REQUEST
FOR PROJECT/PROGRAMME
FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project/programme must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/programme document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
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MSN P4-400
Washington, D.C., 20433
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ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Project/Programme Category:	REGULAR (CONCEPT PAPER)
Country/ies:	INDIA
Title of Project/Programme:	BUILDING ADAPTIVE CAPACITIES OF SMALL INLAND FISHERMEN COMMUNITY FOR CLIMATE RESILIENCE AND LIVELIHOOD SECURITY, MADHYA PRADESH, INDIA
Type of Implementing Entity:	NIE
Implementing Entity:	NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT (NABARD)
Executing Entity/ies:	**TOWARDS ACTION AND LEARNING(TAAL)**
Amount of Financing Requested:	US $ **1,737,864** (in U.S Dollars Equivalent)

Project / Programme Background and Context:

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline the economic social, development and environmental context in which the project would operate.

1. 1. PROJECT BACKGROUND AND CONTEXT

1.1 Fisheries Sector in India

Marine and inland fisheries and aquaculture are the two constituents of the fisheries sector in India. Marine fisheries are carried out in the 2.02 million sq. km. of oceanic resources. The declaration of the EEZ has enabled India to have absolute rights to conserve, develop, and optimally exploit the marine resources. Inland fisheries include maze of rivers, canals, estuaries, flood plain lakes and the ponds/tanks. A combined length of 1,97,024 km, the riverine resources cover more than 3 mha water spread area. Inland fisheries provide employment to 1.24 m fishers and 4.98 million MT of annual fish production.

Fisheries have grown from a traditional livelihood activity to a commercial enterprise contributing to the employment, food and nutritional security, and foreign exchange earnings of the country. The share of fisheries at factor cost in GDP at current prices has increased from 0.40 percent to 0.96 percent during 1950-2009.

1.2 Fisheries in Madhya Pradesh (M P)

Madhya Pradesh has a river length of 17,088 kms that is 8.6% of the country's riverine resources. The freshwater spread area in India is 7.36 m ha of which Madhya Pradesh has 0.34 m ha that constitutes 4.6 percent of country's resource. Within the state 0.29 m ha is accounted for by reservoirs and 0.053 by rural ponds. Madhya Pradesh contributes 1.13 percent to the inland fish production of the country.

In MP the water bodies have been allocated between Panchayat institutions, Fisheries Department and Fisheries Federation. The ponds with area of less than 10 ha are with Village Panchayats, 10 to 100 ha with Block Panchayats and 100 to 1000 ha with District Panchayat. The department has control over reservoirs with area 1000 to 2000 ha. All the other reservoirs above 2000 ha are with the Fisheries Federation. Development indicators of Madhya Pradesh are presented in Annexure 1.

1.3 Climate Change and Fisheries in Rain-fed Areas

Rainfall plays an important role in development of inland fisheries. The IPCC AR4 Climate Change projections indicate a decrease in number of rainy days, increase in the intensity of rainfall on a given rainy day, increase in extreme rainfall events and increase in the intensity of storms or monsoon depressions (Kumar, 2009). The INCCA assessment for 2030s for India commissioned by Ministry of Environment and Forest also shows an increased extreme precipitation trend over the country (INCCA, 2010). These projected Climate Change scenarios indicate a much greater potential of increased inflows into the water bodies fed by local catchments resulting in increased fillings and enhanced temporal storage.

Climate change affects fishery production along many pathways. Fish reproduction and growth are affected by temperature, rainfall and hydrology. Changes in these parameters will therefore shift patterns of species abundance and availability. Patterns of change in fertility, nutrition and growth are also influenced by changes in climate. Extreme weather events could further harm fish production in rain-fed area by causing loss of aquaculture stock and destroying fishing and aquaculture infrastructure.

Some of the likely impacts of climate change/variability on inland fisheries can be as follows:

- Seed availability might be affected with warming as it has been observed that with increase in temperature there is a decrease in fish pawning and hence decrease in fish seed availability;
- Temperature increase will have an impact on the suitability of species for a given location with warm water fishes surviving more than the others;
- Growth retardation may take place in different inland water fish species suitable for the different temperature ranges;
- Seasonal shifts in the breeding period, as well as shortening or lengthening of breeding periods may occur for different types of fish;
- Geographical shift of fishes may also happen; and
- Increase in frequency and intensity of drought will decrease fish catch and thus pose a great threat to the communities which are dependent primarily on fisheries.

1.4 Adaptation Deficit and Climate Resilience

There is substantial **Adaptation Deficit** in fish production in small water bodies. The system, stressed by climate variability, is operating under very low productivity regimes. It is important to fill-in the climate variability adaptation-deficit for the system to realize the opportunities open with Climate Change and to build resilience (Brander; 2007, Keptesky; 2000). In addition, the promotion of inland fisheries in rain-fed areas will add to resilience to climate change by diversifying the agriculture economy which is highly prone to drought conditions. These economies are net consumers of fish and hence increasing local fish production will reduce the carbon foot-print of fish transport.

The proposed project aims at making fishery sector climate resilient and adaptive to the changing climatic scenario.

2. 2. CLIMATE CHANGE SCENARIO IN MADHYA PRADESH

The State of Madhya Pradesh lies between latitude $21^0$04'N-26.87^{0}N and longitude $74^0$02' and 82°49'E, and is centrally located. The State physio-graphically has a varied land form with large plateau and numerous mountain ranges. Madhya Pradesh is the second largest state with an area of 0.3 m sq.km which constitutes 9.38% of the land area of the country.

The diversity of the state is exemplified in the fact that it is divided in to 11 agro-climatic zones which are the basic units that define micro climatic trends. The agro-climatic zones include the Chattisgarh Plains; Northern Hill Region of Chattisgarh; Kaimur plateau and Satpura hills; Vindhyan Plateau (hills); Central Narmada valley; Grid (Gwalior) region; Bundelkhand region; Satpura Plateau (hills); Malwa plateau; Nimar Plains; and Jhabua hills.

The climate risks identified in SAPCC with respect to temperature and precipitation indicate warming of climate, and increase in intensity and frequency of precipitation along with the delay in onset of monsoon. The projected changes till the end of the century have been forecast as follows:

Parameter	2021-2050	2071-2100	Spread
Daily Max Temp	Increase by 1.8-2^{0}C	Increase by 2.4-4.4^{0}C	Across the state
Daily Min Temp	Increase by 2.0-2.4^{0}C	Increase by > 4.4^{0}C	Across the state
Monsoon Precipitation	Increase by 1.25 times	Increase by 1.35 times	No change in northern districts (2021-50) Excess rainfall in central, eastern and western part (up to 1.45 times)
Winter precipitation	Decrease	Increase between 1.45 to 1.85 times	Increase is in central, south and western regions

The vulnerability analysis of the state undertaken in SAPCC maps the districts and the agro-climatic zones on the socio-economic and biophysical indicators. Based on the vulnerability map three agro climatic zones of the state were identified as highly vulnerable on both the parameters. These

regions are the Jhabua Hills, the Bundelkhand and the Vindhyan region. The vulnerability rank of districts compiled at the national level ranked Jhabua district (including Alirajpur district that was carved out of Jhabua) as very high i.e. rank 48 out of 50 districts (hence highly vulnerable) and the districts of Bundelkhand and Vindhyan were ranked higher (hence low on vulnerability). The agro-climatic zone of Jhabua hill covers the entire districts of Jhabua, Alirajpur and extends up to southern part of Dhar district (including tehsils of Manawar, Gandhwani, and Kukshi). The pilot for the proposed project was carried out in Gandhwani tehsil that has the same micro climatic conditions that exist in Jhabua Hills agro climatic zone.

The project proposes to enhance the adaptive capacity of fish farmers to ensure their livelihood security in the agro-climatic zone of Jhabua hills comprising the districts of Jhabua, Alirajpur and Dhar.

3. Climate change, Vulnerability and Livelihood Security of Fish Farmers

A pilot project on climate proofing of fish farming under Minakshi sub scheme of MGNREGS was implemented by the Agency (TAAL) with the support of GIZ in Gandhawani block of Dhar District of Madhya Pradesh. The findings from the pilot and analysis of secondary data of IMD and other sources highlight the vulnerability of fishers in the agro climatic zone. The details of the data are given in the ensuing paragraphs.

3.1 Availability of Water for Fisheries

(a) Temperature

The climate in the district varies from dry sub-humid to moist sub-humid. The month of May is the hottest month with maximum temperature varying between 39^0 C to 41^0 C and January being the coldest month with minimum temperature in the range of 9 to 15^0C. Humidity is high during monsoon months of July and August (75 to 88%) and lowest during March and April (40-15%).

The temperature of Dhar and Jhabua were compared between the first and the second half of the 20^{th} century. The comparison revealed that the average minimum temperature in the second half was higher by 3% than the first half and the average maximum temperature was high by 1.5% during the same period. (Sources: India Meteorological Department)

The PRA exercises with the community in the area had concluded that the summer days are becoming hotter and that the duration of summer months is increasing. Another factor pointed out during the PRA was that the wind pattern is changing. High velocity winds during summer months often blow away the rain bearing clouds thus lengthen summers and delaying the onset of monsoon.

(b) Rainfall

The rains in the area are accompanied with high velocity winds that dislodge and loosen the top soil and with flow of water leads to formation and widening of already existing gullies. The SAPCC states that extreme precipitation events which are above 150 mm are increasing in terms of their intensity and frequency with low and moderate events becoming more and more infrequent across the state.

The annual average rainfall of Dhar (project district) as reported in the Gazette published in 1984 was 897.4 mm (1901 to 1950). The 100 year IMD data from 1901 to 2000 reflects that the district receives mean rainfall of 834.2 mm. The district receives about 93.2% of the rainfall from June to September.

Table 1: Monthly Rainfall Variation in Project Districts

Rainfall 1901 to 2000- Dhar	Jun	Jul	Aug	Sep	Oct	Annual
Mean rainfall (in mm)	124.1	252.6	223.1	167.6	30.6	834.2
Standard Deviation (in mm)	77.1	97.1	118.8	125.6	42.5	236.9
Coefficient of Variation (in %)	62.1	38.4	53.3	75.0	139.0	28.4
Rainfall 1901 to 2000- Jhabua (including Alirajpur)						
Mean rainfall (in mm)	114.1	259.6	236.2	146.9	28.8	806.5
Standard Deviation (in mm)	83.7	126.8	149.5	124.3	49.8	286.2
Coefficient of Variation (in %)	73.3	48.9	63.3	84.6	173.1	35.5
Source: IMD						

The standard deviation calculated from 100 year data of rainfall indicates that the deviation from the mean is significant. It implies that the rainfall has been away from the mean indicating high variations. The coefficient varies from 38% to 75% in case of Dhar and 49% to 84% for Jhabua which points to low reliability of rainfall for all the districts.

The variation from the 100 year average rainfall in recent years is tabulated in Table 2. The data indicates that the fluctuations are high implying high variability of rainfall. The issue of availability of water to carry out fisheries is becoming critical for the fishers, especially the small fish farmers.

Table 2: Annual Rainfall Variation

Annual Rainfall- Dhar	2006	2007	2008	2009	2010
District Rainfall in mm	1137.3	1055	648.3	640.6	764.9
% Variation with respect to the 100 year average rainfall	36.33	26.47	-22.28	-23.21	-8.31
Annual Rainfall- Jhabua including Alirajpur					
District Rainfall in mm	1494.1	1188.6	632.2	622.6	639.8
% Variation with respect to the 100 year average rainfall	85.26	47.38	-21.61	-22.8	-20.67

The number of wet days during the monsoon months of June to September based on 100 year average data are 36 for Jhabua and Dhar. However from 1990 to 2002 the number of wet days has reduced from 42 to 29 days in Dhar and 40 to 27 days in Jhabua.

The variability of rainfall and the decrease in number of wet days indicates the need for adequate storage capacity of water that allows and enables productive fishery for most part of the year.

(c) Livelihood of Fishers

There is lack of data on production of fish that is disaggregated for small pond fisheries. The main reason being that production from small pond fisheries is not transacted in the organised sector.

Production is local and so is its sale and consumption. Hence it will be difficult to establish the impact of climate change on the livelihood security of small pond fishers.

The PRA data collected from traditional fishermen in the pilot area revealed that there is a 20 to 40% fall in fish production in the area over a period of 25 years. The reasons for the decrease in production identified by them are:

- Delayed monsoon implies delayed introduction of fish seeds in the pond. The fishers anticipating low production tend to increase the density of fish seed in the pond so as to achieve the same level of productivity as before. This however has an adverse impact on growth of the fish and there is an overall fall in production. Traditional fishermen estimated that fifty percent of the fall in production is due to delayed monsoon.
- On account of extreme weather events like high intensity rainfall and floods, there is run off of excess water from the pond. This run off carries with it fish seeds/fingerlings resulting in total loss for the fisher.
- Decrease in post monsoon rainfall implies fast depletion of quantity of water in fish ponds. Fishers tend to over harvest fishes with the apprehension that the remaining water will evaporate quickly. As a result there are days when there is surplus fish in the market as the harvesting is not evened out throughout the season. The fishers, consequently, have to resort to distress selling on days when there is surplus fish in the market.
- The delay and fluctuation in monsoon creates pressure on existing water bodies to supply water for protective irrigation. Availability of water for fisheries decreases and in the absence of mediation mechanism between the fishers and farmers the use of water for irrigation takes priority over fishing.

The other factors that further adds on to the vulnerability of small fishers is lack of market infrastructure and their lack of access to savings, credit and insurance products to compensate for their losses occurring due to factors of climate change. The institutional support to small pond fishers is not available as they are not linked to the Government schemes, if they are not part of federation or a common interest group. Even when they are part of the federation they lack capacities to fulfil the institutional and legal requirements.

(d) Water Storage Capacity

The Block Zoning report of Gandhwani block in Dhar district by the hydro-geologist concluded that the evaporation rate in the region is about 1.5 m which incidentally is the depth of pond recommended for construction under Government Schemes like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). As a result, fish farmers, using such tanks for fishing do not get required quantum of water for fishing between December to July (if no pre-monsoon rain is there). In such a case, it is essential to have adaptation measures by which more water remain available for fishing in the tanks and run-off water during the less precipitation conditions can be harvested scientifically for fishing. The geo-hydrological maps of Gandhwani block in Dhar District is given in Annexure 2. The geo-hydrological block zoning report is presented in Annexure 3.

