabad.

GHMC has chosen 19 lakes to be the best fit for first round of restoration activity. Choice of lakes is primarily based on NLCP guideline. The criteria chosen were hydrological criteria, scientific criteria and administrative criteria.

a. Out of 169 lakes 30 lakes were studied on the criteria, given a score based on NLCP criteria.

b. The recharge and flood control potential of the lakes with greater than 10 hectare area is expected to be more than of lakes that are less than 10 hectare in area. Thus, lakes of size less than 10 hectare were removed from the study.

c. Parallel to this was the technical socio-economic challenges i.e. willingness of local population. In some cases, the local population was unwilling to let the team gather technical information related to lakes. Hence, these were eliminated from the first set of lakes chosen for the study.

Thus, finally 19 lakes were identified for rejuvenation. These lakes have a total water storage capacity of 22mcm, and a possibility of 1 to 2 cubic meter of ground water recharge. Detailed analysis and final choice of lakes is presented below and also provided in the pre-feasibility report.

Some of the lake rejuvenation measures to be applied will be Lake treatment by de-silting of the accumulated sediment, de-weeding accompanied with design and engineering measures like Improvement of inlet/outlet points - clearing the weed cover, Restoration of Weir / Sluice, preventing unauthorised entry of sewage by interception and diversion works so as to reduce the pollution load from entering the lake waters and setting up STP, if needed.

Upon successful completion of the rejuvenation activity, a second round of lake assessment will be undertaken to identify the lakes and the method of rejuvenation.

**Outcome 4:** Pilot project on water supply, recycling and rainwater harvesting
The outcome 4 is an effort to pilot and demonstrate some of the measures which are not prevalent in Hyderabad and need a testing ground. Rainwater harvesting and artificial ground water recharge present good ground water restoration measures. However, for an urban area like Hyderabad where several ground water resources are tagged as exploited and critical, it becomes necessary to identify suitable spots and pilot them to understand the behaviour and impact of these systems. After successful implementation mass implementation plan can be developed.

Wastewater recycling will also be pilot at one of the locations before implementing it at all the sites. This would enable to understand any technical constraints or socio-economic issue that may arise and addressing it before simultaneous implementation of the task begins at all the sites.

**Outcome 5: Capacity building and awareness raising**

Though capacity building and awareness raising is a key component of all the above 4 outcomes as well, the outcome 5 will drive overall process of capacity building, awareness raising and knowledge sharing in this project activity. It will though a need assessment identify the immediate and long term capacity building needs of various stakeholders like government departments, contractors etc on climate water nexus, following the good practices, gender sensitivity, project specific component implementation etc.

New tools of capacity building will be explored so that training and capacity building can be carried out continuously. For example use of electronic training material in the form or video or local language which can be shared with concerned departments for continuous training or development of e-courses for basic skills needed for project development

This component will also develop a robust mechanism to share the learning’s of the project and best practices with other ULBs within and outside the state.

Conducting initial (maximum 5) stakeholder capacity building exercises

- Awareness raising among public for responsible behaviour towards water for removing biases on recycled water use.

### B.2. Background information on project/programme sponsor

Describe project/programme sponsor’s operating experience in the host country or other developing countries.

Describe financial status and how the project/programme sponsor will support the project/programme in terms of equity, management, operations, production and marketing.

NABARD is the accrediting entity for the project activity. It has been working in the field of finance for several decades. It has been accrediting/implementing/agency for NAFCC and National Adaptation fund for some time. It is now also an accredited entity with GCF. All funds for the project will flow through NABARD.

EPTRI is the executing entity for this project activity.

- Environment Protection Training and Research Institute (EPTRI) was set up in 1992 as an independent registered society by the Government of Andhra Pradesh with assistance from the Government of India. The State also provided bilateral assistance for technical collaboration between EPTRI and the Swedish International Development Co-operation Agency (Sida). EPTRI is headed by an IAS officer.
- EPTRI has a centre for climate change. It has been notified by Government of Telangana as nodal agency for undertaking all activities related to climate change including development of projects for climate finance for the state of Telangana, undertaking formal approval of projects, coordinating among departments etc. EPTRI has assisted state government in development and securing of INR 25 crore under National adaptation fund on climate change (NAFCC). NAFCC is a fund under Ministry of Environment and Forest (MoEF), India dedicated towards climate change adaptation projects. EPTRI is the coordinating agency for this project as well. It has set up a PMU for this project. It is assisting in implementation of the project mainly through knowledge and capacity building.
- EPTRI is well to connected with various government departments and has the ability coordinated among them to deliver multi departmental outputs.
- EPTRI has experience of setting up PMU for other climate change project. It will in this project as well b responsible for setting up a PMU and implementation of the project.
It will also execute some of the technical aspects of the project through its climate change cell.

Execution of individual component will take place through each of the designated urban bodies namely GHMC, HMWSSB and ground water department and EPTRI. All these departments and institutes are well established and capable of handling the project components. These departments have well defined procedures and contractors to assist in project design and implementation.

<table>
<thead>
<tr>
<th>B.3. Market overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the market for the product(s) or services including the historical data and forecasts.</td>
</tr>
<tr>
<td>Provide the key competitors with market shares and customer base (if applicable).</td>
</tr>
<tr>
<td>Provide pricing structures, price controls, subsidies available and government involvement (if any).</td>
</tr>
</tbody>
</table>

In this project activity, recycled water is the only component for which a market needs to be established. All other activities are neither a product nor market based. As on date, only 3% of the wastewater is recycled. So, there is no market based data available for the project activity.

<table>
<thead>
<tr>
<th>B.4. Regulation, taxation and insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide details of government licenses, or permits required for implementing and operating the project/programme, the issuing authority, and the date of issue or expected date of issue.</td>
</tr>
</tbody>
</table>

The project will be implemented by government bodies and institutions which the government has created for handling different water and climate related aspects. None of these bodies require any government licence or permit for implementing or operating the project.

Describe applicable taxes and foreign exchange regulations.

Project should not attract any taxes. However, taxes will have to be paid for any component of the project like purchase of equipments etc as per the government norms.

Government of India has standards foreign exchange regulations which will be applied wherever applicable.

Provide details on insurance policies related to project/programme.

No insurance policy is planned for the project activity. The contractors may undertake insurance for their workers.

<table>
<thead>
<tr>
<th>B.5. Implementation arrangements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe construction and supervision methodology with key contractual agreements.</td>
</tr>
</tbody>
</table>

Describe operational arrangements with key contractual agreements following the completion of construction.

Provide a timetable showing major scheduled achievements and completion for each of the major components of the project/programme.

- EPTRI will be the executing entity for the project. Within EPTRI a project management unit (PMU) will be established to undertake day-to-day activities of the project.

- A project level steering committee will be formed and it will be chaired by Chief Secretary of Telangana state. Members of the project steering committee will include secretaries from relevant departments like MAUD, Environment, Forest, Science and Technology, ground water board, etc. It will certainly include EPTRI, members of NABARD and representatives of MoEFCC.

<table>
<thead>
<tr>
<th>Project implementing organizations</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project steering committee</td>
<td>Oversee implementation of the project and its consistency with national policies</td>
</tr>
</tbody>
</table>
Overseeing the progress and resolving issues hindering progress
Providing guidance

EPTRI
Delivery of out puts
Establish PMU
Ensure timely bidding and award of works
Supervise project management and design and supervision
Monitoring and evaluation of work as per the monitoring framework

PMU at EPTRI
Day to day operations

HMWSSB
- Data support
- Technical coordination
- Implementation of works on STP, water supply and sewerage mains

GHMC
- Data support
- Technical coordination
Implementation of works on Lake restoration

HMDA
- Data support
- Technical coordination
Implementation of works on STP, and other aspects as needed

Ground water department
- Data support
- Technical coordination
Implementation of works on ground water

- Before the submission of the first withdrawal application, EPTRI will submit to NABARD sufficient evidence of the authority of the person(s) who will sign the withdrawal applications
on behalf of the borrower, together with the authenticated specimen signatures of each authorized person. Withdrawal applications and supporting documents will demonstrate, among other things that the goods, and/or services are eligible for financing.

- All disbursements under government financing will be carried out in accordance with regulations of the government. EPTRI will maintain separate project accounts and records by funding source for all expenditures incurred on the project. Project accounts will follow international accounting principles and practices or the national equivalent, acceptable to NABARD.