4. Climate proofing of fish farming:

The pilot project mentioned at para 3 above supported by GIZ aimed at identifying impact of climate change on fisheries sector and to come out with suitable recommendation for enabling fisherman community to adapt to the climate change. The project was implemented during November 2011 to June 2013 by TAAL. A brief account of the Pilot Project and its outcome are given below.

Small farmers in Madhya Pradesh's Dhar district traditionally depend on rain-fed agriculture for their livelihood. Some areas are irrigated with ground water. However, groundwater extraction has reached a critical stage, since recharge rates are low. Lately, farmers have also been affected by changes in rainfall patterns, such as decreases in pre- and post-monsoon rainfall and a shift in the onset of the monsoon. Rising temperatures are another challenge. To increase livelihood options, the Government of Madhya Pradesh has initiated the Meenakshi sub scheme of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The goal of MGNREGS is to enhance livelihood security in rural areas by guaranteeing at least 100 days of wage employment a year. The Meenakshi sub scheme aims to provide alternative income sources to farmers by constructing small ponds or hatcheries for fish farming on sections of their land. The sustainability of these activities is threatened by changes in precipitation and temperature. Since high intensive rainfall events have become more frequent, causing surface runoff, the siltation rates of ponds are increasing. In addition, rising temperatures are likely to affect fisheries, e.g. changes in the breeding period, growth retardation and declining overall production.

The objectives of the project were to showcase climate-resilient pond designs, institutional arrangements between farmers and traditional fishermen, and insurance schemes which will provide farmers with options for coping more effectively with climatic variability. The major recommendations include increasing the depth of the pond upto 4 m from the present level of 1.2 to 2.0 m so as to have a minimum water column depth of 2.0 m; construction of smaller size of ponds (0.5 ha) as against 1.0 ha size pond, introduction of common carp fish species, water retention for a period of 10 months, and capacity building of small fisheries farmers on climate resilient fish production technology.

The proposed project is to field test the above recommendations made through the pilot project and to create models which could be replicated and upscale through mainstream programme like MGNREGS.

Project / Programme Objectives:

List the main objectives of the project/programme.

The broad objective of this project is to make the fishery sector (captive inland fishery) adaptive to climate variability and enhance the adaptive capacity of the fish farmers to ensure their livelihood security in Madhya Pradesh, India.

Project Objective: Climate Change Adaptation in fishery sector for secured livelihoods of small and marginal farmers

Specific Outcomes: The project is having following specific outcomes;

Outcome 1: Increasing water retention capacity of the tanks as an adaptive measure to address rainfall variability by modifying technical specification of the tanks;

Outcome 2: Diversification of fish species and temperature regulation of ponds as adaptive measures to warmer climatic regime;

Outcome 3: Making small pond fisheries climate adaptation resilient through productivity enhancement by capacity building and institutional linkages;

Outcome 4: Preparing and disseminating evidence based resilient climate change adaptation strategies for inland fisheries for small pond fishers.

Project / Programme Components and Financing:

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

For the case of a programme, individual components are likely to refer to specific sub-sets of stakeholders, regions and/or sectors that can be addressed through a set of well-defined interventions / projects.

PROJECT/PROGRAMME COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
Component 1: Adaptive measures to address rainfall variability	1.1 Design of the pond modified technically and water retention situation improved; 1.2 Insurance product developed that provides resources for making modifications to the technical design of the	**Outcome 1:** Increasing water retention capacity of the	

PROJECT/PROGRAMME COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
	pond after the projected climatic changes take place	tanks as an adaptive measure to address rainfall variability by modifying technical specification of the tanks	1,176,750.00
	1.3 Construction of 75 fish farming tanks / ponds made adhering to technical design / specification;		
	1.4 Treatment of about 0.1 to 0.2 ha. of catchment of ponds / tanks made in each case		
Component 2: Adaptive measures to address warmer climatic regime	2.1 Plantation of surrounding pond area of 0.1 to 0.2 ha done	**Outcome 2:** Diversification of fish species and temperature regulation of ponds as adaptive measures to warmer climatic regime	158,300.00
	2.2 Three layer farming system in 100% tanks adapted with a minimum of one cycle of harvest for each layer of farming.		
	2.3 Paddle wheel aerators (green-tech) of 75 numbers covering all the ponds installed and used		
	2.4 Seed hatcheries (3 numbers) 2 nurseries (0.1 ha) and 1 seed rearing unit (0.1 ha) per district established.		
Component 3: Building resilience for climate adaptation	3.1 Productivity of 75 fish farmers enhanced towards optimal level of production through training and capacity building on climate resilient fish farming.	**Outcome 3:** Making small pond fisheries climate adaptation resilient through productivity enhancement by capacity building and institutional linkages	73,213.00
	3.2 Fish farmers supported through market infrastructure and value chain assessment done.		
	3.3. 75 fish farmers prepare business plan based on local market and existing value chain.		

PROJECT/PROGRAMME COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
	3.4 Institutional support interventions so as to enable Local Governance Institutions and fishers to play the role envisaged in the legal framework of the State.		
	3.5 Insurance coverage provided for risk minimisation of 75 fish farmers of the project.		
Component 4: Knowledge generation and management	4.1 Project benefit document prepared that provides evidence for environment, social and economic benefit	**Outcome 4:** Preparing and disseminating evidence based resilient climate change adaptation strategies for inland fisheries for small pond fishers	41,293.00
	4.2 Annual process document prepared		
	4.3 Evidence based Resilient climate adaptation strategy for inland fisheries developed and information on same disseminated.		
6. Project/Programme Execution cost			**152,163.00**
7. Total Project/Programme Cost			**1,601,718.00**
8. Project/programme Cycle Management Fee charged by the Implementing Entity			136,146
Amount of Financing Requested			**1737,864**

▣ Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme

MILESTONES	EXPECTED DATES
Start of Project/Programme Implementation	October 2014
Mid-term Review (if planned)	October 2016
Project/Programme Closing	March 2018
Terminal Evaluation	May 2018

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. *Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.*

Component 1: Adaptive Measures to address rainfall variability

Activity 1.1: Technical Modification of Pond Design- Hydro geological Assessment

The technical modification of pond design will address the current climate stresses namely the increased variability of precipitation, delayed monsoon, extreme weather events leading to high intensity rainfall, and lengthening of summer months. These climatic stresses here necessitated review of the present technical design of ponds in terms of their water retention capacity to enable conduct of fisheries for most part of the year. The present design of ponds recommended for fisheries for the entire state stipulates pond depth of 1.5 m for fisheries and 1.2 m for nurseries.

The pilot carried out in the project area reviewed the present recommended design through hydro geological assessments, consultations with traditional fishermen, and fisheries expert. The review had concluded that these designs are deficient to retain required quantum of water that is suitable for fish rearing beyond certain period (July to October). The required water retention stipulates more depth of water that is suitable for productive fish farming. The pilot had recommended minimum water depth of 1.82 m (or 6 ft.) even during dry periods.

The present proposal envisages construction of new ponds/repair/modification of existing ponds on private lands and on common property land (of Gram Panchayats). The construction will be based on the technical review of existing and recommended sites. The review will entail conduct of hydro geological block zoning assessment; consultations with traditional fishermen in the project area; and inputs from experts in fisheries. The central thrust of the review will be to reassess the existing design and recommend the new design that accounts for climatic stress and ensures water retention in ponds to a level that allows the fisher to conduct fisheries during dry period- December to June. For example, during the pilot phase the technical design recommended was for the construction of pond with 4m depth and an average tank area of 0.5 ha that would be able to account for climatic factors and will ensure 1.82 m water in dry periods. The suggested design of the pond is presented in Annexure 4.

The Technical Assessment will have hydro geological zoning exercise which will make an assessment of individual ponds and will take an area approach and make assessment of

- Existing and proposed water bodies in the block.
- Possibility of water logging in selected sites
- Existing natural habitats in the region
- Potential natural habitats which need protection
- Sites with unique natural value
- Physical Cultural resources
- Relevant and Important aspects of the Biodiversity of the area

- Relevant and Important aspects of the Eco services of the area

The assessment will refer to the existing research and documentation by appropriate agencies on the above identified subject. The assessment will be presented to the Technical committee for approval as it will make recommendation to the block on the future possibilities of conducting small pond fisheries in the area. These assessments will also recommend the different technical options available to the fishers based on different climatic projections.

The designs would be evaluated to ensure that it does create barriers for the poor, children, and differently abled and has necessary protections to be an inclusive intervention.

Activity 1.2: Technical Modification- Insurance Product

To deal with the projected climatic stresses two distinct yet related activities will be undertaken:

One, Presently there is no exclusive insurance product to address the comprehensive requirement of fisherman community. The major insurance product under implementation covers accident, life insurance, agriculture crop insurance etc. During the implementation of the pilot project supported by GIZ, weather based fisherman insurance scheme was brought out by one of the major private sector insurance company in India (ICICI Lombard Ltd.). The product for small fish farmers compensated the fisher against losses due to water scarcity or excessive rainfall. The agency has tied up with SKYMET and National Collateral Management Limited (NCML) for sourcing weather data. This product will be further developed and repackaged for the individual fisher so that the latter is willing to take risk to make investments for technical modification of their pond at a later date. This will be a long term insurance product that demands low premium and enables the fishers to mitigate the risk of making significant investments once the projected climate change factors come in to play and affect the production of fish.

Two, for individual fisher the project proposes to facilitate fishers to be members of existing fishermen cooperatives. These organisations, among other activities, will develop a fund to undertake technical modifications on ponds necessitated by changes in climatic factors. This fund will be formed out of contributions by individual members and would be used for leveraging funds from other institutions for individual or groups of fishers. This would require working at all the institutional structures responsible for the fisheries activity as per the framework of the State Government. The working would involve identifying the financial support system required by federation of fishers and individual fishers in terms of services, incentives and issues of capacity building.

Activity 1.3: Construction of ponds according to Modified Design

2100 ha m of water area created with adaptive technical design of tanks leading to climate resilience of small and marginal fish farmers. The tanks will include new tanks or repair and modification of existing tanks in the three districts of Jhabua, Alirajpur and Dhar. In all 75 numbers of fish ponds/ tanks (@ 25 per district) are proposed to be constructed as demonstration models. The tanks would be constructed in the identified geographically suitable locations, adhering to the technical specifications.

The community tanks would be managed by the local Panchayati Raj Institutions, as per the Government norms. The tanks constructed at the fishermen level would be managed by individual fishermen who will also seek support of local fishermen cooperatives and Department of Fisheries of the state government. The participation of women ward members will be inbuilt in the construction/repair of community ponds and in case of tanks on private land; the women members of the household would be associated in project processes.

The tanks/ponds proposed for construction would be earthen ponds without utilisation of any concrete boundary. Earthen ponds would be helpful to regulate the temperature and delaying the heating up of the water and increasing cooling intensity.

Activity 1.4: Catchment Treatment

The available catchment would be treated by plantation / soil conservation measures (vegetative and/or mechanical) and run-off check. The catchment treatment plan will be submitted to the project steering committee for their concurrence. The project plans to treat about 0.1 to 0.2 Hectares of catchment of each pond / tank. The catchment treatment will address the climatic stresses as follows:

- the heavy silt load that accompanies high intensity rainfall will be arrested thereby protecting the pond from reduced water retention capacity;
- The changing wind pattern as reported by the community carries top soil and increases the silt load of the pond reducing water retention capacity. This will be reduced with plantations working as wind breakers and protecting the pond from excessive silt;
- catchment treatment leading to improved soil moisture will reduce the pressure on existing water bodies for drawing water for irrigation thus enabling the ponds to retain larger quantity of water than otherwise;
- At the micro level plantations in the catchment area will regulate temperature there by reducing the rate of evaporation and thus enabling the pond to retain water for longer duration and hence the pond may not require further modifications when projected climatic stresses become frequent and real.

The catchment treatment will be based on the regional biodiversity and eco-services requirements so as to ensure enhancement of natural resources. All measures will be taken to avoid degradation of natural resources, physical and cultural heritage. The women elected representatives and women members of the households in the catchment area, would be included in the processes of the project. The catchment plan would be evaluated to ensure that it does create barriers for the poor, children, and differently abled and has necessary protections to be an inclusive intervention.

Component 2: Adaptive measures to address warmer climatic regime

Activity 2.1: Temperature regulation of Pond

Death of aquatic organisms due to high temperature takes place during peak summer. It is significant that temperatures at which mortality occurs is so precise that change of even a fraction of

degree of temperature can make difference of life or death of the aquatic organisms[1]. The adaptive mechanism is to ensure that temperature does not rise from a point level. The project will take two measures to regulate the tank water temperature in peak summer i.e. (1) Provision of shade (cover) over a part of the pond and (2) Greening the pond surrounding. Greening, suitable to the local geographical and environmental condition, will be undertaken to regulate the pond water temperature.

Activity 2.2: Promotion of Poly Culture through Selected Fish Species

The existing recommendation of the Fisheries department for the region comprises of *catla*, *rohu* and *mrigal*. From climatic adaptation point, especially to address the warmer climatic regimes, poly-culture farming system would be adopted in the tanks. Four different species of fish would be promoted in the tanks, namely *catla, rohu, mrigal* and common carp. The logic of adapting these four categories of fish is based on their adaptive characteristic, feeding practices and the fact that they are native and endemic to the region.

Table 3: Fish species to be promoted in the tanks

Fish Species	Feeding Habit	Feeding Zone	Adaptive Aspect	Economic Value
Catla catla	Plankton Feeder	Surface Feeder	Survival in less water level	Local market demand and one harvest cycle
Labeo rohita **(Local Name: Rohu)**	Omnivorous	Column Feeder	Survival in medium water level	Local market demand and one harvest cycle
Cirrhinus mrigala **(Local Name: Mrigal)**	Detritivorous	Bottom Feeder	Survival in medium – deep water level	Local market demand and one harvest cycle
Cyprinus carpio **(Common Carp)**	Detritivorous	Bottom Feeder	Survival in medium – deep water level	Local market demand and one harvest cycle

The common carp and *Labeo rohita* (Rohu) are featured prominently in capture and aquaculture fisheries on the Indian subcontinent and are well adapted to increases in temperature, shows increased tolerance to elevated temperature following acclimatization to water temperature of 30^0C and 35^0C. The common carp is more thermally tolerant than the *Labeo rohita* (Chatterjee et al, 2004). *Catla catla* is hardy; natural temperature range 18-30^0C; lower and upper thermal tolerance limits, 16.7°C and 39.5°C; sensitive to low oxygen conditions; tolerates pH 6.5-8.5 and salinity up to 5 ppt; prefers deep pools; breeds during the southwest monsoon (May - September) in water temperatures around 24-31°C.

Common carps are normally preferred by the consumers like earlier discussed species. They are bottom dwellers and breeds twice a year. It can be harvested when the water depth decreases and does not pose competition to the feed and space of other fishes. The Feed Conversion Ratio (FCR) is on the higher side and they can be harvested in 5 to 6 months. When water level is high in the pond, water at the bottom will be least affected with changes in temperature and Common Carp will be least affected with increase in water temperature. The ecological spectrum of carp is broad. Best growth is obtained when water temperature ranges between 23°C and 30°C and it can be achieved through the proposed temperature regulation mechanism. Apart from that the fish can survive cold

[1] FAO Corporate Document Repository, Fisheries and Aquaculture Department

winter periods. Salinity up to 5% and the optimal pH range of 6.5-9.0 can be tolerated by the common carps. The species can also survive low oxygen concentration (0.3-0.5 mg/lit) as well as super saturation.

The project proposes to introduce common carp in the region. The pilot conducted in Dhar district had led to the state government to recognise common carp as the species that is suitable for adaptation and have consequently issued notification that the species can be introduced in small pond fisheries being promoted under MGNREGS.

If any new species are found to be favourable in the climatic context and result in economic benefit to the fishers, the details would be submitted to the technical committee members for their technical concurrence.

Activity 2.3: Oxygenation

The oxygen concentration of the tanks goes down with increased temperature. The oxygen squeeze adversely affects the growth of fish and other aquatic organisms. As an adaptive measure, aeration of tanks is essential so that dissolved oxygen content is maintained throughout the year.

The project will adopt following means of aeration:

(a) *Surface Aeration*: To be done through Fountain aeration and/or through Paddle Wheel Aerator.

(b) *Sub-Surface Aeration*: To be done through Jet Aeration to infuse air at the bottom of the pond and/or through Fine Bubble Aeration and/or through Coarse Bubble Aeration.

Activity 2.4 & 2.5: Water Quality and Nutritional Management

A good water condition is necessary for the survival and growth of fish as the entire life process of the fish is wholly dependent on the quality of its environment. The physical, chemical and biological qualities of water would be closely monitored by the fish farmers and the implementing agencies in a periodic interval. The parameters that will be monitored include:

a) Transparency and colour of water;
b) Temperature of tank water;
c) pH level of water;
d) Biological factors;
e) Odour of the fish pond;
f) Dissolve Oxygen Level;

Apart from monitoring the water quality in periodic interval, the quality of in-flow water would also be checked / monitored before it flows in to the tank.

Nutritional requirement of the fished would be supported through micro-nutrient feeding.

Its effects on the public health will be assessed in the mid-term evaluation. The Gram Sabha will be informed and made aware of the potential health hazards and preventive measures for the same.

Health camps by the health department will be facilitated to ensure adequate prevention from vector borne diseases.

Activity 2.6: Establishment of Seed Hatchery/Nursery

On-time supply of quality seeds/fingerlings to the fish tanks is a basic requirement and for that the hatchery/nursery establishment is essential at the cluster level. The current seed/fingerling production and supply capacity of the existing units is limited. Establishment of additional units is required to ensure on-time production of seeds / fingerlings and increasing the availability of fish seed, which is currently a major constraint.

In each district, one seed hatchery, 2 nurseries (0.1 ha) and 1 seed rearing unit (0.1 ha) would be established to supply fingerlings to the fish farmers. The project would promote farming of fingerling for better harvest. An integrated fish husbandry system would be followed in the hatchery / nursery/ seed rearing unit. The husbandry system would encompass nursery phase and Grow-out phase i.e. spawn, fry and fingerling production. In the fish tanks, fingerlings would be released for rearing. The hatchery/ nursery/ seed rearing unit would be located near to the cluster of ponds so that cost of transportation and allied expenses of farmers can be minimised making the unit economically viable.

The hatchery/ nursery/ seed rearing unit would be established as common facility centre for the benefit of participating fish farmers under the project and would be operated by the group.

Component 3: Building resilience for climate adaptation

Activity 3.1 Climate resilience through productivity enhancement

Fishery is a climatic sensitive livelihood activity. In the proposed project area the productivity of pond fishery is well below the national average. At low productivity the vulnerability of small and marginal farmers and fishers to climate stress is higher as compared to the regions where the productivity is higher. Making interventions in the package of practices in small pond fisheries to enhance the productivity along with climate adaptation measures will make the latter resilient and the increased productivity itself will work as an adaptive measure. Secondly, the increased productivity will enable the fisher to be better prepared when projected climatic factors become real at a future date.
Capacity building of fish farmers on scientific and adaptive means of fish farming will be taken up in the three project districts. The women members of the households of fisher community and the private pond owners will be included as participants. The capacity building will be on:

- Improved practices for productivity enhancement
- Adaptive practices in fish farming
- Economics and commercial fish farming practices

The training will be conducted in different phases and will involve combination of class room, experiential learnings and exposure visits. The aim will be bring the fish productivity to an optimal level so that it decreases the vulnerability of the fish farmer to climate stresses.

The Orientation and training of the Gram Sabha members will be conducted to inform the community about the

- Physical and Natural history of the region
- Climate Change indicators
- Adaptation Principles

The entire village residents are the members of the gram sabha.

Activity 3.2 Climate resilient through market and institutional linkages

Institutional linkages of the farmer to institutions in market and with institutions that provide credit and insurance are very important aspect to address value change related issues as well as to ensure sustainability of the project benefits. The same would be ensured through following components will work towards provisioning of security to the small pond fishers.

(a) Market Linkages

Market analysis, Value Chain analysis and Infrastructure assessment of the different fish markets will be undertaken that will form the basis for making technological and market intervention for the small pond fish farmer. These assessments will provide inputs to the fishers in enabling them to develop their respective business plans and make the best possible use of the market opportunities. Training resource, IEC material and other informational materials will be prepared under the project for a wider use within the project districts. Market assessments will not be restricted to only fish as the commercial product from the pond. Potential and possibilities of other water related commercial products will also be assessed, e.g. water chestnuts that complement fish production as well as income from fisheries for the small pond fisher.
Based on the market and value chain analysis the business plan for production and marketing would be prepared with active consultation of fish farmers.
Support for iinfrastructure demonstrations to develop fish routes like ice box, solar chilling facilities to link to larger markets would be provided. Further, models of Hygienic fish markets at least 2 in the district would be developed for demonstration purpose.

(b) Institutional Linkages

Pilot project had led to the development of weather based insurance product for the small pond fish farmer. These and other such insurance products will be bundled with saving and credit products of financial institutions and customised for the small fishers. The project will engage with financial institutions including insurance companies and establish their linkages with the fish farmers in the project area.

Component 4: Knowledge Generation and Management

Activity 4.1 Project Benefit Assessment

The project benefit in terms of cost of adaptation and actual economic return will be assessed during the life of the project. The benefits will be assessed in terms of environmental, social and economic benefits. Specifically a base line and an end line survey will be done to identify and quantify the

benefits that have accrued on account of project's interventions. Mid-term assessment to study the implementation and benefits generated would also be done during project implementation.

Activity 4.2 Knowledge Generating and Sharing Learning

Knowledge generated during the course of the project and its sharing with multiple stakeholders will be undertaken during the course of the project. These learning documents will include:

- Process documentation of the project activities
- Policy analysis with respect to the existing practices vis-a-vis the practices adopted under the project
- Documentation of productive practices for replication

The sharing will be through dissemination of documents through print, digital and audio visual media and also by conducting multi stakeholder workshops at different levels.

B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The project is expected to deliver a set of targeted and interlinked economic, social and environmental benefits, as well as serve as a model for future replication throughout the country. The project will promote a set of innovations, together with partner institutions / organisation that will help create better living conditions for the marginalised fishermen community.

Vulnerable groups expected to be benefited from this project include:

Rural communities: Rural communities including tribal communities and fishermen in particular whose livelihoods are highly dependent on climatic conditions and who are particularly vulnerable to extreme weather events, and dependent on fish farming. The proposed project districts are predominantly inhabited by scheduled tribes and the project will be implemented with these ethnic groups.

Fisher Folk: Fisher folk from the scheduled caste and other backward class who suffer in a regular manner due to the degradation of fragile ecosystems such as forest cover, degradation of catchment, high siltation of fish tanks, high fish mortality due to temperature, less production / productivity of fish etc. would be benefitted directly. Adaptive mechanisms in fishery would ensure their livelihoods and food and nutritional security.

Women: Women of the family and women-headed households deriving major part of their livelihoods from fishery will be benefited directly from the participation in project activities, capacity building inputs and in terms of economic gain and nutritional security.

Fish Businesses: People associated with fish related business activities would be benefitted due to increase in scale of harvest, regularity in fish catch supply and better scope of marketing the increased quantum of produce.

General Local Consumer: With stabilisation in fish production, local consumer can avail nutritional / protein rich food more regularly in a cheaper rate. Because of the local production and demand for farm gate selling, the price would be relatively low in comparison to market price in urban areas and big markets. So, with less purchasing power, poor people can access protein rich food more frequently. This includes people with poor income level. Dependency on preserved fish will reduce and fresh fish would be available to the local rural consumers.

Benefit Areas	Key benefits	Baseline scenario
Social	The proportion of households living below the poverty line is higher in the proposed region. The instances of malnutrition among children and high proportion of distress migration are clear indicators of lack of livelihood security among the population. The situation is compounded by the fact that the agriculture is at low levels of productivity and with variability in climate it is further likely to accentuate the state and situation of farming community. Fish farming is a feasible option for the households to fulfil their nutritional requirements as well as ensuring livelihoods. The principles of inclusion in the project activities will initiate empowerment process of the communities.	Poor social standing of small fish farmers, poor level of education and those considered to be the deprived, vulnerable and marginalised.
Economic	With ensured catch / harvest, economic gain of the fish farmers will enhance from the present level of income from fishery.	Unsecured and poor income of the small fish farmers due to climate variability.
	Changes in income/ earning of the small fish farmers from fisheries is being addressed by developing a package of financial instruments comprising of saving, credit and insurance that will enable the farmer to cope with financial losses arising out of vulnerability from climate change	Poor insurance coverage and credit access to meet the required capital and recurring expenses.
Environmental	Making modifications in the design of the pond so that it creates a buffer against the variability in its water storage capacities based on the local rainfall	At present it is at the maximum of 4-5 months which would increase to 8-10 months
	Reviewing and taking measures in the catchment area of the pond to arrest the rate of siltation	Siltation in the tanks due to denuded catchment and no management of run-off. Treatment can minimise the soil erosion and improve soil profile.
	Introducing fish species that can adapt to climatic variability and yield optimally. This will reduce vulnerability and improve adaptive capacity of the farmer. Protection and recovery of biodiversity with the use of native and adapted	Without the project, the survival rate of species in extreme weather conditions would reduce

Benefit Areas	Key benefits	Baseline scenario
	species.	drastically.
	Improved vegetative cover around the tank area and rehabilitation of pond catchment will improve the green cover status, stabilisation of pond banks, decrease run-off and restoration of top soil.	Denudation in the catchment increase soil erosion through run-off due to rain variability.

A number of environmental benefits are expected to accrue from the project, especially under component 1 and 2. Firstly, the project is to utilise the available rain water to the possible extent for fish rearing and conservation and optimisation of run-off water. Secondly, catchment treatment would be helpful to minimise the soil erosion, better soil water holding, minimise top soil erosion and increasing fertility. Thirdly, temperature regulation mechanisms would help to grow micro-organisms, along with fish in an ambient temperature situation maintaining the diversity in the local ecosystem. Fourthly, increase in green cover around the fish tank. Other environmental benefits to be accrued by this project include water quality maintenance, tank water protection for utilisation in dry condition and carbon sinks.

Activities	Key benefits (Direct)		
	Social	Economic	Environmental
Component 1: Adaptive measures to address rainfall variability			
Technical modification of pond design.		Better harvest, improved economic return from the tanks	Water harvesting, improved water retention
Geographical suitability assessed.	Small / marginal farmers with required holding in different geographical set-ups benefitted		Assessment of existing resources, Drought prone vulnerable areas having water bodies, retention of surface water and water availability for farming
Modification of insurance product		The insurance product would improve the economic risk management in case of failure of the production system	
Construction of fish farming tanks / ponds.		Better economic return to fish farmers	Adaptability to climate variability, increased surface water utilisation
Treatment / rehabilitation of catchment of tanks.	Small and marginal fish farmers get the benefit	Cost of de-siltation reduced, less cost for water quality treatment due to poor soil content.	Minimise run-off, decreased soil erosion, in-situ moisture conservation and vegetative coverage
Component 2: Adaptive measures to address warmer climatic regime			
Pond temperature regulation		Reduced fish mortality and hence increased income	Less surface evaporation minimised surface water temperature and making the environment less prone to fish mortality.
Promotion of climate resilient		Better survival of fish, better harvest and	Meeting fish survival conditions by maintaining

Activities	Key benefits (Direct)		
	Social	Economic	Environmental
fish species		improved return on investment	water level for different fish species. Improved fish diversity in small ponds and in the region
Promoting Poly-culture		Four harvests per year i.e. one harvest cycle per species.	Optimal use of stored water and maintaining diversity based on the feeding habit and feeding zone.
Oxygenation		Reduced mortality of fish and hence better income from harvest	Maintaining dissolved oxygen level suitable for fish survival.
Water Quality Management		Fish production reach optimal level	Ambient condition for fish habitation, survival and growth.
Establishment of seed hatchery / nursery/ seed rearing unit		Economic way of supply of fingerlings , minimised transportation cost due to establishment of infrastructure near the tank cluster	Development of species under local conditions
Component 3:Building resilience for climate adaptation			
Capacity Building	Improved management skill and better understanding of adaptive measures in fishery	Higher productivity of fish leading to higher income	Better management of local environment by the farmers
Market linkages	Increased skills to understand market institutions	Increased access to market and improved terms of engagement	
Financial and Governance Linkages	Increased skills to understand financial and governance institutions	Competitive credit availability for businesses	
Insurance Coverage	Small fish farmers recover part of their investment in worse cases through insurance	Shift of risks and cost recovery	Weather proofing measure
Component 4: Knowledge Generation and Management			
Benefit assessment	Adaptation policies and plans recognise the social imperatives of the small pond fishers	Identification of areas of investment that will enable expansion of productive practices to other areas	Green practices identified and case for replication developed
Knowledge generation and dissemination	Recognition as a key stakeholder in policy development for climate adaptation	Priority areas for economic investment identified	Contribution in the development of green practices and policies

As may be seen from above, implementation of the project will not cause any negative social and environmental impacts. Local communities have been consulted in design of the project and components proposed are in line with the prevalent regulations, policies and standards of National

and Sub-national Governments. Components proposed under the project have been designed with consideration towards the Social and Environmental Policy of Adaptation Fund.