- EPTRI will (i) prepare the annual financial statements for the project, in accordance with standard accounting principles; (ii) have such financial statements audited annually by independent auditors whose qualifications, experience, and terms of reference are in accordance with international standards for auditing or the national equivalent; and (iii) furnish to NABARD, not later than 6 months after the end of each related fiscal year, copies of the audited financial statements, audit report and management letter, all in the English language, and other information concerning these documents.

- Public disclosure of the project financial statements, including the audit report on the project financial statements, will be guided by Government of India’s norms.

- EPTRI through the PMU will maintain and present to steering committee (i) quarterly progress reports in a pre-designed project performance reporting format; (ii) consolidated annual reports including: (a) progress achieved by output as measured through the indicator’s performance targets, (b) key implementation issues and solutions; (c) updated procurement plan; and (d) updated implementation plan for next 12 months; and (iii) a project completion report within 6 months of physical completion of the key Project elements. To ensure projects continue to be both viable and sustainable, project accounts and the executing agency audited financial statements, together with the associated auditor's report, should be adequately reviewed.

- NABARD may along with Government of Telangana undertake 2 project reviews a year to (i) discuss progress of project implementation activities, compliance with covenants and project agreements, (ii) monitor progress in achieving project outputs; and (iii) agree on any required changes to the project implementation arrangements. A mid-term review will be undertaken within 3 years of project being effective or at any time that NABARD and MoEFCC may consider it necessary. The midterm review mission will carry out: (i) a review of institutional, administrative, organizational, technical, environmental, social, economic, and financial aspects of the project based on the assumptions and risks included in the design and monitoring framework and updated project performance reports; (ii) a review of covenants to assess whether they are still relevant or need to be changed, or waived due to changing circumstances; (iii) an assessment of need to restructure or reformulate the project and the effects of this on the immediate objectives (purpose) and long-term goals of the project; and (iv) an updating of the project’s design and monitoring framework where restructuring or reformulation is necessary or its immediate objectives will change.

- Prior to construction contracts procurement, the project will finance consulting services to design each construction package and provide support to EPTRI to supervise the construction works and do the construction contract management. During the construction contractual implementation, the consultancy firm recruited will provide the day to day construction works supervision, to ensure compliance with the quality and technical specification requirements, compliance with all relevant administrative regulation, monitor works progress to ensure construction implementation within the projected time frame, and record all works completed in compliance with the Bill of Quantities under the contract. Upon works completion, the supervision consultant will perform all the required technical tests necessary to declare the acceptance of the works and will establish all the monthly progress certificates to be approved by relevant departments (like HMWSSB) and EPTRI for issuance of Progress Claims by the contractor and related payment by EPTRI. The contractor will produce weekly reports on progress of its Construction Environment Management Plan (CEMP) implementation, and the supervision consultant will also produce monthly progress reports reflecting on contract implementation status, works progress, financial disbursement and implementation time monitoring. When necessary, the consultant will coordinate with EPTRI to prepare and issue all necessary Variation Order under the contract.
C. Financing / Cost Information

Please provide:

- A breakdown of cost estimates analysed according to major cost categories.
- The component wise breakup of the project cost is provided in table below (all figures are in INR crore unless mentioned otherwise)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Component Sub component</th>
<th>Total cost</th>
<th>GCF</th>
<th>State government</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Comprehensive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Development of database</td>
<td>7.17</td>
<td>7.17</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Setting up grided ground water mapping</td>
<td>4.83</td>
<td>4.83</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Climate resilient framework for the city</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Enabling waste water recycling system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Setting up of wastewater treatment plant</td>
<td>690</td>
<td>690</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Pumping station</td>
<td>97</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>I&amp;D</td>
<td>15.51</td>
<td>15.51</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Conveying mains</td>
<td>321.45</td>
<td>321.45</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>Land acquisition cost</td>
<td>18</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>Recycled water transportation &amp; distribution system</td>
<td>100.38</td>
<td>100.38</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lake rejuvenation for ground water recharge</td>
<td>310</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Pilot project</td>
<td>50</td>
<td>32.96</td>
<td>17.04</td>
</tr>
<tr>
<td>7</td>
<td>Capacity building and awareness raising</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Project management</td>
<td>16.35</td>
<td>16.35</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Contingency</td>
<td>16.35</td>
<td>16.35</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub total</th>
<th>1635.34</th>
<th>1599.3</th>
<th>36.04</th>
</tr>
</thead>
</table>

- a financial model that includes projection covering the period from financial closing through final maturity of the proposed GCF financing with detailed assumptions and rationale;

Financial model is attached.

Assumptions and cash inflow and outflow calculations

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total project cost</td>
<td>1668 INR crore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Recurring expenditure

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0.3585</td>
<td>INR crore</td>
<td>From 6th year of implementation</td>
</tr>
<tr>
<td>b</td>
<td>1.2</td>
<td>INR crore</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>12.24</td>
<td>INR crore</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>3.1</td>
<td>INR crore</td>
<td>From 6th year of implementation</td>
</tr>
<tr>
<td>e</td>
<td>0.00</td>
<td>INR crore</td>
<td>From 1st year of implementation</td>
</tr>
<tr>
<td>f</td>
<td>0.3</td>
<td>INR crore</td>
<td>From 1st year of implementation</td>
</tr>
<tr>
<td>g</td>
<td>12.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>18.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Direct saving / income/inflow

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>269.37</td>
<td>INR crore /annum</td>
<td>From 1st year of implementation</td>
</tr>
<tr>
<td>b</td>
<td>18.78</td>
<td>INR crore /annum</td>
<td></td>
</tr>
</tbody>
</table>

Cash inflow for the project activity s only due to saving in fresh water production due to recycling of waste water. Cost of water production is INR45/KL.
Cost of water production (source HMWSSB) | INR/KL
--- | ---
Wastewater to be recycled | 164.0 MLD
Financial saving by WW recycling | 0.738 INR crore/day
Annual saving by water recycling | 269.37 INR crore

- A description of how the choice of financial instrument(s) will overcome barriers and achieve project objectives, and leverage public and/or private finance.

The project is proposed for implementation under Grant mode.

**Outcome 3: Recycling of wastewater**

- Wastewater treatment capacity of Hyderabad has reached about 55% (i.e. 710MLD) of the total wastewater generated. However, wastewater recycling is only 3%. Currently, the recycled wastewater is used primarily by only one bulk consumer (i.e. Rajiv Gandhi International Airport). This leads to fresh water being used for nearly all the activities in the city of Hyderabad. Considering, that Hyderabad is located in semi-arid region and in one of the 9 most water stressed states in India there is severe pressure on fresh water resources available to Hyderabad. 70 to 80% of the city water is being sourced from rivers like Krishna and Godavari which is located about 100 km away from the city. The city faces a current water deficit of about 300 MLD. The Outcome 3 of the project activity intends to increase the wastewater usage to 28% from the 580 MLD of wastewater planned to be treated under the project. Thus, if the project is implemented it will contribute about 164 MLD of water to the water supply of the city. Under Godavari Phase II an additional 172MGD of water supply system is proposed for the city. If 28% water recycling is achieved, it will contribute about 15-20% of the 172MGD proposed to be lifted from Godavari. In addition, due to changing climatic conditions, this recycled water will be helpful in reducing the water gap faced by city during drought and irregular rainfall season. Hence, with the project fresh water will be available for more critical human uses like drinking specially during times of climatic-water stress.

- As a part of the project nearly 100% of the water entering river Musi will be treated waste water. Downstream of Musi 40,600 hectares of land is cultivated with this water. Thus, in a water stressed situation, induced due to climatic and non-climatic reasons, several social benefits will be accrued by the cultivators and community as a whole.