C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

To improve cost effectiveness the project specifically addresses the issue of ad-hoc and small scale adaptation efforts (private ponds). The strategy recognises that though fragmented responses may address a local issue, however, without a combined community based and ecosystem based approach it is unlikely that context specific priorities of local populations will be implemented. The project will help address this concern by specifically aiming to reduce fragmentation by targeting water catchments and promoting an ecosystem approach.

Small adhoc activities often lead to externalities and are hard to bring to scale. The proposed project aims to achieve a large scale impact and avoid externalities as actions will be based on the priority of affected communities. However, this shall be determined only after a project cycle completion in a pilot area. The Government has already put in an enabling framework linking it to MNREGS under a sub-scheme and replication will not be difficult.

The cost of fish farming in 0.5 ha of tank would normally cost around 65% to 70% of the proposed cost in a non-adaptive situation yielding less harvest, more mortality, fewer crops per cycle and high loss to natural eco-system services. With an escalation of 30% to 35% cost in capital heads, the project will gain in areas like increase in water retention capacity of the tanks by 50%, growth in catch by 25-30% in a sustained manner, reduction in fish mortality by 20%, catchment restoration and arresting top soil erosion, saving standing crop at least in 0.2 ha of land from the available tank water during dry spell in monsoon. The additional cost to be incurred towards adaptation can attain breakeven at the end of the project cycle, at least in 40% tanks. So, assuming the life of a tank at 25 years with full operation and required maintenance, a farmer can generate profit at least for a period of 20 years.

The emphasis on participatory decision making, catchment level interventions, and an integrated approach enhances the cost effectiveness of the project. The integrated approach of community based and ecosystem based approaches will promote an integrated package of measures that will build knowledge, awareness, tools and local capacities to address the threats of climate change. The project strategy emphasizes coordination between different organizations and full involvement of communities.

Inclusive development and enhancement in social capital by consciously ensuring gender equity in coverage of project activities and strategizing linkages with banks and insurance companies will enhance cost effectiveness of the proposed project.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications,

or national adaptation programs of action, or other relevant instruments, where they exist.

Key Policies of Central and State Government, on which this project is based are as follows.

SN	Central/State Government Policy	Responsible Agency	Project Component Consistent with the Policy
1	12th Five year plan	Planning Commission, Govt. of India	1. Maintenance of surface water bodies; 2. Concrete effort to engage in the process of de-siltation and restitution of water bodies through treatment of their catchment areas making tanks suitable for storage of rain water and fishery promotion;
2	National Water Mission	Ministry of Water Resources, Govt. of India	1. Designing incentive structures to promote water neutral or water positive technologies; 2. Integrated water resource management helping to conserve water 3. Optimise water use by increasing water use efficiency by 20% 4. Enhancing storage, both above and below ground, special effort to increase water storage capacity;
3	National Mission on Strategic Knowledge for Climate Change	Cross cuts all the Ministries & Department	1. Identifying challenges of and response to climate change 2. Research on socio-economic impacts of climate change, including impact on health and livelihoods 3. Development of innovative technologies for adaptation and mitigation; 4. Research to support policy and implementation
4	Madhya Pradesh State Action Plan on Climate Change	Housing and Environment Department, Govt. of Madhya Pradesh	1. Conservation of fish bio-diversity; 2. Study of impacts of climate change on inland fisheries; 3. Develop agro-climatic zone wise plan for fisheries; 4. Strengthening the existing system of fish management in the State; 5. Capacity building to integrate climate change risk in planning
5	Madhya Pradesh State Fishery Policy, 2008	Department of Fisheries, Govt. of Madhya Pradesh	1. Loan to fish farmers; 2. Janshree Bima Yojana for all fishermen; 3. Use of latest techniques in fishing to improve production.

E. *Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.*

The overall objective of the project is in line with the Fishery Policy of Government of Madhya Pradesh 2008 and adheres to the recommendations of the State Action Plan on Climate Change. Secondly, the project will be governed as per the policy and preference of Government of Madhya Pradesh in adherence to all the specific local criteria. Apart from that the project would also adhere to the national scientific criteria with regard to adaption such as economic, social and environmental benefit etc. The project meets the sustainable fishing guidelines developed by Inland Fishery Research Institute. The environmental norms (water quality) notified with regards to hatcheries will be in conformity with state pollution control board norms. The involvement of the key stakeholders in the Technical committee and the Project Steering committee will ensure compliance with the law.

SN	Activity	Applicable Standards	Application to Project by	Monitoring
	Component 1			
1	Technical modification of pond design	With reference to the MGNREGA (Meenakshi) guideline and Guidelines of Fisheries Dept.	Implementing agency and Dept. of Fisheries	NABARD (NIE)
2	Geographical Suitability Assessment	Technical standards of Fisheries Department	Implementing agency along with Geo-hydrology expert	NABARD (NIE)
3	Construction of Tanks	With reference to the MGNREGA (Meenakshi) guideline and Guidelines of Fisheries Dept.	By implementing agency with technical expert	NABARD (NIE) Dept. of Rural Development
4	Catchment Treatment	Standards of watershed development programme and standards of forest department.	Implementing agency along with expert	NABARD (NIE) Housing & Environment Department
	Component 2			
5	Pond Temperature Regulation	Specification of Fisheries Dept.	Dept. of Fisheries, Govt. of MP along with Implementing Agency	NABARD (NIE)
6	Promotion of selected fish species	Specification of Fisheries Dept.	By implementing agency with technical expert	NABARD (NIE) Dept. of Fisheries, Govt. of MP
7	Oxygenation	Specification of Fisheries Dept.	Dept. of Fisheries, Govt. of MP along with Implementing Agency	NABARD (NIE)
8	Water quality management	Specification of Fisheries Dept.	Dept. of Fisheries, Govt. of MP along with Implementing Agency	NABARD (NIE)

SN	Activity	Applicable Standards	Application to Project by	Monitoring
9	Establishment of seed hatcheries / nurseries	Specification of Fisheries Dept.	Dept. of Fisheries, Govt. of MP	NABARD (NIE)
	Component 3			
10	Training of fish farmer	Specification of Fisheries Dept.	Implementing Agency	NABARD (NIE)
11	Project linkage	Convergence Guidelines of Govt. Institutional framework for fisheries sector	Dept. of Fisheries, Govt. of MP along with Housing and Environment Department	NABARD (NIE)
12	Insurance Coverage	Specification of Fisheries Dept.	Dept. of Fisheries, Govt. of MP along with Implementing Agency	NABARD (NIE)
	Component 4			
13	Project benefit assessment	Approved national standard, Climate Change Action Plan suggested benefits	Housing and Environment Department	NABARD (NIE)

The project is not expected to violate and social and environmental regulations as applicable at National and Sub-national level.

F. Describe if there is duplication of project / programme with other funding sources, if any.

Both central and state Government has a number of schemes that have similar components, except having adaptation mechanism, integrated fishery development perspective and convergent implementation arrangement. Proposed project will take required measures to avoid potential fund duplication with other funding sources for similar activities. Some of the potential schemes/programmes of Government that have complimentary components are as follows.

SN	Project	Objectives	Complementarities	Geographical Coverage	Agency
1	MGNREGS	Wage employment (unskilled) and asset creation	Mainstreaming of adaptation strategy developed under the project	All Districts	Panchayat and Rural Development Department, Govt. of MP
2	National Rural Livelihoods Mission	Rural Livelihoods promotion through women collective	Fishery as one of the livelihoods components (financial support for fish farming & enterprise)	10 Districts	Panchayat and Rural Development Department, Govt. of MP
3	RKVY	Holistic development of agriculture and	Enhancing fish production	All Districts	Ministry of Agriculture & Department of

SN	Project	Objectives	Complementarities	Geographical Coverage	Agency
		allied sector to achieve 4% annual growth			Fishery, Govt. of MP
4	Development of inland fisheries & aquaculture (Development of freshwater aquaculture)	Development of fisheries to strength food security, generate employment opportunities, improving the socio economic status of fishers and other people engaged in the sector.	Construction of new ponds Reclamation/renovation of ponds/tanks Cost of inputs Integrated fish farming Support for aerators / pumps Fresh water fish seed hatchery Fish feed unit Training of fish farmers Transportation of fish seed	All Districts	Dept. of Fisheries and Ministry of Agriculture
5	National Mission for Protein Supplements (NMPS)	Intensive aquaculture in ponds / tanks along with reservoir fishery development and aquaculture development through integrated approach for protein supplement	Construction of Nurseries / hatcheries Capital cost for construction of battery of cages Input cost Establishment of infrastructure like cold storage, ice plant, insulated truck, marketing/retail outlets	All Districts, based on feasibility	Dept. of Fisheries and Ministry of Agriculture
6	National Fishermen's Welfare Fund	Welfare of the fishermen community	Personal accident insurance Savings cum relief plan	All Districts	Dept. of Fisheries and Ministry of Agriculture

G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Component 4 of this project describes both the cross-cutting and specific knowledge management functions that will be undertaken in this project. These include stocktaking and monitoring of various project indicators, as well as the creation of a Climate Change Observatory that will function as a clearing house for information related to project themes.

Climate Change Observatory (CCO) is in the form of a committee comprising of community of practitioners (traditional fisher folk and present fishers); representatives from three tier Panchayat Raj Institutions; experts on fisheries from Fisheries Department and service providers (financial institutions/ insurance companies). CCO will review data generated as part of the project's experiences, climate data from local and IMD sources, and data on adaptation practices in fisheries

from other places. CCO will function under overall guidance of the Technical Committee and Project Steering Committee (PSC). Functioning of CCO involves holding of periodic meetings at the district level, the cost of which will be borne out of the project execution cost and hence no separate budget is indicated. There will be policy briefs and operational manuals for wider dissemination and policy linkages based on project lessons. It is expected that the Climate Change Observatory will become the prime mechanism whereby adaptation knowledge is transformed into policy-relevant tools to be used at the national and local level.

In order to focus on concrete adaptation activities, however, this project focuses on the necessary elements of climate resilience and learning the successful activity implementation and policy linkages, and will work with other projects and initiatives to disseminate information as cost-effectively as possible. The project will generate / record and disseminate explicit as well as tacit knowledge. Explicit knowledge will be generated and shared with different stakeholders during meetings, workshops and seminars and/or through publication. Tactical knowledge (learning generated through implementation experience) will be documented in shape of process learning document for sharing / publication.

The specific steps for replication of tested methodologies will be undertaken through:

1. Presentation of the tested methodologies in the meetings of the Project Steering Committee (PSC), which has membership from key departments of Government (Fisheries and Rural Development).
2. Developing Good Practice documents as part of process documentation.
3. Sharing the Good Practice documents with:
    - members of Climate Change Observatory/ Committee
    - community of practitioners through the existing e-groups
    - other stakeholders- financial institutions, insurance companies
    - Civil Society networks involved in Natural Resource Management and/or Livelihood Enhancement
4. Presentation to stakeholders like the Fishing Federation
5. Presentation to Academic institutions

Quantified data and analysis will be prepared during implementation to monitor the viability of the investments (cost-benefit analysis) as well as sustainability. Such analyses will be reported and used as part of the rationale for future up-scaling/replication

Key areas of learning and knowledge generation, its documentation and sharing would be as follows.

1. Production comparison: Fingerling Vs Yearling (in a pre-post project situation);
2. Water quality maintenance and its relation to fish production / productivity;
3. Success of temperature regulation through vegetative and shed means;
4. Temperature variation and mortality of different fish species;
5. Water level variation and tank productivity by fish species;
6. Water oxygenation and dissolve oxygen level linked mortality of fish species;
7. Benefit of catchment treatment & its linkage to water level and water quality;
8. Livelihoods security, income and annual catch improvement (pre-post project).

The knowledge management system, to be adapted in the project is multi fold i.e. through (1) technology base i.e. web-site / library linkage and sharing through social media sites, (2) publication mode in shape of reports / research papers etc., and (3) interactive mode i.e. seminars and workshops.

H. *Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.*

Before the preparation of the concept proposal, consultations were conducted in different rounds with people of the region (community in general and fish farmers in particular), different Government and non-Government agencies, members of the local Panchayati Raj institutions, different agencies working at district and sub-district level and independent development professionals. As this project is the outcome of a one and half year's pilot intervention in the proposed region, interaction with community, PRIs, fish rearing farmers, fish traders, Government agencies at district and sub-district level etc. were consulted in a regular manner. The list of the agencies contacted in the preparation of the project is as follows.