- Without GCF funding the project activity will not be implemented because
  - i) No special funds are available with Central Government or the state government of Telangana for implementation of sewerage treatment system and wastewater recycling system. The earlier Wastewater treatment system (i.e. NRCD Phase I of 690 MLD) was implemented through the NRCD funds provided by central government. However, these funds have now been diverted towards Ganga action plan, which intends to focus on the problems in the catchment area of river Ganga. As the project location does not fall in the catchment of river Ganga, funding is not available for the same.
  - ii) IRR of the wastewater recycling system alone is only 16% considering that the project is financed under grant mode. This IRR will drop significantly if the project is to be implemented through loans making it unacceptable to commercial lending institutions. If the project is financed under loan mode the IRR will fall substantially. Moreover, success stories or precedence of implementing dedicated wastewater recycling system is not available in India. Usually, wastewater recycling is an activity taking place in few cities in India, in small quantum and in an unorganized fashion. The trend of setting up STPs with a focused structure to recycle large quantum of wastewater is not a business as usual practice in India. Thus, approaching commercial lending institutions is not a feasible option for financing outcome 3.
  - iii) It also faces the hurdles of user acceptance. The project intends to overcome them by providing recycled water primarily for industrial, commercial and institutional users. The project would contribute to end
user awareness raising and capacity building of all stakeholders would be key part of the capacity building outcome (i.e. Outcome 5) of the project.

○ The sensitivity analysis of this component of the project indicates that if all the factors progress positively the project can lead to IRR as high as 26%. Upon user acceptance there also lies a provision for HMWSSB to sell the wastewater to industries at cost lower than the cost of procuring fresh water. This can further increase the IRR of the project and make it profitable/commercially viable project. Thus, a significant barrier to investment will be overcome through this project.

- If GCF funding is not available, then recycling of wastewater will not take place. About 45% of the city wastewater will continue to flow untreated either into river Musi or to the nearby lakes. Due to polluted water lake rejuvenation will not be successful. This will prevent cities climate resilience development from increased peak rainfall and flood. Untreated wastewater will continue to impact the health and create negative social impact for entire city, as vegetables will continue to grow in untreated/mixed water as scarcity of water increases. It will hamper the plans of rejuvenation of lakes, which assist in flood control and ground water recharge (i.e. about 1.2 to 1.4 mm/day of the area of lake that is covered with water for the year), which is essential in adapting to climate change.

Outcome 3: Rejuvenation of Lakes for ground water recharge

- The lake system in Hyderabad assists in rejuvenating the ground water recharge, which has a positive impact on the hydrology of the city. Out of 169 lakes in Hyderabad, 19 lakes have been chosen for ground water recharge. The water storage capacity of these lakes is about 22 MCM. If the lakes are rejuvenated, there is potential for ground water recharge of 1 to 2 cubic meter per annum. It will assist in increasing the ground water level. Lakes act as natural flood damage mechanism also. Such surface water bodies assist in adapting to climate change. Hyderabad is increasing events of peeking of rainfall and drought both. In both cases, lakes become an important natural drainage and recharge mechanism. The lake rejuvenation is funded through central government scheme i.e. National Lake Conservation Program (NLCP). However, this program does not have funds for the activity. Since, it does not generate any revenue commercial lenders do not lend money for the same. Thus, in the absence of GCF funding Outcome 3 will not be implemented.

Other outcomes

Other outcome of the project activity does not have any precedence of being implemented in Hyderabad or in major cities in India. They do not create direct financial return proposed under pilot/demonstration study. However, implementation of each of these components will lead to climate resilient planning, efficient and more climate friendly infrastructure on water. In the absence of GCF fund these activities will not be implemented. This will lead to non climate resilient water and wastewater management/development in Hyderabad. This would lead to increased flood events and drought situation.

However, if all the project components are implemented successfully, it will be possible to exactly quantify the water and energy savings, if any and financial impacts of these activities individually and overall. The immediate positive and tangible impacts of climate resilient infrastructure would become evident to all stakeholders. It may attract commercial financial institutions to fund some of these project components during replication. Implementation of the project will positively impact entire population of Hyderabad (about 8 million people).

Economic Analysis

Economic analysis has been carried out for the project activity. It has been carried out for a time frame of 15 years. All values in the analysis are in Indian currency i.e. Indian Rupee. In the absence of the project activity, i) Lake rejuvenation would not be possible, thus the natural flood control system would be non-functional during climate induced...
peaking rainfall events ii) Due to non rejuvenation of lakes natural ground water recharge mechanism also becomes non-functional iii) untreated wastewater would continue to be let out in surface water bodies i.e. river Musi and lakes apart from open spaces thus, degrading the surface water bodies, causing ground water contamination, causing soil pollution and impacting the health of public directly or indirectly.

At 75 percent more than the national average and 60 percent more than the urban average, the poorest 20 percent of households living in urban areas bear the highest per capita economic impacts of inadequate sanitation (which includes improper sewerage system).

Central pollution control board has done analysis of concentration of nutrients in tonnes/day for the states in India. Based on this the value of nutrient in sewage assuming at the rate of Rs. 4220/- per tonne of nutrient (1996) works out to be 4.39 million/day. The total annual economic value of sewage generated from class I cities (2000) assuming there is no loss of nutrients after treatment, works out to be Rs. 1595.05 million.

Previous research shows that investments in sanitation yield large benefits, which in low-income countries are at least five times higher than the amounts invested (Hutton, Haller, and Bartram, 2007). In India, additional sanitation and hygiene (hand washing with soap) interventions in 2006 would have prevented 346,000 deaths and 338 million cases of diseases and saved at least 1.7 billion days of time lost in 2006. It is also estimated that up to `1.48 trillion ($32.6 billion) of annual economic gains could result from a combination of sanitation and hygiene interventions; these interventions would need to include access to improved toilet facilities, hygiene education, and behaviour change (including hand washing with soap), improved domestic water quality, improved water supply, improved food handling, and safe confinement and disposal of fecal matter (wastewater/sludge collection, treatment, and disposal). The benefits would result from improvements in health, domestic water supply and quality, access time, and tourism.

It is estimated that at least 45% of the city population would be impacted positively due to the project activity. The social benefit due to the project activity is projected to be about INR 640 million or about 1 million USD per annum.

Financial and Economic Analysis of the project presents following returns:

<table>
<thead>
<tr>
<th>Description</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR</td>
<td>Positive</td>
</tr>
<tr>
<td>Overall project</td>
<td>10.27%</td>
</tr>
<tr>
<td>Water recycling</td>
<td>16%</td>
</tr>
<tr>
<td>Economic IRR overall project</td>
<td>14.30%</td>
</tr>
</tbody>
</table>

C.2. Project financing information

<table>
<thead>
<tr>
<th>Financial Instrument</th>
<th>Amount</th>
<th>Currency</th>
<th>Tenor</th>
<th>Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total project financing (a) = (b) + (c)</td>
<td>..........245........</td>
<td>million</td>
<td>USD ($)</td>
<td></td>
</tr>
</tbody>
</table>
(b) Requested GCF amount

<table>
<thead>
<tr>
<th>(i) Senior Loans</th>
<th>Options</th>
<th>( ) years</th>
<th>( ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii) Subordinated Loans</td>
<td>Options</td>
<td>(5) years</td>
<td>(10.27) %</td>
</tr>
<tr>
<td>(iii) Equity</td>
<td>Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iv) Guarantees</td>
<td>Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(v) Reimbursable grants *</td>
<td>Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(vi) Grants *</td>
<td>Options</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

240

* Please provide detailed economic and financial justification in the case of grants.
Detailed economic and financial justification for the project is provided above in C1.

Total Requested (i+ii+iii+iv+v+vi) | Million USD |
|-----------------------------------|-------------|

(c) Co-financing

<table>
<thead>
<tr>
<th>Financial Instrument</th>
<th>Amount</th>
<th>Currency</th>
<th>Name of Institution</th>
<th>Seniority</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Government financing</td>
<td>5</td>
<td>Million USD</td>
<td>Options</td>
<td>Options</td>
</tr>
</tbody>
</table>

Lead financing institution: ……………………GCF…

(d) Covenants

(e) Conditions precedent to disbursement

D. Expected Performance against Investment Criteria

Please explain the potential of the Project/Programme to achieve the Fund’s six investment criteria as listed below.

D.1. Climate impact potential [Potential to achieve the GCF’s objectives and results]

Specify the climate mitigation and/or adaptation impact. Provide specific values for the below indicators and any other relevant indicators and values, including those from the Fund’s Performance Measurement Frameworks.

- Total tonnes of CO₂ eq to be avoided or reduced per annum
- Expected total number of direct and indirect beneficiaries and number of beneficiaries relative to total population (e.g. total lives to be saved from disruption due to climate-related disasters)

Direct beneficiaries: The slum population in Hyderabad is most vulnerable to reduced water supply due to climate change. The GCF project will recycle 28% of the treated wastewater (i.e. about 164MLD) and provide an equivalent amount of saved fresh water to the slum population of the city. This will result in additional water
availability of 70lpcd for the slum population. Thus, about 30% of Hyderabad’s population i.e. 2.2 million people will be the direct beneficiaries of the project activity. Currently, at full capacity non-slum areas receive 150lpcd of water supply where as the water supply to slum areas are often irregular and intermittent.

**Indirect beneficiaries:** All 5 components of the project are designed to provide long term climatic resilience towards water to the entire city of Hyderabad. It provides investment in hard and soft infrastructure based solutions along with development of long term climate resilient pathway for the city of Hyderabad. Thus, indirectly entire population of Hyderabad i.e. 7.6 million people will be the beneficiaries of this project.

Avoidance of investment in lock-in long-lived, climate-vulnerable infrastructure:

Project will contribute towards climate resilient sustainable development. 28% of the wastewater recycled under this project will contribute towards nearly 10% of the cities fresh water requirement. This will support the large water supply infrastructures being built to draw water from River Godavari. The project will augment about 15 -20% of this 172 MGD pipeline based water supply system.

The lake rejuvenation will not only restore about 22mcm of water storage capacity, it will also increase the ability of the city to manage increasing flooding due to rainfall peaking incidents without constructing intensive storm water drainage systems to carry water for long distances. The rejuvenation of 19 lakes will serve as demonstration before rejuvenation of all lakes and tanks in the city. Thus, the city will address two important climatic impacts i.e. water scarcity and flooding through investing in climate-resilient system instead of locking in alternative long-lived, climate-vulnerable infrastructure.

The project outcome will strengthen the adaptive capacity and reduce exposure to climate risks through strengthening of institutions, human resources, awareness and knowledge for climate resilient urban water planning. This will be accomplished through comprehensive database on water and climate for public policy planning and implementation. The climate resilient framework and blue print will also add to institutional capacity to make informed decision on water supply demand and sewerage management.

**D.2. Paradigm shift potential**

Potential for scaling-up and replication (e.g. multiples of initial impact size)

The project has three main interventions a. water saving, b. flood control measure implementation, c. strengthening institutional mechanism and providing long term measures to adapt to climate change. These interventions are achieved through an array of activities which are interlinked to each other. The project intends to bring about long term changes in approach to water management in climate constrained world by means of implementing demonstrable short term interventions.

Successful and measureable demonstration of climate factors in planning, investment and implementation of water management infrastructure has a potential to drive a change not only for Hyderabad but also within other water boards, government and relevant sector agencies to use this as a basis for future strategic planning and decision-making in water and wastewater sector investments in other cities. Hyderabad has a topography which allows it a brilliant method to propose a climate model of adaptation. From a topographical point of view Hyderabad has a water shed that drains into the Musi river and this feature of its topography allows one to be able to design and place wastewater treatment plants in such a manner that the waste water can be effectively, comprehensively collected treated and recycled for industrial parks, urban forestry. Hyderabad is fortunately and ideally dotted with 169 lakes covering all its basins which are interconnected and drain into the Musi. These lakes have the function of recharging the ground water and act as an effective mechanism of flood control. Many other cities in the country also have lake systems and rivers nearby. They may not share the same topography but the model of using the hydrology of the city appropriately to address impacts of climate change is one of the
key messages of the project which other cities can also adopt.

Outcome 1 of the project activity will employ GIS based mapping system for all 169 lakes, which will provide real time status of key lake performance parameters. **This outcome is linked with outcome 3 where 19 lakes would be rejuvenated.** The progress of 19 lakes in performing the desired outcome will be monitored through this outcome and support implementation of similar measures in other lakes. Monitoring of water bodies through GIS based system can be replicated in other locations within or outside Telangana. As Telangana has a large base of Tanks, the stat government may replicate the model.

**Outcome 3 i.e. water saving through recycling of wastewater** has tremendous potential in India. It is supported by various programs and policies in the country; however, it often faces the barriers of limited experience in implementation of such program at large scale and thus, knowledge on user acceptance. Large industries are aware and are adapting to wastewater recycling, however, purchase of wastewater to meet the non-process and non-drinking needs has not been conducted at a large scale. The project initially identifies its users to be industrial parks which are in the periphery of Hyderabad, institutions and public organizations. The financial success and user acceptance will undoubtedly trigger large scale replication of wastewater recycling not just within Hyderabad but within India. **Outcome 4 will serve as a testing phase for the water recycling.**

- **Potential for knowledge and learning**

Knowledge development and training are an important component of the project. **Capacity need assessment** for different groups of stakeholders will be taken up under **outcome 5 of the project.** Based on this project will develop different modules for raising awareness, increasing the knowledge of workforce involved or to be involved in various activities and training identified groups to perform the task of implementing the climate change measures The project proposes to not just impart lecture or class room training but to also develop web based or technology based tools on different aspects of the project which can be placed at the data management centre to be created as result of **outcome 1** and shared with respective departments for sharing the knowledge with other stakeholders as and when needed. Some of these tools may be converted into online courses which can be operated through the data management centre or nodal climate change agency or institutes.

The other set of knowledge will develop from the implementation of the project. The comprehensive data centre will undertake the documentation of these lessons along with the ULB’s and other partners and make it available through its publications, or the knowledge sources of MoEFCC. Other ways of channelizing these lessons for use will also be explored during the project development.

The climate resilient framework development i.e. outcome 2 will also result in formation of a tool for Indian conditions which other cities can adopt with necessary modifications. It is proposed that this tool will be shared with MoEFCC and other government institutions so that it can be utilized by other cities.

- **Contribution to the creation of an enabling environment**

**Outcome 1: Database creation** – Its expenses are expected to be internalized through government budgets on knowledge management. However, if need be the project may offer paid services for use of data for commercial purposes. Detailed sustainability model will be presented during the project report preparation

**Outcome 2, development of climate resilient framework** will also work towards identification of measures that can support the outcomes which do not have self sustaining financial model.

**Outcome 3a: Water saving through recycling would generate enough return to be**
Outcome 3b: Flood control and ground water recharge through lake rejuvenation will be able to meet the basic expenses through the PPP model. Whereas GHMC has a lake department which oversees and manages the lakes. It will be able to internalize any remaining expenses. Other outcomes will not require any expenses after the end of GCF project as they would be completed in that duration.

- Contribution to the regulatory framework and policies

The projects components will contribute to the regulatory framework and policies as follows:

- The National Disaster Management Authority has in its guidelines (urban flood management, 2010) suggested that the magnitude of inundation levels due to various scenarios and causes will be simulated on GIS-based inundation model, duly incorporating drainage capacities in the analysis in order to estimate depth, duration and extent of inundation by using an integrated city specific framework. The project in outcome 1 and outcome 2 proposes a GIS based mapping of all lakes, software packages and data analytics system for water and climatic data monitoring, and development of dynamic model for continuous study of climato hydrological parameters of the city.

- Outcome 2, climate resilient framework for the city will result in Development of vulnerability scenarios for 2020 and 2050, adaptation plan and creating policy framework and implementation plan for the city taking into account the city growth path. These outcomes will be discussed and developed in coordination with the local ULBs, and other government departments to understand their fitment within the existing planning and operational framework of these departments. The same would be presented to seek approval of steering committee to enable the adoption of climate resilient framework in to different departments.

- Mainstreaming through SAPCC: SAPCC undergoes revision after five years. The SAPCC of Telangana was prepared after formation of the state and was approved by MoEFCC in 2016. It has a monitoring framework in which performance of the identified interventions will get captured. Since, climate resilient urban water management is one of interventions with several sub performance criteria, it’s learning’s will be reported and captured in the implementation of SAPCC. Thus, through SAPCC the learning’s and outcome of the GCF project will be mainstreamed into the state framework and policies.

D.3. Sustainable development potential

Provide the estimates of economic, social and environmental co-benefits.