Government Departments:

- Department of Rural Development, Government of Madhya Pradesh;
- Department of Fishery, Government of Madhya Pradesh;
- Housing and Environment Department, Government of Madhya Pradesh

Panchayati Raj Institutions:

- Elected Panchayat Members at the Gram Panchayat level;
- Elected Panchayat Members at the Block level;
- Elected Panchayat Members at the District level;

Community Level:

- Individual fish farmers;
- MGNREGS beneficiaries
- Community in General (villagers)

SN	Date	Place	Objective	Participants	Outcome
1	23.7.2013	Bhopal (State Capital)	Discussion on the project components	Implementing agencies and fishery expert	Project feasibility discussed and study reports reviewed
2	24.7.2013	Bhopal (Dept. of Fishery, Govt. of MP)	Exploring the project feasibility and support provision of Fishery Department, Govt. of MP	Director, Dept. Of Fishery; Additional Director; Dept. Of Fishery; Fishery Expert and other Officials of Fishery Department.	Review of project components by Officials, agreed on improving the depth of the tanks for increased water retention, other additional adaptive options explored
Note: Consultation with community, Dept. of Panchayat and Rural Development, Department of Fishery and Dept. of					

Housing and Environment was regular and more frequent due to the association in the pilot project.

Local communities have been consulted in design of the project and components proposed are in line with the prevalent regulations, policies and standards of National and Sub-national Governments. Components proposed under the project have been designed with consideration towards the Social and Environmental Policy of Adaptation Fund.

I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Component 1: Adaptive measures to address rainfall variability

Baseline Scenario: In-land fish farming remains a possibility only during monsoon (June to October) in a rain-fed situation. In a scarcity of precipitation and skewed distribution situation, this option also goes out of the hand of fish farmers. Availability of water in the tank, as per the present design can be for a maximum of 4-5 months and in many cases, getting a good harvest also becomes difficult for the fish farmers. Prior to this proposition, a detail participatory study was conducted in one of the proposed project district of Madhya Pradesh (Dhar) which reflects a number of factors that are not conducive for fish rearing such as poor depth of the tank, denuded catchment, poor tank maintenance etc.

Present construction of tanks, as per the technical specification does not address these issues. Further, the design also does not take in to account the temperature and wind related evaporation which is common to all water bodies. As a result, very less or no water remain available in the tanks for fish rearing after monsoon.

In the absence of adaptation fund support, the present system of fish farming is expected to continue as Government is having stipulated tied fund provision for different components. Provisioning of additional fund in to the existing plan/programme to meet the cost of adaptation is cumbersome unless its benefit dimensions are demonstrated successfully and fish farmers realise the benefit.

Adaptation Alternative: under the proposed component the design of the farm pond is proposed to be modified so that the water retention capacity is improved. This is expected to improve prolonged fish rearing and good harvest of fish. Further, the catchment treatment would reduce the siltation of the ponds and maintain the water depth for fish rearing. The insurance product proposed to be developed would address climate risks associated with the fish production system.

Component 2: Adaptive measures to address warmer climatic regime

Baseline Scenario: Experience gained during one and half year of direct association with in-land fishery shows that required adaptive measures to climate variability is deficient in many ways in most parts of the State. Even in commercial firms in different other districts, the adaptive measures are inadequate. The study conducted in one of the project districts further reveals that there is no initiative to maintain the quality of fish habitation, no measure for temperature regulation, maintaining dissolved oxygen level, water quality monitoring etc. Supply of good quality fingerings is also important constraints due to non-availability of adequate hatcheries.

Adaptation Alternative: under the proposed component climate resilient fish species would be promoted in the specially designed tanks. Multi- layer fish farming would be introduced with plantation in catchment area. The component would help in diversification of fish species and temperature regulation of ponds as adaptive measure in warmer climate regime. The fish hatcheries/ nursery/ seed rearing unit component would help is supply of good quality fingerings and yearlings. Presence of these hatcheries near production centre would also reduce transportation cost as well as improve survival.

Component 3: Building resilience for climate adaptation

Baseline Scenario: As most of the fishermen are small and marginal in their operation, it becomes difficult for them to make required investment in this regard. Secondly, as fish farming is more seasonal in character, no farmer is willing to make additional investment as it will cost them more than what they get from the harvest. Thirdly, required additional investment support also does not come from other sources due to tied nature of the fund and missing adaptation perspective in fish rearing. Further, marketing and other backward / forward linkages are either weak or non-existing due to poor institutional support.

Adaptation Alternative: under the proposed component the capacity building needs of fisheries community is taken into consideration. The component includes training and capacity building, insurance coverage etc. The components also aims to link entire aspects of value chain related to fish production proposed under the project. Adaptation fund can help in bridging persisting gaps and fostering adaptive practices in fish rearing.

Component 4: Knowledge Generation and Management

Baseline Scenario: Government is having a number of schemes / programmes that helps in building the capacity of the fish farmers. But the imparted knowledge is more traditional in nature and of less importance for climate responsive adaptive practices. As a result, the fish farming methods, adapted are also traditional in character. On the other hand, the existing formal mechanism is deficient to record and share innovative practices and coping mechanism. It is expected that with adaptation fund, available knowledge on adaptation in fishery sector will percolate to the farmers end, and farmers would adopt practices that are climate resilient and by that their annual catch position would improve.

Adaptation Alternative: The proposed components would include process documentation, documents indicating social, environmental and economic benefit of the proposed model, development of evidence based strategy for inland fish production.

Funding is requested to the Adaptation Fund Board in order to start up concrete adaptation activities in fishery sector to improve the resilience to climate variability and change. The project covers the full cost of adaptation in the western regions of Madhya Pradesh. Specific reasoning for adaptation funding is as follows.

1. Through the construction or rehabilitation of climate suitable tanks, there would be availability of water, at least for a period of 8 months which will help in fish farming in a more sustained and profitable manner (climatic adaptation for better survival and growth);
2. Water quality maintenance would keep the pond ecosystem clean and suitable for fish species to grow. By temperature and water quality regulation, farmer's adaptive capacity to the changing climatic conditions would improve to a great extent;
3. Catchment based planning and treatment of catchment would further help to adapt to increasing temperature, minimizing soil erosion and there by pond siltation and restoring soil moisture content;
4. The use of fingerlings, instead of spawn would be helpful to minimise the mortality of fish, ensuring appropriate growth and hence better economic return (economic adaptation);
5. Apart from natural aeration, artificial mechanised aeration would be further helpful to maintaining the dissolve oxygen level and there by improved fish survival.
6. New management practices and system will be adopted by fishery extension system in rain-fed area
7. A convergence model for integrating programs of poverty alleviations/ rural development, fisheries development, and financial institutions.
8. A policy framework on 'Climate Change Resilient inland Fisheries in Rain-fed Areas' evolved through integrating scientific production technologies, appropriate community institutional systems and management practices .

J. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

The project has inbuilt sustainability enhancing design parameters which would continue beyond the life of the project. The sustainability parameters of the project are many folds and interlinking i.e. (1) related to the physical / structural, (2) economic and (3) operational aspects. With increased economic return, tanks under fish farming would continue for a longer period. The tanks, with annual maintenance as suggested, would be having a life span of minimum of 20 years where farmers would continue doing fishing. Secondly, the life of the hatcheries, with required production, supply and maintenance would be more than 25 years as it will be financially and technically linked with the Department of Fishery for the production of fingerlings and with nursing firms. The vegetative and mechanical measures taken in the catchment would also continue with a refilling and rehabilitation mode and with active participation of the fishing and general community. In the economic sphere, the tanks would be utilised for fish farming and economic return to fish farmers would continue in a longer run. The sustainability and economic return can be guaranteed due to direct and increased return.

The project will take a livelihood-based approach to adaptation developing asset / capital base of individual / community in a participatory model. Four types of capital base will be created i.e. human capital, natural capital, physical capital and financial capital. The human capital will be formed through developing adaptive knowledge and skill base of fish farmers whereas physical capital will be in shape of tanks and hatcheries. The natural capital will be the catchment treatment measures, water quality management, temperature regulation and providing an ambient atmosphere

for fish farming in the tanks. This will impact on building the financial capital of the small and marginal fish farmers, which will also be strengthened by linking the fishers directly to savings and credit and insurance products. All these will lead to improve the adaptive capacity, both at household and community level. Combined impact of these components will ensure the sustainability of the outcome in the long run.

The proposed project approach and strategies contributing to sustainability are as follows:

1. The institutional arrangement for implementation of the project is based on the institutional capacity and its operational mandate given by State and National Government. This will help to synergise the outcome in future plan and policy of Government;
2. Strengthening the Capacity of the fish farmers and service providers on adaptive mechanism will percolate down further with emerging best practices and learning lessons. The cascading of learning will help the fishing community in general and small and marginal fish farmers in particular to follow scientific adaptive practices;
3. Collaboration with Fish Farmer's Cooperative/s and regular sharing of learning with them would further help to cascade the learning to a larger section of the fishing community;
4. The project is expected to create a model which could be replicated and up-scaled through existing government programmes like MGNREGS.

In addition to increasing the local capacity in the stakeholder groups through training and project support, maintenance and replication of the infrastructure put in place will be ensured through a system of MoU between the Executing Entity (TAAL) and the beneficiaries, with the participation of Gram Sabha (a peoples body under Gram Panchayat)

As indicated in the project report, the project is expected to create a model which could be replicated and up-scaled through existing government programmes like MGNREGS which is being implemented through Gram Panchayat.

Based on the data and analysis that will be undertaken during implementation, the viability, sustainability and replicability of the model will be tested. The tank construction and maintenance unit cost ($15,500) per fish farmer is a significant investment for livelihood enhancement. Actual per fish farmer output, revenues, savings performance and savings mechanisms will be monitored. Also the potential for cost reduction, additional value added and future financing options, will be monitored and assessed for use in replication and expansion of the project.

K. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

Checklist of environmental and social principles	**No further assessment required for compliance**	**Potential impacts and risks – further assessment and management required for compliance**
Compliance with the Law	• The project complies with Environment (Protection) Act, 1986 and Forest Conservation	None

	Act, 1980. • Further the project complies with MP Land Revenue Code (for ownership of land); MP Panchayat Raj and Gram Swaraj Act (local governance); and other administrative orders of Subnational Government.	
Access and Equity	• The project provides fair and equitable access to the project beneficiaries and will not be impeding access to any of the other requirements like health clean water, sanitation, energy, education, housing, safe and decent working conditions and land rights. • The project has the component of regular water monitoring. In case the quality of water will get affected mitigation measures will be undertaken. • The project will design ponds for small and marginal landholders as much as it will for other landholders. • The proportion of benefits that will flow to each category of landholder will be determined in consultation with the Project Steering Group.	None
Marginalized and Vulnerable Groups	The beneficiaries of the project will be tribal communities residing in the proposed project area. The other community that will benefit will be the traditional fishers who are also categorised as scheduled caste. In both the cases the marginalised groups will benefit from the project. The Technical assessment and Baseline and Project Benefit Assessment includes identification of impact on marginalised groups.	None
Human Rights	The project does not foresee any violation of human rights	None
Gender Equity and Women's Empowerment	Project would ensure participation by women fully and equitably, receive comparable socio-economic benefits and that they do not suffer adverse effect. The beneficiary related activities, e.g. training, exposure visits, will include women so as to enable them to develop their capacities and strengthen their skill base. In addition the Fish Farmers Associations (ref. Implementation Arrangement) that will be formed will have representation of women so that they also participate in the project related decision making process (ref point 2 of Part II)	None
Core Labour Rights	Payments to labour under the project will be made as per Government approved norms duly following minimum wage rate and hence ensuring core labour rights.	None
Indigenous Peoples	Not applicable to this project	None
Involuntary Resettlement	The project does not displace any community and hence issue of resettlement does not arise	None
Protection of Natural	Project does not affect any of the natural habitats	None

Habitats		
Conservation of Biological Diversity	The fish species proposed to be promoted under the project are native and endemic to the area. The project would not cause any impact on bio-diversity values.	None
Climate Change	The project is basically for enhancing the adaptive capacity of the fisherman community against adverse impact of climate change and is not expected to contribute to GHG emissions	None
Pollution Prevention and Resource Efficiency	Project is not expected to create any environmental pollution and aims for higher resources efficiency for better management of available natural resources like water, fish species, plantation species (locally available), etc. In order to further ensure the same, water quality monitoring will be regularly undertaken to assess whether the water bodies created under the project are not being subjected to in flow of pollutants from nearby fields. Mitigation measures will be implemented for water bodies where the pollution levels are found to exceed national and international standards.	None
Public Health	No adverse impact on public health related issues is envisaged. However, considering that with creation of water bodies there is possibility of increase in vector borne diseases. The Gram Sabha (local governance structure) will be informed and made aware of the possible increase in incidences of diseases and the preventive measures for the same. The project will conduct health camps and will specifically focus on vector borne diseases.	None to low
Physical and Cultural Heritage	No adverse impact on cultural heritage related issues is identified.	None
Lands and Soil Conservation	Creation of farm pond and catchment area treatment is envisaged to help in land and soil conservation and will not create any damage to land & soil resources.	None

In view of the above the project is categorized as **"Category C"** with no adverse Environmental or Social Impacts.

As indicated earlier project districts are predominantly inhabited by scheduled tribes. The implementation of the project is expected to provide benefits to these communities. As such no adverse impact is envisaged to the people belonging to Scheduled Tribes or any other marginalized groups in the project area. However, the project will identify and ensure that the provisions of the UN Declaration of the Rights of Indigenous people are strictly adhered to.
The AFP's Environmental and Social Policy (approved in November 2013) will be made available to project stakeholders and promoted through training and dialogue with implementing agencies to build a common understanding of the principles and practices that have been adopted to enhance development benefits and avoid unnecessary harm to the environment and affected communities. Any potential impacts on marginalized and vulnerable groups will be properly screened and considered by the implementing agencies.