Economic co-benefit: World Bank report “The Economic Impacts of Inadequate Sanitation in India” estimates that comprehensive interventions (use of toilets, hygiene promotion, improved access to safe water, and proper waste management) can save India US$32.6 billion (Rs.1.48 trillion) or US$29 (Rs.1321) per capita. The project aims to improve access to safe water to the 2.2 million slum population of Hyderabad, provide waste management and increase access to safe water for irrigation and livestock use in vicinity by discharge of treated waste water in the river Musi. Based on these facts, the project contributes an estimate a socio economic benefit of INR 630 million per year. This will be complemented by economic benefit that the urban local bodies like HMWSSB and GHMC will be able to achieve due to availability of more water due to recycling of wastewater, expected decrease in flood or water logging issues and infrastructure damage. These additional benefits will be quantified during the detailed project report development.

Component 1 and 2: Component 1 and 2 of the project would contribute significantly to the gender sensitive component of co-benefit as the early warning system strengthening proposed will provide women with more easy access to information during possible rainfall/flooding scenarios. The outcome of component 2 i.e. climate resilient framework for the city will promote use of alternate region specific green
technologies which is likely to provide impetus to green innovations resulting in economic co-benefits.

Component 3a: Infrastructure implementation for water recycling:
Hyderabad and its vicinity experiences semi arid climate and is water constrained. Downstream of river Musi, which flow through Hyderabad, agriculture, horticulture and livestock activities depend significantly on the water that flows in this river. A study projects that 16,000 hectares of land in an around Hyderabad is irrigated with untreated wastewater mainly flowing through the river Musi\(^\text{16}\). Currently, only 55% of the wastewater is given secondary treatment before it joins river Musi whereas the remaining wastewater finds its way into the river without treatment. Most of the households with livestock in the urban and peri-urban areas of Hyderabad, India, use wastewater irrigated para grass as fodder and generate an income through the sale of the milk. The case of Musi River, studied by UNEP, revealed the transfer of metal ions from wastewater to cow's milk through grass fodder irrigated with wastewater. Milk samples were contaminated with different metal ions ranging 12-40 times above permissible levels\(^\text{17}\). Study reveals that mainly women are involved in both the cultivation and sale of leafy green vegetables in the surrounding wastewater-irrigated fields of Hyderabad. While they make income out of this work, they tend to suffer from several health impacts too. Thus, the other significant benefit will be the amelioration of the health damages estimated to be INR 2000 crore per annum due to use of poor quality water for agriculture and livestock.

By providing appropriate treatment to the remaining wastewater of the city before discharging it into the river would have positive environmental and health benefits to the field workers especially women and the public consuming these items. Since, most of the items grown in and around Hyderabad finds its way to Hyderabad, this component will have a sustainable benefit for 7.6 million people of Hyderabad.

Component 3b: Infrastructure implementation for flood control and water storage through lake rejuvenation
Lakes in Hyderabad carry various social importances like recreation centre, fishing spot and/or religious place. Rejuvenation of lakes will provide local population with opportunity to use the lake for these purposes. GHMC has also proposed to developed green recreational area around the lake adding some green space for physical activity for local people. Upon rejuvenation, the green space will be provided with, trees of local varieties and other infrastructure which will be managed under private public partnership mode. Developing good ecosystem for fishes is also proposed. Thus, the lake rejuvenation will bring about several socio-economic and environmental benefits

Job creation: Project will create several new jobs at different stages of the activity. For outcome 3, many temporary jobs will be created during the execution phase. Whereas, all the outcomes will result in some long term job opportunities during and after implementation of the outcomes. The exact details on the number of job opportunities will be available at detailed project report stage. The project aims to provide better and more effective delivery of services by improving water and sanitation infrastructure, and by strengthening project management capacity in planning, executing implementing the project and incorporating gender mainstreaming in every aspect of the project design, during implementation, monitoring and evaluation. Gender representation will be a focus in all activities of the project.

Component 5: Ensuring higher-level representatives of government are aware of (or involved in) climate change impacts and the relationship of their actions with overall sustainable development which will facilitate the transfer of lessons to wider planning policy as a mainstreaming co-benefit.

\(^{16}\) http://www.ruaf.org/sites/default/files/WW%20Use%20for%20UA.pdf

\(^{17}\) Economic Valuation of wastewater the cost of action and the cost of no action, United Nations Environment Programme, page 48
Vulnerability and Exposure to climate change

The Intergovernmental Panel on Climate Change (IPCC) estimates that the Indian subcontinent will experience more intense rains over fewer days, triggering an increase in monsoon floods while at the same time the country is projected to suffer an overall decrease in rainfall. Projections also suggest that India will experience significant water stress by 2025. Such circumstances create the potential for a cascading chain of impacts on vital resources such as water supply, for which public officials must prepare, especially in light of projected increases in water demand.

The National Disaster Management Authority (NDMA) issued guidelines on urban flood management in the year 2010. In the guideline it mentions that there has been an increase in the average annual rainfall of Hyderabad from 806 mm in 1988 to 840 mm in 2002. Between the year 2000 and 2008, Hyderabad has been one of the cities with significant urban flooding. In August 2000, Hyderabad received 240 mm of rainfall in a 24 hr period which resulted in very severe flooding. These floods caused severe loss of life and infrastructure. The annual losses from urban flooding are now much greater than the annual economic losses due to other disasters in the country. Guidelines also suggest that corrective actions must account for the possible increases in rainfall intensities in the years to come, due to climate change. The impact of floods control through lakes and supporting infrastructure the damage per incident of rainfall can be significantly reduced (up to INR 100 crore per event of high rainfall with projection of minimum of 5 to 6 events in a year).

According to study conducted by Rockefeller foundation suggests that amongst the non-coastal cities in India, Hyderabad is one of the most exposed cities to climatic vulnerability.

Simultaneously, the city has been facing increasing heats and drought situations with continuously depleting ground water and other water resources within the city. This is forcing the city to draw water from more than 100 kms distances. The gap in water demand and supply reached a critical level in the recent years (2015 and 2016) when the Himayatsagar, Osman sagar and Manjira reservoirs and other sources of water supply reached critical levels in summer, threatening the water availability for the city. This situation was a result of drought situations in the city in past two years. During the crisis situation, the vulnerable population of the city living in slums, whose water supply is intermittent and poor saw a further diminished water supply.

The SAPCC of Telangana and similar other studies suggest that such scenarios will only continue to rise in Hyderabad at a fast pace.

Financial and Economic Needs of Recipient

The design of this GCF project is different from many climate change related projects being undertaken at ULB level in the country. It does not intend to look at urban climate induced water problem from the microscopic view point of implementing only a niche solution for a specific part of the city. The project while addressing Hyderabad’s resilience to climate change related stress holistically, and intends to stand as an example and provide confidence to other ULB’s and cities to act comprehensively on the subject of water and climate change. While some finance is available for smaller climate change projects, there is no finance option available for this project.

The activities proposed under the project activity are not streamlined into the budgetary provisions of the urban local bodies (ULB’s) of Hyderabad. Telangana is a newly formed state in India and the state government needs to address various socio-

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18 Management of Urban Flooding, National Disaster Management Guidelines 2010, issued by National Disaster Management Authority, page 114
economical developmental issues across the state towards which its budget has already been committed. In this situation, the state government does not have enough funds to implement a climate resilient water project for Hyderabad alone.

As compared to other cities in the country, Hyderabad has a basic wastewater management infrastructure which covers about 50% of the city. Other infrastructure and institutional mechanism of the city demonstrates certain minimum adaptive capacity to be able to implement such a project and reach a demonstrable adaptive capacity.

However, as explained earlier and later in the PCN, the sources of government finance under the schemes of central government are either not available due to paucity of funds or no funds for some components of the project. The private sector contribution or finance in the project is difficult at this stage due to proposal for implementation of non-routine activities for which the performance benchmarks, and past results are unknown.

Thus, the project due to its unique nature is in need of GCF funds to provide vulnerable population of the city support from climate induced water problems and demonstrate to other cities in the country the opportunity loss/economic loss by not acting on similar climate friendly water management practices.

Provide details of the below and specify other relevant factors.