PART III: IMPLEMENTATION ARRANGEMENTS

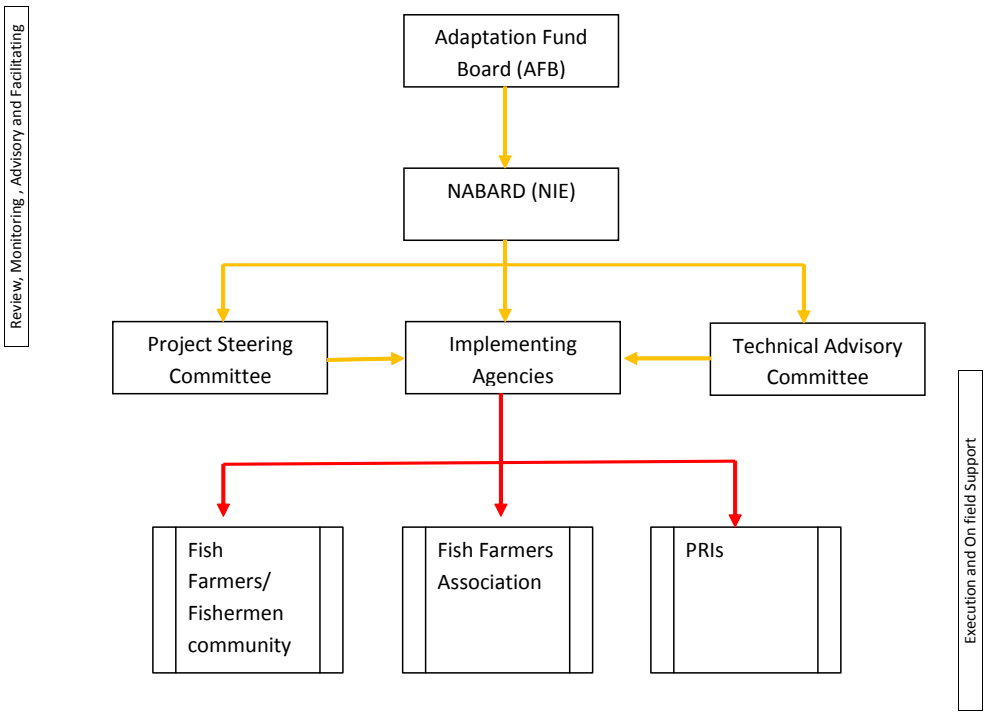
A. Describe the arrangements for project / programme implementation.

The project would be implemented through a strategic institutional arrangement, headed by the NIE (NABARD) which will cater to the requirement of different components of the project. The project will have following institutional arrangement.

Project Steering Committee (PSC): The project would be steered by a panel of members, comprising from Government institutions, non-Government agencies and independent advisors (based on the requirement). The National Bank (NABARD-NIE) would act as the convenor of the steering commit. The members to be a part of the committee would be from State Government Departments viz., Department of Rural Development, Department of Housing and Environment, Department of Fisheries and representatives of the implementing agencies.

Ground Implementation: The project would be implemented at the ground with the support of local NGO/s and their consortium. Initially, TAAL, a local organisation along with MART would be associated in the implementation of the project. In due course, more agencies may be associated, based on the requirement.

The implementation of the project would be supported by a sub-committee of PSC comprising of a team of experts in the areas of fisheries, geo-hydrology, etc.



B. Describe the measures for financial and project / programme risk management.

Expected Risks	Perceived Risk Level	Proposed Mitigation Measures
Operational: On-time support from Government Departments	Medium	Prior approval of the association with proposed Govt. Departments. Govt. agencies as part of the Project Steering Committee to discuss and expedite the support
Operational: Expected procedural delay in the construction of tanks	Low	Procedural delays are not anticipated implementation is thorough NGO.
Environmental: Occurrence of continuous drought situation may affect the water availability and fish farming	High	Nearby available alternative sources of water would be utilised for filling the tanks. Harvesting the run-off (in less precipitation situation), its quality assurance and utilisation for fish farming
Financial: Resource allocation / and flow of resource from AFB to NIE and to Implementing Agencies.	Low	The proposed steering committee would review the progress and facilitate the process of fund release based on the progress against the plan

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

The project is categorized as **"Category C"** with no adverse Environmental or Social Impacts and hence no additional measures for risk management are envisaged.

However, implementation mechanism is designed to take care of social and environmental risks as per the AFB's Policy. The principles of the environmental and social policy of the adaptation fund have been included in each of the project activities. The Technical Assessment will have hydro geological zoning exercise which will make an assessment of individual ponds and will take an area approach and make assessment of

- Existing and proposed water bodies in the block.
- Possibility of water logging in selected sites
- Existing natural habitats in the region
- Potential natural habitats which need protection
- Sites with unique natural value
- Physical Cultural resources

- Relevant and Important aspects of the Biodiversity of the area
- Relevant and Important aspects of the Eco services of the area

The Pond design/construction, catchment treatment, introduction of fish species etc. will be based on the regional biodiversity and eco services requirements so as to ensure enhancement of natural resources. All measures will be taken to avoid degradation of natural resources, physical and cultural heritage.

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The project will follow the monitoring, supervision and evaluation guidelines, issued by the AFB and in accordance to the government procedures. NABARD will develop a monitoring and evaluation plan during the project's inception phase that will be shared and presented to all stakeholders in the Inception Workshop. The emphasis of the monitoring and evaluation plan would be process and outcome monitoring, documentation of the key processes and documentation of learning. Both physical and financial monitoring would be done by the NIE (NABARD). The NIE would also monitor the project risks and mitigation strategies adapted on regular basis. While the project progress monitoring would be on quarterly basis, financial monitoring would be once in six months. The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify required corrective measures, if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term.

At the end of the project, an independent final evaluation will take place after the completion of the project period, preferably within one month of completion of project duration. The Final Evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the Mid-Term Evaluation, if any such correction took place). The Final Evaluation will assess the impact and sustainability of results, including their contribution to capacity development and the achievement of adaptation benefits. The Final Evaluation will also recommend for follow-up activities. Apart from regular monitoring and supervision, there would be quarterly project review, to be conducted by the NIE based on the quarterly monitoring report. Necessary corrective measures would be introduced on quarterly basis so that project realise its objectives as per the plan.

Technical monitoring of the project would involve soil and water quality monitoring at periodic intervals. Socio-economic benefits would also be monitored periodically. Monitoring and evaluation plan would essentially include, review by PSC / technical committee, on-field monitoring (structured) annual project progress reporting, mid-term evaluation, ex-post evaluation and final project completion reporting.

E. *Include a results framework for the project proposal, including milestones, targets and indicators.*

Component 1: Adaptive Measures to address rainfall variability					
Outcome 1: Increasing water retention capacity of the tanks as an adaptive measure to address rainfall variability by modifying technical specification of the tanks					
Activity	**Output**	**Indicator**	**Target**	**Baseline**	**Means of Verification**
Technical modification of pond design.	Pond design modified from 1.2 to 2 m depth to at least 4 m depth	Modified technical specification and tank design	One sketch for each site, based on hydro-geological suitability	Technically specified tank design under Govt. scheme with less suitability for fish farming	Sketch of the design
Technical modification- Insurance product	Insurance product that covers losses from future climatic projections developed	Insurance product developed	One insurance product that covers losses from future climatic projections	There is no product that covers fishers against losses from climatic changes	Insurance product
Construction of pond according to modified design	Tanks / ponds constructed/ repaired based on modified design	Fish farmers with at least 05 ha land selected and tanks constructed	A total of 75 fish farmers selected i.e. 25 fish farmers per district.	Selection as per norms	List of fish farmers and photo documents
Treatment / rehabilitation of catchment of tanks.	Available catchment of the tanks treated through vegetative and mechanical means	Catchment of all ponds treated suitably	A total of 37.5 ha. of area treated / rehabilitated	No measures for treatment of catchment under Govt. Scheme	Report on treatment and physical verification / observation
Component 2: Adaptive measures to address warmer climatic regime					
Outcome 2: Diversification of fish species and temperature regulation of ponds as adaptive measures to warmer climatic regime					
Activity	**Output**	**Indicator**	**Target**	**Baseline**	**Means of Verification**
Promotion of poly culture through selected fish species	Four types of fish species promoted in all the ponds covered under the project.	Fish species promoted are *Catla catla, Labeo rohita, Cirrhinus mrigala and*	Four species in 75 ponds	In practice in commercial tanks but not adhering to the 4 species norm	Field observation

		Cyprinus carpio			
Pond temperature regulation	Temperature regulation mechanism in all ponds	Shades and plantations	In all the 75 ponds	No mechanism in place	Temperature measurement report & field testing
Oxygenation	Oxygenation by natural/ mechanical aerators	Mechanical aerators and oxygen concentration	In all the 75 ponds	No mechanism in place in most cases	DO level measurement report and water testing
Climate resilience through Water Quality Management	Pond water quality in all ponds assessed and maintained	Water quality suitable for fish farming in tank	In all the 75 ponds	No maintenance of water quality	Water quality test report and water quality testing at field
Climate resilience through establishment of seed hatchery / nursery/ seed rearing unit	Seed hatchery/ nursery/ seed rearing unit established in each district.	Production of fingerling and yearling	3 seed hatcheries. 2 nurseries and 1 seed rearing unit	Seed hatcheries / nurseries/ seed rearing unit existing with inadequate production	Field observation and production report review
Component 3: Building resilience for climate adaptation					
Outcome 3: Making small pond fisheries climate adaptation resilient through productivity enhancement by capacity building and institutional linkages					
Activity	**Output**	**Indicator**	**Target**	**Baseline**	**Means of Verification**
Climate resilience through Capacity Building	Fish farmers trained on adaptive farming system	Scientific fish farming in a suggested adoptive way	3 phase training for each farmer, one exposure and participation in one demo.	Capacity building measures in fishery is taken in general and not from climatic standpoint	Training report, list of participants and learning document from exposure visits
Climate resilience through Project Linkage with government	Project linkage established with Govt. Dept.	Support rendered by Govt. Dept.	Linkage with 4 Govt. Dept. In terms of accessing technical and financial support	Convergence guideline in place which is to be optimised	Funds and technical support
Climate	Fish farmers	Business	75 business	No business	Business plan

resilience through linkage with market institutions	have their respective business plans	plans	plans	plan prepared	with farmers
Climate resilience through linkage with financial institutions	Fish farmers linked their fishery activity to savings, credit, insurance and other securities	Fish farmers users of institutional linkages	75 fish farmers linked to financial services	No linkage with insurance at present	Insurance policies and financial transaction papers
Component 4: Knowledge Generation and Management					
Outcome 4: Preparing and disseminating evidence based resilient climate change adaptation strategies for inland fisheries for small pond fishers					
Activity	**Output**	**Indicator**	**Target**	**Baseline**	**Means of Verification**
Project Benefit Assessment	Project benefit in terms of quality and quantitative achievement recorded	Qualitative & quantitative project benefit indicators	Two structured assessment	Performance parameters more from production and not from climatic issues	Assessment report
Knowledge Sharing	Process documentation and using existing platform for sharing the learning	Better understanding of different other stakeholders and their awareness	1 State level learning sharing workshop for 100 participants covering institutions from national level	No such national sharing of experiments and experiences at the state level	Workshop minutes, participants list and stakeholder interaction

F. Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

Project Objective	Project Objective Indicators	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
OBJECTIVE 1: Increasing water retention capacity as an adaptive measure to address rainfall variability by modifying technical	Climate vulnerability and exposure risk decreased in fishery sector	Improved water availability for fishery through scientific design and adaptive measures	Water retention capacity of the tanks increased by 50%	**1176750**

Project Objective	Project Objective Indicators	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
specification of the tanks				
OBJECTIVE 2: Diversification of fish species and temperature regulation of ponds as adaptive measures to warmer climatic regime	Improved livelihood security through adaptive farming mechanisms.	Semi-intensive mode of selected fish species farming in the tanks	Decreased mortality, higher survival and income growth	158300
OBJECTIVE 3: Making small pond fisheries climate adaptation resilient through productivity enhancement by capacity building and institutional linkages	Livelihoods sustainability, improved nutritional security and enhanced income for project farmers	Adaptive capacity of the fish farmers increased with resilient adaptive measures	At least 75% fish farmers having adaptive measures	73213
OBJECTIVE 4: Preparing and disseminating evidence based resilient climate change adaptation strategies for inland fisheries for small pond fishers.	Knowledge dissemination, process documentation and learning.	Climate resilience fish farming model standardised and knowledge on the same disseminated to other farmers in the state.	Design and operational details available for wider dissemination of technology. Preparation of Documentation for adoption of the climate resilience fish farming.	41293

Project Outcomes	Project Outcome Indicator (s)	Fund Output	Fund Output Indicator	Grant Amount (USD)
1. increasing water retention capacity of tanks as an adaptive measure to address rainfall variability by modifying technical specifications of the tanks	Improved water availability for fishery through scientific design and other adaptive measures	1.Modified technical specification and tank design 2.modified insurance product 3. treatment of catchment area	1. No. of Ponds with modified design constructed 2. No. of fish farmers covered with comprehensive insurance product 3. catchment area treated	1176750
2. Diversification of fish species and temperature regulation of	Adoption of semi-intensive fish farming with species resilient to	1. Climate Resilient fish species promoted in the specially designed	1. no. of ponds adopting climate resilient fish farming	158300

Project Outcomes	Project Outcome Indicator (s)	Fund Output	Fund Output Indicator	Grant Amount (USD)
ponds as adaptive measures to warmer climatic regime	climate change	tanks; 2. Plantation of surrounding pond area done 3. Paddle wheel aerators (green-tech) in the ponds installed and used 4. Seed hatcheries /nurseries/ seed rearing units established for ensuring local availability of quality fingerlings and yearlings.	2. Area covered under plantation 3. No. of paddle wheel aerators installed. 4. no. of hatcheries/ nursery/ seed rearing units established and their production capacity.	
3. Making small pond fisheries climate adaptation resilient through productivity enhancement by capacity building and institutional linkages	Adaptive capacity small fish farmers increased with resilient adaptive measures.	1. Productivity enhanced towards optimal level. 2. Appropriate institutional support for backward and forward linkages	1. no. of fish farmers trained 2. No. of farmers benefited from market assessment, business plan and linkages to financial services	73213
4. Preparing and disseminating evidence based resilient climate change adaptation strategies for inland fisheries for small pond fishers	Mainstreaming of demonstration models with modified design	1. Project benefit document prepared 2. Annual process document prepared 3. Evidence based Resilient climate adaptation strategy for inland fisheries developed	1. Project benefit document available 2. Process and learning document available 3. Document on quality monitoring, process & learning available	41293

G. Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

SN	BUDGET HEADS	Unit	QT.	Unit	QT.	Unit Cost (US $)	Total Amount US $
1	**COMPONENT 1**						
1.1	Hydro-geological assessment and Modification of Design	Blocks	2	Dist.	3	3333	10000
1.2	Modification of Insurance product	product	2	Dist.	3	1000	3000

SN	BUDGET HEADS	Unit	QT.	Unit	QT.	Unit Cost (US $)	Total Amount US $
1.3	Construction of Tanks	Tanks/dist.	25	Dist.	3	375000	1125000
1.3.1	Repair and Maintenance of Tanks	Tanks/dist.	25	Dist.	3	12500	37500
1.4	Catchment Treatment	hectare/dist.	5	Dist.	3	417	1250
	Sub-Total						**1176750**
2	**COMPONENT 2**						
2.1	Temperature Regulation of Ponds (Plantation of Surrounding Pond Area)	hectare/dist.	5	Dist.	3	583	1750
2.2	Poly culture Fingerling Support (Part support)	Ponds/dist. for 3 years	25	Dist.	3	15625	46875
2.3	Oxygenation (Paddle Wheel Aerators / Other Aerators) and its maintenance	Units	25	Dist.	3	7708	23125
2.4	Water Quality Measurement & Maintenance	Units	25	Dist.	3	4167	12500
2.5	Feeding -Micro-nutrient etc. (Part support)	Units/dist.	25	Dist.	3	6250	18750
2.6	Construction of Hatchery units	Units	1	Dist.	3	8333	25000
2.6.1	Nursery Unit(0.1 ha)	Units	1	Dist.	3	5883	17650
2.6.2	Seed Rearing Unit (0.1 ha)	Units	1	Dist.	3	3800	11400
2.6.3	Transportation of Fingerlings	Units/dist.	25	Dist.	3	417	1250
	Sub-Total						**158300**
3	**COMPONENT 3**						
3.1	Training and Capacity Building	Units	5	Dist.	3	2967	8900
3.2	Marketing and Infrastructure Support	Units		Dist.	3	14167	42500
3.3	Market and Value chain assessment	Study	3	Dist.	3	3000	9000
3.4	Business Plan Prepared	Units/dist.	25	Dist.	3	3000	9000
3.5	Linkages with Financial Services (banking/federation/financial institutions)	Units	25	Dist.	3	1000	3000
3.6	Insurance Coverage (premium part)	Units/dist.	25	Dist.	3	271	813
	Sub-Total						**73213**
4	**Component 4**						

SN	BUDGET HEADS	Unit	QT.	Unit	QT.	Unit Cost (US $)	Total Amount US $
4.1	Baseline Project Benefit Assessment	No.		No.	1	8118	8118
4.2	Mid-Term Evaluation	No.	1	Times	1	7488	7488
4.3	Process & Learning Documentation	doc/year	2	Dist.	3	2763	8288
4.4	Process & Project Quality Monitoring	units/year	2	Dist.	3	3300	9900
4.5	Awareness (Leaflets / pamphlets)	Document	4	Dist.	3	1667	5000
4.6	Project Inception Workshop (State Level)	No.	1	Year	1	1800	2500
	Sub Total						**41293**
	TOTAL						**1,449,555**
E	Project / Programme Execution Cost	9.50%					152,163
F	**Total Project / Programme Cost**						**1,601,718**
G	Project/Programme Cycle Management	8.50%					136,146
	Amount of Financing Requested						**1,737,864**

H. Include a disbursement schedule with time-bound milestones.

Instalment No.	Percentage	Amount ($)	Year	Milestone
First Instalment	25%	434466	October 2014	1. Completion of inception workshop 2. Geo-hydrological assessment 3. Site finalisation 4. Farmer mobilisation 5. Completion of baseline 6. Monitoring, Evaluation & Learning framework 7. Finalisation of site specific maps 8. Start of tank construction in 15% sites
Second Instalment	25%	434466	April 2015	1. Annual review and planning 2. Completion of 25% tanks 3. Start of work of hatchery units 4. Four monitoring (quarterly) 5. New tank construction – 25% started
Third Instalment	25%	434466	April 2016	1. Start of operation in 25% tanks 2. Functioning of hatchery unit 3. Start of work in remaining 50% tanks 4. Adaptation benefit assessment in tanks
Fourth Instalment	20%	347573	April 2017	1. Start of operation in 100% tanks 2. Adaptation benefit assessment-all tanks

Instalment No.	Percentage	Amount ($)	Year	Milestone
				3. Completion of mid-term review 4. Modified action plan based on review
Fifth Instalment	5%	86893	Oct. 2017	1. Fully functional tanks-100% 2. Fully functional hatchery units 3. Adaptation benefit assessment-all tanks 4. Process and learning documents 5. Preparatory work for terminal evaluation

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. **Record of endorsement on behalf of the government**[2] *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

Ravi Shankar Prasad, IAS, Joint Secretary, Ministry of Environment and Forest (MoEF), Government of India	Date*: February, 07, 2014*

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (National Action Plan on Climate Change) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
(Dr. Venkatesh Tagat) *Chief General Manager* *NABARD, Head Office, Mumbai* (Implementing Entity Coordinator)	
Date: *February,10, 2014*	Tel. and email: +91 22 2653 0174 +91 9820892803 venkatesh.tagat@nabard.org
Programme Contact Person: Shri. Sanjay Kumar Dora, DGM, NABARD, Head Office, Mumbai	
Tel. And Email: +91 22 2653 9640, +91 8450997360 Email: sk.dora@nabard.org, dora.sanjaykumar@gmail.com	

2 6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Annexure 1
Development Indicators of Madhya Pradesh:

(UNDP Report)

		MP	India
	Demographic Indicators	**2011**	**2011**
1	Total Population (In Millions)	72	1210
2	% contribution to national population	6	100
3	Sex Ratio (females per 1000 males)	930	940
4	Under 6 sex ratio (females per 1000 males)	912	914

	Economic Indicators	**2009-10**	**2009-10**
5	Net domestic Product (at factor cost) (Rs crores) (For state)	139300	4493743
	Gross Domestic Product (at factor cost) (Rs crores) (For India)		
6	Contribution of Agriculture to NSDP/GDP (%)	26.50	14.62
7	Contribution of Industry to NSDP/GDP (%)	15.87	20.16
8	Contribution of Services to NSDP/GDP (%)	57.63	65.22
9	Per Capita Net State Domestic Product (factor cost) (Rs) (for State)	19736	33731
	Per Capita Net National Product (factor cost) (Rs) (For India)		
10	NDP Growth rate (%) (for State)	8.22	8
	GDP Growth Rate (%) (For India)		

	Human Development Indicators	**2007-08**	**2007-08**
11	Human Development Index Value (HDI)	0.375	0.467
12	HDI Rank (out of 23)	20	
		2006	**2006**
13	Gender Related Development Index (GDI)	0.516	0.590
14	GDI Rank (out of 35)	33	122
15	Gender Empowerment Measure (GEM)	0.463	0.497
16	GEM Rank (out of 35)	21	

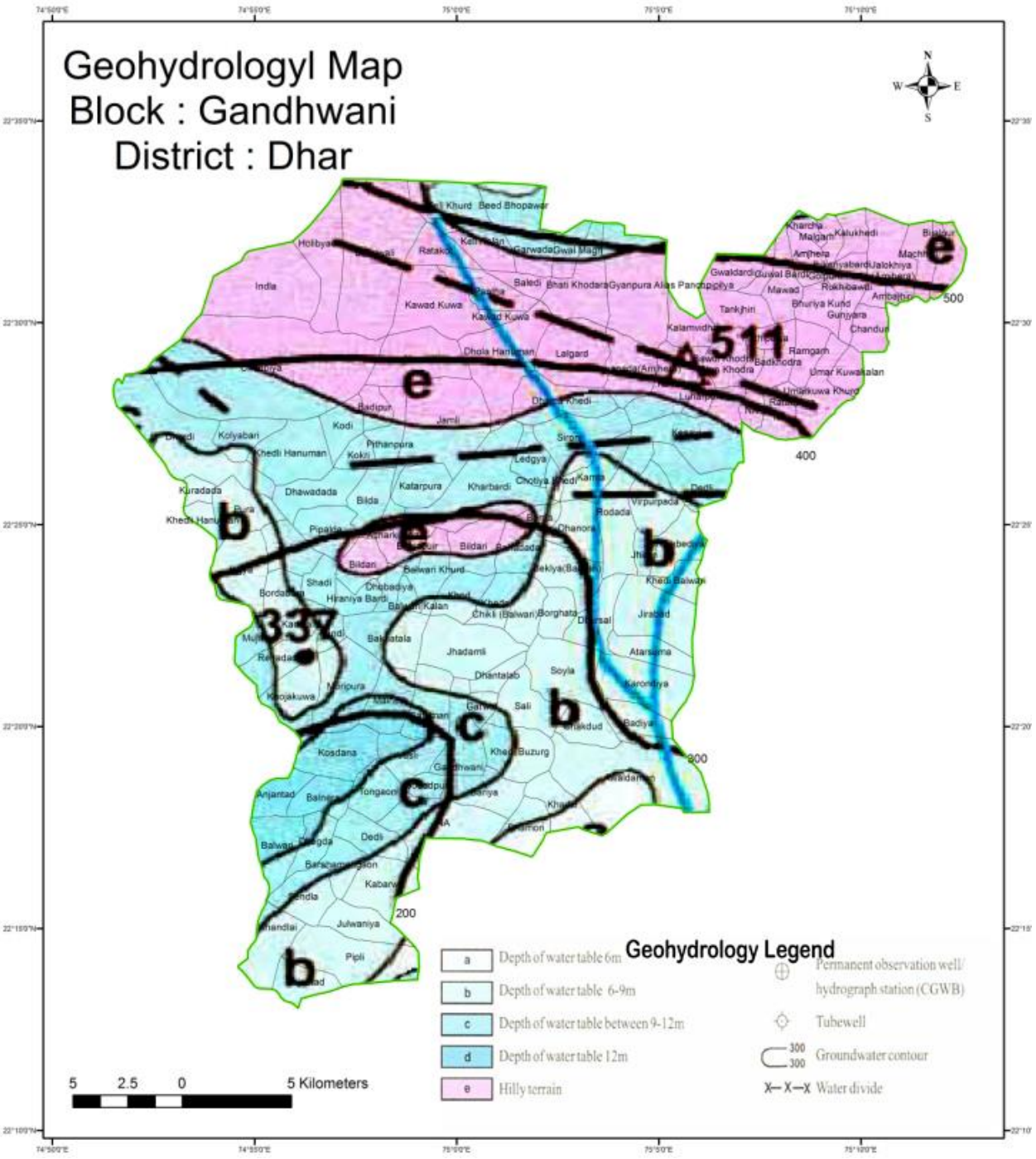
		MP	India
	Human Development Indicators	**2011**	**2011***
17	Inequality Adjusted Human Development Index Value (IHDI)	0.29	0.343
18	Inequality Adjusted Human Development Index Rank (out of 19)	19	
19	Loss in HDI due to Inequalities (%)	35.74	32
20	Literacy Rate (%)	70.63	74.04
21	Male Literacy Rate (%)	80.53	82.14
22	Female Literacy Rate (%)	60.02	65.46

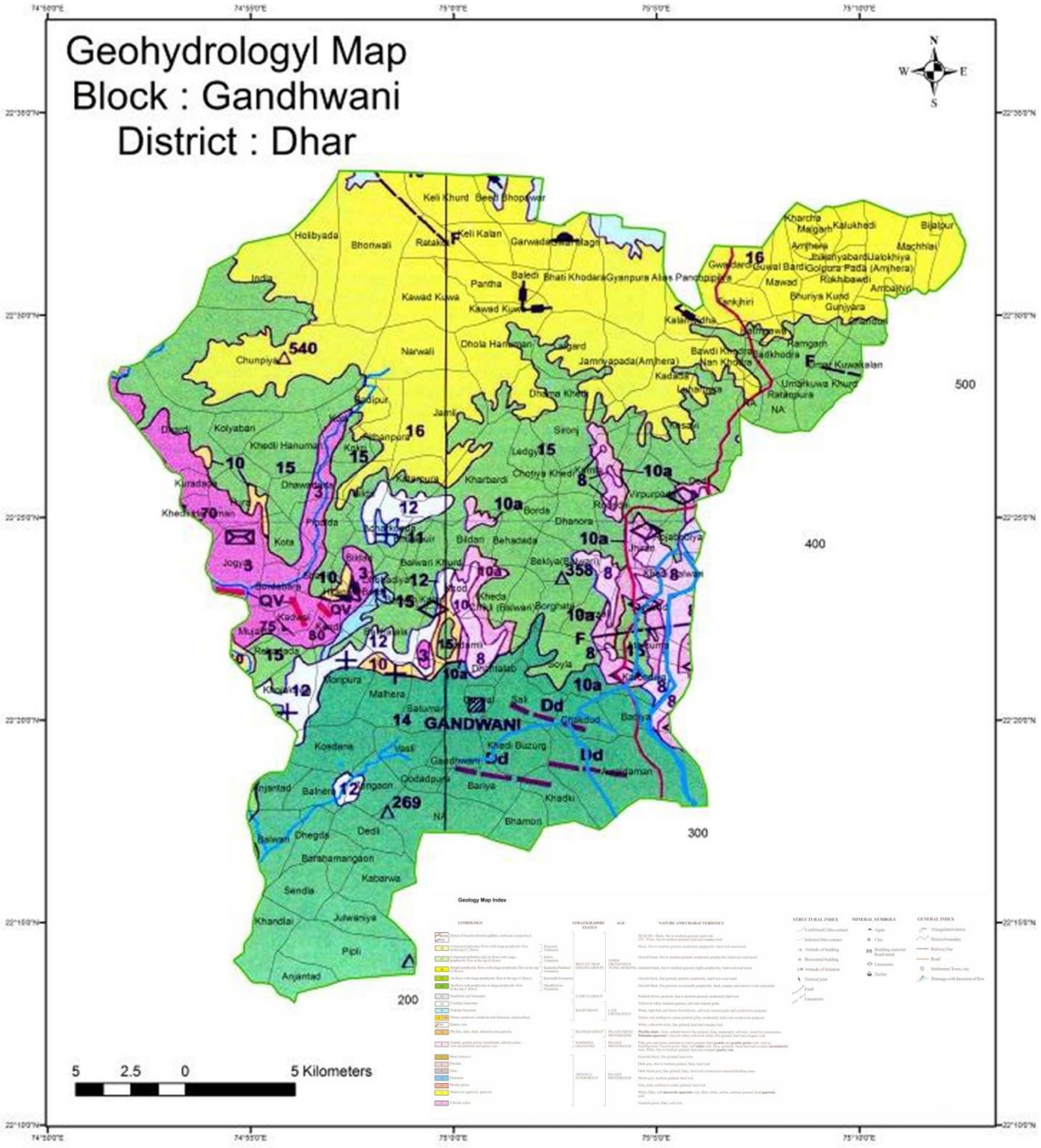
* Value differ from India IHDI in Global HDR 2011 due to different data sources.

	Poverty and Hunger Indicators	2009-10	2009-10
23	Poverty Headcount Ratio (%)	36.7	29.8
24	Total number of poor (in millions)	26.18	354.68
		2005	2005
25	Multidimensional Poverty Index (MPI)	0.374	0.283
26	Multidimensional Poverty Headcount (%)	68.1	53.7
27	Number of Multidimensional Poor (in millions)	50.1	612
		2007	2007
28	Global Hunger Index (GHI)	30.87	23.3
29	GHI Rank (out of 17)	17	
		2005-06	2005-06
30	Prevalence of calorie undernourishment (%)	23.4	20
31	Prevalence of Underweight Children under 5 years of age(%)	59.8	42.5

ANNEXURE 2

GEO-HYDROLOGY MAP OF ONE BLOCK OF PROJECT DISTRICT




Geohydrologyl Map
Block : Gandhwani
District : Dhar
GANDWANI
5 2.5 0 5 Kilometers

Annexure 3

GEO-HYDROLOGICAL BLOCK ZONING REPORT OF GANDHWANI IN DHAR DISTRICT

A preliminary feasibility report on project planning of climate proofing fish farming

By
Mr. R. C. Gupta
Ex. Senior Geo-hydrologist
Water Resources Department
M.P. Government

Entire project area i.e. Gandhwani (tribal) block. District Dhar M.P. was thoroughly visited. Four field visits were conducted along with team officials of TAAL between 1st June 2012 to 28th May 2013. Total 14 sites were inspected during the visits. Out of 14 sites, 8 sites were found suitable for proposed project. The entire Gandhwani block of Dhar District is located in southern slope of Vindhyachal mountain ranges with highest altitude of 540 m AMSL at Chumpya village and lowest is of 200 m AMSL at Pipli village. Tight valleys high hills and uneven topography is a common feature of most of this area. Man in east border and Uri in west border are two seasonal rivers flowing with its tributaries from south to north right angle to major Narmada River. The drainage density is very high in most of the area. The Nimar region has high temperature in summers leading to evaporation losses of 1 to 1.5m/annum.

As per ground water resources estimation report for the year 2009 Dhar in District ground water resource development reached up to 83% while in Gandhwani block is up to 48% and there is a net ground water availability for future irrigation development is 3297 hectare/meter. The Ground water levels during pre-monsoon season is about 8.73 m below ground level (bgl) and post-monsoon season is about 4.0 m bgl There is water level fluctuation of 4.73 m. **(Source: Dynamic Ground Water Resources of Madhya Pradesh As on March 2009).**

The geological rock formation of the area: (As per GSI Map of Dhar district)

Geological Age	Group	Rock Formation	Exposure Area (Approx.) (in Sq.-KM)
Upper cretaceous to Paleocene	Deccan Trap	Basaltic Lava Flow (Layered Rocks)	670
Lower Cretaceous	Bagh Group	A. Coralline Lime Stone B. Nodular Lime Stone C. Nimar Sand Stone and Lime Stone	20 5 4
Palaeo - Proterozoic	Narmada Granitoid	Granite, granite Gneiss Chlorite Schist with Quartz vein	12
Palaeo - Proterozoic	Aravalli Super Group	Chlorite Schist	25
	Total Area		**736**

The Aravalli Super Group:
The oldest litho unit belongs to The Aravalli Super Group of Palaeo - Proterozoic age. Which Consist of chlorite schist. The Formation occurs along Uri rivers form village Dhardi to majalda. The main villages are Piplda, Koti, Jogya, Kadwal, Kirodada, Bardavara etc. The Chlorite schist are metamorphic rocks generally green in colour. The rocks are flaky and soft nature.

Narmada Valley Granitoids:
Narmada valley granitoids of Palaeo - Proterozoic age are exposed along Man River and North of Gandhwani town. This group includes rocks of granite, granite gneiss and chlorite schist. These are intruded by matabasic dyke and quartz vein. The occurrence of these rocks are in villages Khod, Chiklibarghat.

Bagh Group:
Bagh group of Lower Cretaceous age unconformable overlies the rocks Aravalli Super Group with expose thickness varying from 5 to 40 meters this group comprises Nimar sand stone at base followed by the calcareous unit comprising nodular lime stone and coralline lime stone. The calcareous unit is fossiliferous and contain Echinoids, Lamellibranches, Gastropod, Corals and Brachiopods.

Occurrence:
Nimar sand stone - Kamda, Rodada, Kheda, Kharberd (in four linear patches)
Nodular Lime Stone - Achalkoda, Dhobadiya (two small patches)
Coralline Lime Stone - Khajakuba, Barhatala, Banwarithurd , Bilda, Kharbardi, Tipgoan (three patches)

Deccan Trap:
Major part of the block about 90% areas is occupied by basalt flows of Malwa Group as per GSI Map these are further subdivided into three groups.

1. **Mandleshwar Formation –** This formation occurs in south part of the block its covers about 30% area of the block. The area of this formation is generally plan having gentle slope with sub parallel drainage. The formation consists of seven lawa flows. The rocks of these formation of are grayish black fined grained occasionally porphyritic hard compact and massive in nature.

2. **Kali Sindh Formation –** This formation extend from east to west in middle part of the block formation occupied about 30% area of the block in the foot hill zone of Vidhyan Mountain ranges. These formations consist of 11 lawa flows. The rock of these formations is grayish black, find grained sparely porphyritic.

3. **Kankaria – Pirukhedi Formation –** This formation occurs in north part of the block in the form of plateau with escarpment. This formation in further divided in to 5 distinct lawa flows. The rocks of the group are fine to medium grained, Highly for porphyritic generally greenish black in colour it covers about 30% area of the block.

The Gandhwani block can be divided into following three different zones for perennial tank/pond sites.

1. **Command areas of Man river irrigation project**:
   Right bank Canal of Maan River irrigation project with its distributaries is irrigating about 7.5% area of this block. ComMaand area is having surplus ground water flowing in the form of streams even in the month of May. It is observed in Atarsuma and Korodiya village. This

water is outcome of return flow of applied irrigation water to the field. Hence this area is suitable for series of fish ponds. Other than Maan project there are other irrigation dams like Sironj and Khod, and its comMaand area are also feasible for fish ponds. The comMaand area is composed of lime stone rocks in upper reaches and in lower part Deccan trap Basalt is main aquifer. In the commend area the stage of ground water development is only 7%. It indicates there is sufficient scope for ground water development. The surplus water available for irrigation is about 785 hecatre/ meter. (as per ground water resource estimation of MP)
In this zone, there were following 6 sites found suitable for development of fish pond/tank namely:

(a) Beklya I & II,
(b) Pipli I, II & III
(c) Khandlay I.

2. **Foot hill zone of Vindhyachal Mountain**:
   Foot hill zone, which is extends about 4 to 5 km in length and 1.0 km in width, is having shallow water table zones. These zones are found suitable for fish ponds. In these valleys large numbers of wells are working for irrigation. This area is having sufficient surplus surface water runoff from the mountains serves as a recharge to ground water resources. Fish pond site in village Khode -I is recommended in this zone.

3. **Low relief area of Uri river drainage basin:**
   The drainage basin Uri River and Wurda nala is making gentle slope plane valley is also found suitable for fish pond development. Recommended site in this zone is Dhardi.

Following technical points needs to be taken into consideration while finalizing the sites for construction of fish ponds. A detailed study may have to be carried out for meet the requirements technically.

1. **Slope:**
   Pond site should have favorable topography of medium to gentle slope 0 to 3%. In mountainous relief area such sites will be available in pediment, buried pediment with weathered basement and a valley fill landforms.

2. **Catchment:**
   There should be sufficient catchment for availability of non-committed surplus Monsoon runoff in space and time. The availability of surface runoff at the point of interest is essential for deciding the size and design of the structure. Since, the structure conceives are very small the long term gauge and discharge data is not essential for micro structure empirical method of runoff estimation are considered adequate. The main empirical methods for runoff estimation are using following formulas:

   a. Rational formula
   b. Strange formula
   c. Dickens's formula

3. **Identification of suitable hydro-geological environment**:

   Detailed knowledge of geological and hydrological features of the area is necessary for adequately selecting the site and type of structure.

The features, parameters and data are to be considered for:

a. geological boundaries,
b. hydraulic boundaries,
c. inflow outflow of water hydraulic conductivity,
d. natural discharge of springs,
e. litho logy,
f. depth of aquifer,
g. Tectonic boundaries features such as lineaments, shear zones etc.

Areas of shallow water level zone ranging from 1.5 m to 3.0 m are most suitable for perennial tanks. Selected pond sites are in shallow water table area only. Water table is shallow due to surplus surface water irrigation (command area).

4. **Significance of lithology**:

Ground water occurs in aquifer either as an individual horizon or as multiple layers or proper accounting of resources and judicious planning of exploitation. It is essential to monitor water levels which are indicators of its potential at different time. This will support the water retention in fish ponds.

Desk studies:
Desk studies needs to be carried out in the office through review of topographical maps, geological maps and other relevant information's. Data emerging from the desk studies should be systematically organized location wise for carrying to the field for field review and investigations.

Remote sensing interpretation map:
GIS data sets in which the thematic maps are generated using satellite data should be used during the desk review for locating the appropriate sites. The Remote sensing maps have to be the basis for delineating the fault, lineaments, study the geology, hydro-geology, land use etc. Using the GIS capabilities different themes should be overlaid to zero on the most appropriate location. The Remote sensing interpretation should be used to interpret features like Karsts map topography, dykes, reefs, UN conformabilities, buried channels.

Field investigations:
Field investigations consist of no. of elements including geological hydro-geological, geo-morphological and hydrological investigations:

a. **Geological investigations**:

Geological map of the area on 1:50,000 scale prepared by national agencies like geological survey of India or state mining or geological department should be printed and carried to the field for visualize the occurrence of rock formation, their disposition, sequence and structure, fault, dykes etc. Surface distribution of rocks and their regional continuity should also be visualized.

The different litho logical and structural features like joints, lineaments, foliation, discontinuities, and degree of susceptibility of rocks to weathering, from dug well section need to be studied.

Drainage pattern is the spatial arrangement of stream and in general vary characteristics of rock structure and litho logy. These drainage patterns reflect the hydro-geological characteristics of the area and therefore can be useful in location of fish pond sites.

b. **Geo-morphological investigations**:
Geo-morphological maps of the area on 1:50000 is available as part of the GIS data sets, should be printed and taken to the field for visualizing the various landforms. Genetically, the landforms are divided in to two groups:
(a) Erosional: Erosional landforms are typically associated with the resistant hard rock terrains.
(b) Depositional landforms: Depositional landforms, developed by depositional processes of various natural agencies (e.g. River and wind).
Favorable landform that contributes significantly to ground water recharge should be identified in the field.

c. **Hydrological investigations**:

Hydro-geological investigation should include detailed well inventory of 2- 4 km around the proposed site. All the ground water abstractions structures need to be inventoried and the information to be collected should include the depth of the well, aquifer position, rate of pumping, pumping duration, drawdown etc. Prepare litho logical cross section using data from the inventoried wells; delineate the prominent aquifer in the area and their thickness and areal extent.

Reporting of the investigations:
Based on the field investigations, the detailed feasibility report should be prepared giving details of the procedure followed in selecting the site. The report should include:

a. A Sketch showing identification of site and important landmark in the vicinity. The sketch should be incorporate the north direction and the distance of the site from the landmark.
b. Locate the site on topo sheet 1:50000 scale, record its latitude and longitude and the reduced level as read from the topo sheet.
c. A narrative of geographical setting of the pond site with administrative details.
d. A narrative describe the regional lithography, strait graphic, structural, and hydrological setting of the area.
e. A narrative must be provided which describe field procedure used to characterize geological and hydrological conditions of the site. Details of the site specific geology & hydrology based on the data collected should be explained.
f. An estimate should also be prepared for the fish pond.

Medium Term Measure:
There is scope for further development of ground water resources. As per the report availability of ground water resource is 3297 hectare/meter. This resource if develop can irrigate additional 8246 hecatre of land. This well double the present irrigated area of the block intensive planning for ground water development is needed.

Long Term Measure:
Hydro geologically the block Gandhwani has varied favorable condition to develop its resources by deferent technological tools.

1. **Lineaments and Dykes** are the most common features of the block. The lineaments are shear zone (weak plains) in the earth which are the good carriers of water they can be arrested and utilize for irrigating the large area of the block.

2. **In the inter mountain valley of the block in valleys specially Keshwi, Berpur and Jamliwaripur** in these areas instant of surface water reservoir constriction of ground water dam (sub surface dam) will support water tables of the area without loosening valuable land.

3. **The area of Gandhwani block** is consisting of 28 litho units. The contact zone of these units are very useful for selecting ground water structure sites. The basement granite rocks acts as an impermeable barriers and they support the ground water reserves. Dykes are running a cross the drainage system of the area. Which makes the natural underground reservoir. They can be utilizing for further development of this backward tribal block.

Annexure 4
Design Details of the Tank