Coherence and alignment with the country’s national climate strategy and priorities in mitigation or adaptation

The project is aligned to many national and state level priorities and supports their implementation as follows:

- **India’s INDC** - India has submitted its INDC in response to the Paris COP21. India’s preliminary estimates indicate that India would need around USD 206 billion (at 2014-15 prices) between 2015 and 2030 for implementing adaptation actions in agriculture, forestry, fisheries infrastructure, water resources and ecosystems. India has in its INDC identified water resources as a sector which is vulnerable to climate change and requiring enhanced investment in development programmes. To enable this India’s INDC suggests that priority areas need a. Development of climate resilient infrastructure and b. Planning and implementation of actions to enhance climate resilience and reduce vulnerability to climate change. The project proposes to implement a climate resilient infrastructure in short term and proposes climate vulnerability assessment and planning in outcome 2 as long term measure to address climate vulnerability of water sector in Hyderabad.

- **National Action Plan on Climate Change (NAPCC)** – In 2008, India announced its NAPCC with eight missions to address climate change. One of the missions is National Mission on Water. Under National Water Mission (NWM)

  - a. Comprehensive water data base in public domain and assessment of the impact of climate change on water resources,
  - b. Promotion of citizen and state actions for water conservation, augmentation and preservation,
  - c. Focused attention to vulnerable areas including over-exploited areas,
  - d. Increasing water use efficiency by 20%
  - e. Promotion of basin level integrated water resources management.

  The outcome 1 and 2 of the project are aligned with the objective a. Comprehensive water data base in public domain and assessment of the impact of climate change on water resources of the NWM and objective b. promotion of citizens and state action. While other activities align with remaining objectives.

- **State Action Plan on Climate Change (SAPCC)** formulated for Telangana under NAPCC has identified urban development as one of the

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19 India’s INDC submitted to UNFCCC
20 National Water Mission volume 1
21 State action plan on climate change Telangana 2015-16
nine sectors needing attention. Activities to reduce water stress, protection and restoration of urban water bodies, study on climate vulnerability and revamping of urban water and wastewater system to address climate vulnerability are proposed under SAPCC to reduce the vulnerability of urban sector. Hyderabad being the capital city, primary economic city having largest slum population with high vulnerability needs prioritization in urban water stress. The GCF project appropriately contributes to the states expectation on climate proofing.

- **The National Water policy (NWP), 2012** also expresses similar concerns due to climate change and proposes measures in accordance with the NWM. The project contributes to *NWP’s objectives of enhancing water available for use, demand management and water use efficiency and conservation of water bodies and infrastructure.*
- Similarly the project also contributes to the objectives of Ministry of urban development (MoUD), National Urban Flood Management guidelines provided by NDMA, National River Conservation Program, and National Lake Conservation Program (NLCP).
- Hyderabad is one of the 100 cities selected to be developed as smart cities in India. Better management of climate stress on water will contribute to the objectives of smart cities as well. However, the budget allocated for smart city is only INR 1000 million which is not enough to make a significant contribution toward the project immediately.
- Under NWM, climate resilient state water policy development has been initiated in the year 2016 which is being implemented by EPTRI for the state of Telangana. The elements of the project may assist in the policy formation and vice-versa.

It is envisaged that the execution of the project will bring landmark changes in planning and implementation of water management in the country. These will become landmark implementations which can be replicated for other areas of Hyderabad and other arid regions and riverine cities and cities with lakes like Bhopal, Jaipur etc.

**Brief description of executing entities (e.g. local developers, partners and service providers) along with the roles they will play**

NABARD is the accredited entity for this project activity. It has been working across the country and with state of Telangana in carrying out several agriculture, irrigation and water related projects. It has the dense network to support the project.

EPTRI is proposed as the executing entity for the project activity. EPTRI is the nodal agency in the state of Telangana on all climate change and climate finance related project activities. It has developed the state level action plan on climate change under NAPCC. It is leading the climate finance project on adaptation funded by MoEF, Government of India. EPTRI is well connected with all the government departments and institutes. It has conducted over 4000 trainings, workshop and capacity building activities for various types of participants. These funding have been funded through the government of India as well as by international organizations. EPTRI will be able to take the role of central agency for coordinating with the local departments.

The local entities like HMWSSB, Ground water department, and GHMC will be the key local developers in these project activities. HMWSSB is the nodal agency in Hyderabad for water supply, wastewater collection, treatment and disposal. It is already recycling 3% of the wastewater and operating wastewater treatment facilities with a total capacity of over 690MLD. GHMC is responsible for various infrastructure and management of lakes in the city. It has a dedicated lakes committee and department to undertake management of lakes through which the lake rejuvenation activities will be implemented.

The flow chart and table describing the role of each of the entities is presented in
sections above.

Stakeholder engagement process and feedback received from civil society organizations and other relevant stakeholders

The project has been formulated in consultation with the ULB’s as explained in detail in section G. Several rounds of discussion with current working group and state steering committee level stakeholder consultation have lead to the defining of this project. The project is accepted by the state government, following which it received approval from MoEFCC ad NABARD before being submitted to GCF. Thus, the project has acceptance at all levels of the government.

The public stakeholder consultation for parts of the project activity have been carried out informally by the ULB’s at the stage of identifying lakes for rejuvenation, treatment locations etc. Civil or public level stakeholder consultation would be carried out at the project proposal development stage. The current stakeholder consultation process takes into consideration the all the key departments and institutions that -would be involved in implementation of the project. Details of stakeholder consultation process are provided in section G.

Financial viability

Except for outcome 3 all the other outcomes of the project do not have any revenue generation or financial return as per the project. Thus, the financial viability of these components is not of relevance. Outcome 3 i.e. lake rejuvenation does not create any direct revenue generation but it is proposed to make the lakes self-sustaining, by providing facilities and recreational activities at affordable prices depending upon the location and type of user of the lake facilities.

The only outcome of the project which will receive financial return is water saving by wastewater recycling. The acceptance of wastewater recycling by users at large will be under a testing phase in the initial duration of the project. Hence, it is assumed that that wastewater will be recycled at a nominal cost. The financial return i.e. IRR of this component of the project is expected to be 16%. However, an overall project IRR has also been worked out to be 10.27%.

Though the project does not produce direct financial benefit it will result in large socio-economic benefit which is expected to be INR 640 million per annum and EIRR of the project will be 14.3%.

After project completion i.e. after first five years, Government will internalize the operational expenses on the project components to be carried forward after the exit of GCF.

Application of best practices and degree of Innovation

The proposed GCF project incorporates lessons and best practices from several other projects in the direction of flood control, disaster management, water supply etc. to bring about transformative impact in the management of water that will be sustainable in the long term despite climate change. These include a) the use of geographically or locally appropriate system for flood control, piloting of artificial water recharge and similar activities based on the ground water status in the local areas; b) introduction of strategy to comprehensively remove barrier for water management; c) an innovative approach for “capacity development” by not just carrying out basic climate change awareness but undertaking a need assessment for field staff to all involved in these activities and developing training and capacity building material necessary for them to carry out climate resilient activities. It is also proposed that through the data management system such capacity building material will be made available in interactive format for future training and capacity building. For example: The operators of recycling unit or lake maintenance team will need sensitization on the objective of the project, its importance and operational guidance and knowhow. This would be provided not just through one time class room session but also in the form of interactive and media based format which can be run periodically to ensure that new field level staff does is not left out. Vernacular language will be used wherever
Continuous capacity building is a key part of the program and is embedded into each outcome of the project.

Project also lays emphasis on combining hard and soft infrastructure solutions without undermining the importance of other. During the project implementation the effectiveness of the combination and the degree to which the combination should work will be exhibited.

The project intends to attract finance through other schemes, social contributions and through other financial sources by demonstration of financial effectiveness of the water recycling component and large socio-economic benefit of other outcomes of the project.

Thus, the project targets comprehensive barrier removal, long-term capacity building, and leveraging available local resources for promoting longer-term adaptation through mainstreaming.

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E. Brief Rationale for GCF Involvement and Exit Strategy

Please specify why the GCF contribution is critical for the project/programme.

1. Addresses the water issue of most vulnerable section of the city

Hyderabad’s slum population has been rising over decades. In 2001, city’s slum population was about 17%\(^{23}\). In 2011, 32% of city’s population (i.e. about 2.2 million)\(^{24}\) lived in slums. Studies also suggest that Hyderabad is the second highest in the number of people living per household in large cities in India. Currently, the slum population of Hyderabad is more vulnerable to fluctuations in water availability being experienced by the city due to changing climatic patterns. The steep rise in this population is only adding to the problem. This project attempts to recycle 28% of the wastewater (i.e. 164 MLD) for industrial and other non-potable uses. Equivalent amount of fresh water is saved in the process and will be diverted towards the slums. This implies that an additional amount of about 70lpcd of water will be available for slums who will be the direct beneficiaries of the project. The government is also working towards providing a tap in the slum households.

2. Addressing flash floods and water logging due to changing precipitation and rainfall patterns

Areas highly prone to flood in Hyderabad are Masab Tank, Vijayanagar Colony, Ashok Nagar, Gandhi Nagar, Adarsh Nagar, Domalguda, Nallakunta-Barkatpura, Yousufguda, Musapet, Sanjeeva Reddy Nagar, Begumpet, Saroornagar and Ramanthapur (Geological Survey of India 2000). The Low-lying areas are subjected to inundation of up to 5 feet of water and are worst affected. However, with the changing climatic pattern it is observed that city is facing water logging and flooding situations which impact not only these but many other parts of the city. The project attempts to view at holistic solutions for the city by using its natural drainage and unique lake system for this purpose. Thus, the project will indirectly benefit the entire city of Hyderabad i.e. 100% of the population which is 7.6 million people. While the current disaster management systems and processes of the country and state do address the problem of water logging but the project proposes to undertake it in a more planned manner considering the changing climatic patterns and using the natural hydrology more than hard infrastructure.

3. Addressing financial barrier to urban climate resilient infrastructure development

Hyderabad faces two major climatic challenges:
- Rainfall – changes in precipitation, heavy rainfall, water logging and flash floods
- High Temperature, Drought and near drought situations

As explained above, these two climatic changes are already being experienced in Hyderabad and based on preliminary projections their intensity and impact will increase several folds in the next decade. City needs to prepare for these changes so that city continues to have enough water and it’s does not make financial and economic losses on account of infrastructure collapse and human health and well being. Like any other metropolitan the climate, population and urban infrastructure are the combined reason for the stresses being experienced and to be experienced by the city.

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\(^{23}\) http://censusindia.gov.in/Tables_Published/Admin_Units/Admin_links/slum1_m_plus.html

\(^{24}\) http://www.census2011.co.in/census/city/392-hyderabad.html
Hyderabad’s current total water demand is about 1900 MLD. The water demand for Hyderabad has been projected to increase at about 20-30% every decade. To cater to this growing demand for water, a DPR on “Augmentation of drinking water supply for Hyderabad” has been prepared in the year 2009. According to this, phase wise development will be undertaken to draw water from river Godavari (which is more than 100km away from the city) to meet the immediate water requirements. Currently, phase I of this project i.e. 172 MGD pipeline has been laid in 2016. The cost of this project is INR 3375 crore. As phase II i.e. another 172 MGD of water to be drawn from river Godavari. It will cost the government about INR 5000 crore. These projects are being implemented through state government fund and central government funds and loans.

While State Government is aware of the challenges in water and is making efforts to bridge the water supply gap, the approach is mainly conventional i.e. to draw water from either ground water or surface water sources far away from the city. This approach also does not take into account the climate change and its overall impact. There is a need to look at water holistically. This project intends to provide a holistic perspective to water and find solution for the Hyderabad.

However, the project and its components face financial barrier as they are not provisioned in either the central governments schemes or the state government’s current plans. Considering that Telangana is a newly formed state (formed in June 2014), the state government’s funds have been channelized into other state-wide activities due to which the funds for the project are currently unavailable.

Component wise financial barriers that GCF will elevate:

1. Component 1- Comprehensive water database for Hyderabad in public domain for better monitoring and management of water resources
   This is one of the objectives of the National water mission but no funds are available from any of the government schemes to set up this system for urban areas.

2. Component 2 - Development of a climate resilient framework for the city – The concept of including climate change (i.e. future climatic trends) while planning and developing a climate resilient water and wastewater management system is not an existing process and it would not take place without involvement of GCF. Also climate resilient studies are being undertaken through different grants/funds etc. there is no such holistic study being taken up for the urban water infrastructure currently in Hyderabad.

3. Component 3a: Infrastructure implementation for water recycling:
   There is no finance available under state government or central government to fund this project. For example, to recycle wastewater there is need to set up Sewerage treatment plants with tertiary treatment system and recycling structure. HMWSSB has in the year 2010-2011 developed detailed project report for setting up of 9 STPs in GHMC area and applied to the National River Conservation Development fund to fund this sub activity. In the past NRCD had funded wastewater treatment plants in the state under with 70% contribution from the NRCD fund and 30% through state funds. However, as NRCD funds have been diverted towards Ganga Action Plan, no funds were available even for a sub component of the activity. The IRR of this component is 16% and has a sensitivity of 26% to 8% when implemented under grant mode. Since, the IRR under commercial lending will be low and the system of wastewater recycling at large scale is still not demonstrated in urban areas, it does not attract other lending institutions as acceptability of recycled wastewater at large scale is still to be assessed. Through GCF fund, this activity would be able to demonstrate for not just Hyderabad but for other urban areas in the country the operational and financial viability of implementing such activities.

3. Component 3b: Infrastructure implementation for natural flood control through lake rejuvenation:

   Similar to the water recycling, the project intends to use the natural lake system for flood control and ground water recharge. The National Lake Conservation Program (NLCP) provides states funding similar to NRCD in the ratio of 70:30. However, the NLCP also does not have adequate funds for the activity. Also the rejuvenation of 19 lakes simultaneously is important to be able to study and demonstrate the real impact, before it can be scaled up. It does not have a tangible financial benefit for the commercial lenders to lend on the project. No other existing scheme supports this activity at this time.

4. Demonstration of other water saving and ground water recharge options
   GW recharge options like rain water harvesting system are very dynamic and dependent on several factors. Thus, their success in achieving actual recharge in the study area needs to be established. No funds are available currently. Thus, GCF fund will enable testing of a critical and replicable water saving option

While all the components of the project are supported by National Action Plan on Climate Change, National Water Missions, National Water Policy and State Action Plan on Climate change, the financial assistance needed for implementing the project are not available. As the urban local bodies and state governments have not implemented
these measures at a large scale and comprehensively in India, they have still not been streamlined into the planning and action of different department.

If GCF does not provide grant for the project it may not get implemented. However, if the project is implemented it would set a benchmark and become a demonstrable project for all medium and large urban centres in India to replicate. Since, some components of the project also provide a direct financial return; it will assist in penetration of additional finance in this sector.

Hence, a grant from GCF would assist in implementing measures beyond business as usual (i.e. water supply augmentation from rivers) and demonstrate the importance of a climate resilient integrated infrastructure development.

Please explain how the project/programme sustainability will be ensured in the long run, after the project/programme is implemented with support from the GCF and other sources.

The proposed project has been designed through extensive consultations and involvement of different government departments to ensure ownership of the interventions and effectiveness of their impact. Relevant government will be leading on implementation of project interventions (as explained in the chart above). The investments and impacts of the project will be sustained for the long-term through the following:

- **Outcome 1: Comprehensive database on water** would incur fix expense on manpower, technology up-gradation and other operation and maintenance cost. The cost is estimated to be INR 3million per annum and an up gradation cost of INR 12 million once in 10 years. In due course of the project this cost will be internalized through government budgets like the budget provided for scientific studies through government of India and through state government budgets. The groundwater department proposes to manage the Telemetry stations through its internal budgetary allocations after the end of the project.

- **Outcome 2: Development of a climate resilient framework for the city:**

  The results of this study are expected to be valid for next 30 year. However, the government may review its applicability 10 years after the development to see if any updating is needed. At that time the state government may decide on the same. However, by design this component does not require any regular monitoring and maintenance

- **Outcomes 3a: Infrastructure for recycling of water, supplying saved water to vulnerable population and flood control infrastructure through lake rejuvenation would require continuous O&M. The wastewater recycling system including the sewerage treatment plants are projected to have an O&M requirement of about INR 130 million per annum. Due to the project an equivalent amount of water would not need to be drawn from long distances hence; HMWSSB will save INR 45 per KL of water that it produces, hence saving a production cost of about INR 2690 million every year. Hence, this component will be self sustaining financially after meeting all the expenses. Currently, industries buy water on an average at INR 60/KL. On acceptance of recycled wastewater it can be proposed for selling at a concessional rate about INR 10/KL. Thus, HMWSSB can receive a revenue of INR 590 million per annum. These returns would make this component financially sustainable in long run. In addition, HMWSSB has been the nodal agency for supplying water and treating wastewater for Hyderabad. Thus, it has an operational structure for these activities. The technical capabilities will be enhanced as a part of the project activity.

- **Outcomes 3b: Flood control and ground water recharge through lakes:**

  Under the lake rejuvenation program, GHMC has planned to develop the lake surrounding for recreational purposes. These areas will be outsourced to third part; the returns received by this will be partially utilized for maintaining the lake. While the government would internalize other lake maintenance expenditure.

- **Outcome 4: Demonstration or Pilot study:** Pilot study's O&M requirements will also be internalized by respective departments or taken care by the project

- The capacity building aspect of the project will provide successful intervention in bridging the gap in human resource to maintain the project elements.

- It is also proposed that full or part of the saving from the project activity is placed with the PMU for an additional time frame of 5 years after the exit of GCF for smooth running of the project till the activities are internalized by the departments into regular work. This will ensure long term sustainability of the project after GCF exit. Detailed plan on this activity can be built in project development stage.

  Thus, the project will be financially, technically and operationally sustainable after GCF’s exit.

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**F. Risk Analysis**
Please describe the financial and operational risks and discuss mitigating measures.

**Assessment of risks for the proposed project activity:**
- **Technical** – No significant technical risk is envisaged for the project activity. The entities implementing various components of the project activity have been involved in similar works. However, as recycling at large scale and use of tertiary treatment technologies may have new technical challenges for which the project has provisioned enough capacity building and training in each of the outcomes. This will assist in enhancing the capacity of workforce. Hence, do not envisage any major technical risks.
- **Operational** – No operational risk is envisaged for soft part of the project. However, as the project is being implemented in urban areas the hard infrastructure development may face few risks. These risks and their mitigation measures are as described in the table below.
- **Financial** – No financial risk has been envisaged at this stage.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few lakes out of 19 lakes considered under the project experience some encroachments. Usually, encroachments can delay the project implementation process.</td>
<td>The urban authorities of Hyderabad recognize lakes as an important priority area. GHMC which is the implementing body has a department called Lakes Department. This department has been handling these risks in several projects. It is capable of addressing the situation. A committee called Lakes Committee has also been formed to assess the ground situation of all lakes in GHMC area. The work of boundary demarcation, fixing FTL level etc. for all lakes is already underway. Encroachment has been identified as an area to be addressed through R&amp;R. The cost of R&amp;R has already been built into the project cost. Thus, the mitigation measure to solve this problem is already prepared.</td>
</tr>
<tr>
<td>Few encroachments near the I&amp;D structure</td>
<td>HMWSSB has already implemented me&amp;D structures and is well aware of the procedures of removing encroachments near these structures.</td>
</tr>
<tr>
<td>Availability of land for implementation of project related infrastructure</td>
<td>The technology choice for the project is such that the project will be implemented at locations where land is available with the government.</td>
</tr>
</tbody>
</table>

Please briefly specify the substantial environmental and social risks that the project/programme may face and the proposed risk mitigating measures.

A comprehensive social and environmental risk assessment of the project will be carried out in accordance with the [interim environmental and social safeguards of the fund](#) which follows the IFC standards. This would be carried out during the detailed project report preparation stage. However, for some of the hard infrastructure components of the projects Rehabilitation &Resettlement has been considered in the financial estimates for the project.

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**G. Multi-Stakeholder Engagement**

Please specify the plan for multi-stakeholder engagement, and what has been done so far in this regard.

**Stakeholder identification:** Government bodies, institutions, technology suppliers and design consultants are the main stakeholders identified at this stage of the GCF project. During the detailed project report preparation and implementation stage public from all group of society especially slums, low income group who will be the key recipients along with NGO’s are additional set of stakeholders identified for the project. They would be consulted as per the plan provided further in this section. In the current conceptualization stage/design state the stakeholder consultations conducted are detailed below.

**Stakeholder consultation at project design stage**

Several stakeholder meeting or consultations have been conducted for the GCF project. These consultations have been
with the government bodies and institutes identified as the key implementers of the project activity. Ground water department, GHMC’s lakes department, Hyderabad Metro Water Supply and Sewerage Board (HMWSSB) are the three key departments identified as stakeholders for this project activity. The stakeholder meetings conducted so far have been attended by these departments, EPTRI, NABARD, DPR consultants, Forest Department and other experts in water and climate space. For a project of this nature to be implemented, it should be a priority of the state government at the highest levels, thus a state level steering committee has been formed for the project. Projects preliminary concept has been presented to the State level steering committee, which is headed by the most senior officials of the state i.e. Chief Secretary, before initiating detailed stakeholder consultations with all the concerned departments. List of stakeholder engagements conducted so far are as below:

1. 23/01/2016 – To initiate a conversation and gather their perspectives
2. 1/02/2016 – Presentation of the preliminary concept to Steering committee headed by Chief Secretary of state
3. 29/02/2016- Stakeholder consultation to gather initial information and request for additional data
4. 14/03/2016 – Follow up stakeholder engagement
5. 23/04/2016 – Stakeholder meeting to finalize the concept
6. 02/05/2016- State Steering Committee Meeting to approve the project

The above stakeholder consultations/meetings were organized to understand the view of individual stakeholders/departments on the subject, include their views and gather information and formulate the project components. Thus, the project has been prepared by taking the views of all concerned departments into consideration.

In addition to this, several formal and informal stakeholder consultations have been conducted by the respective departments with the public including beneficiaries and/or vulnerable sections.

In addition to these meetings, a multi stakeholder engagement is planned during the project proposal development stage where a participatory discussion approach will be observed. In this meeting public, NGO’s, IMD department, Pollution control board, other research organizations in Hyderabad, will be invited to provide their suggestions on the project activity. In addition, the project will be made available on EPTRI’s website for 10 days to invite any additional comments. These suggestions wherever possible will be incorporated into the project proposal. Feedbacks will be collected and minutes of the meeting will be shared with GCF. A minimum of 20% representation from women will be aimed in all the meetings.

**Stakeholder engagements at project implementation stage**

Stakeholder consultation during the project implementation stage will include:

1. Working group meetings
2. Steering committee meetings
3. Public stakeholder consultations/engagement

In addition to the above, there would be several informal stakeholder consultation at the implementation stage and these may include/be clubbed the water awareness campaigns.

Working groups will be formed based on the outcome of the project. During the implementation of each outcome working group will meet at least once in a quarter to discuss issues regarding the same.

Steering committee will meet at least once in six months to review the progress and provide inputs on the action items. At least one general /public stakeholder consultation/ engagement will be conducted at the initial stage of each outcome, one intermediate and one at the completion of the outcome.

**Mode of consultation:** To engage the vulnerable sections and the public stakeholder consultations will also be carried out at slum level/ward level in local/ vernacular language. Material would be prepared and discussed in local language i.e. Telugu along with English and/or Hindi. The frequency of these stakeholder engagements would be decided at the time of project implementation.

For climatic vulnerability assessment, stakeholder consultation would be conducted as per the methodology suggested by ADB’s guidebook on climate change resilience in cities.

At least 20% women participation will be focused in all the public stakeholder consultations.

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25 Attendance sheet attached and minutes of steering committee meeting
1) A pre-feasibility study is expected to be completed at this stage. Please provide the report in section J.

2) Please indicate whether a feasibility study and/or environmental and social impact assessment has been conducted for the proposed project/programme: Yes ☐ No ☐
   (If ‘Yes’, please provide them in section J.)

3) Will the proposed project/programme be developed as an extension of a previous project (e.g. subsequent phase), or based on a previous project/programme (e.g. scale up or replication)? Yes ☐ No ☐
   (If yes, please provide an evaluation report of the previous project in section J, if available.)

I. Remarks

J. Supporting Documents for Concept Note

- Map indicating the location of the project/programme
- Financial Model
- Pre-feasibility Study
- Feasibility Study (if applicable)
- Environmental and Social Impact Assessment (if applicable)
- Evaluation Report (if applicable)