PROJECT ON CLIMATE RESILIENT AGRICULTURE- MAHARASHTRA (POCRA)
PROJECT IMPLEMENTATION PLAN

Department of Agriculture, Government of Maharashtra

The World Bank

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Abbreviations

AOA	Article of Association
APMC	Agricultural Produce Marketing Committee
BBF	Broad Bed Furrow
BIS	Bureau of Indian Standards
BOD	Board of Director
BPL	Below Poverty Line
CAAA	Controller of Aid, Accounts and Audit
CCT	Continuous Contour Trenches
CDP	Cluster Development Plan
CEM	Carbon Enhancement Measures
CEP	Carbon Enhancement Potential
CHC	Custom Hiring Centre
CNB	Cement Nala Bund
CRIDA	Central Research Institute for Dryland Agriculture
CRT	Climate Resilient Technology
CSSRI	Central Soil Science Research Institute
DEA	Department of Economic Affairs
DOA	Department of Agriculture
DSAO	District Superintending Agriculture Officer
EMF	Environment Management Framework
ENB	Earthen Nala Bund
ESMF	Environment Social Management Framework
FFS	Farmer Field School
FGD	Focus Group Discussion
FIG	Farmer Interest Group
FLD	Front Line Demonstration
FPC	Farmer Producer Company
FPO	Farmer Producer Organization
GAP	Good Agricultural Practices
GDDP	Gross District Domestic Product
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoI	Government of India
GoM	Government of Maharashtra
GP	Gram Panchayat
GSDP	Gross State Domestic Product
GVA	Gross Value Added
HDI	Human Development Index
ICT	Information Communication Technology
IMD	Indian Meteorological Department
IPM	Integrated Pest Management
INM	Integrated Nutrient Management

INCCA	Indian Network of Climate Change Analysis
INDC	Intended Nationally Determined Contribution
IWMP	Integrated Watershed Management Programme
KPI	Key Performance Indicator
KVK	Krushi Vigyan Kendra
MACP	Maharashtra Agriculture Competitiveness Project
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIS	Management Information System
MPKV	Mahatma Phule Krushi Vidyapeeth
MSAMB	Maharashtra State Agriculture Marketing Board
MLE	Monitoring, Learning and Evaluation
mn	Million
MOU	Memorandum of Understanding
MT	Metric Ton
MWS	Micro-Watershed
NABARD	National Bank for Agriculture and Rural Development
NAPCC	National Action Plan on Climate Change
NICRA	National Initiative on Climate Resilient Agriculture
PAO	Pays and Accounts Officer
PDO	Project Development Objective
PDKV	Punjabrao Deshmukh Krushi Vidyapeeth
PMKSY	Prime Minister Krushi Sinchai Yojna
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
PRI	Panchayat raj Institution
RAMETI	Regional Agricultural Extension Management Training Institute
RFD	Result Framework Document
ROM	Rest of Maharashtra
SAU	State Agriculture University
SC	Scheduled Caste
SDAO	Sub-divisional Agricultural Officer
SFAC	Small Farmer Agribusiness Consortium
SHG	Self Help Groups
SOC	Soil Organic Carbon
SREP	Strategic Research Extension Plan
ST	Scheduled Tribe
TPPF	Tribal Peoples Planning Framework
VCRMC	Village Climate Resilient Agriculture Management Committee
Yashada	Yashwantrao Chavan Academy of Development Administration

1 EXECUTIVE SUMMARY

Maharashtra is the third largest State in India accounting for 9.4% of the total geographical area of the country. It is the second most populous State with a population of more than 112 million (2011 Census). Agriculture is the primary source of livelihood in the State. The state has 22.6 million ha of land under cultivation (gross cropped area) and area under forest is 5.21 million ha. About 84% of the total area under agriculture is rainfed and dependent only on the monsoon. The growth in the agriculture sector in the state of Maharashtra has been dependent on the vagaries of nature. Poor farmers with small, unirrigated land holdings are especially vulnerable to the climatic shocks. Such shocks could impose large and irreversible losses, plunging them into destitution. In Maharashtra, Vidarbha and Marathwada region are particularly vulnerable for this kind of phenomenon.

One of the biggest challenges for the state is to pull farmers out of the current crises of high production cost and low profitability due to low productivity, price fluctuations, lack of market access, and lack of agri-business opportunities. The issues related to growing water scarcity, degrading land resources, increased cost of cultivation, stagnant farm productivity, and the impacts of climate change need to be systematically addressed in order to achieve not only sustainability & profitability of smallholder farming system but also to reduce the distress among the farmers. It is under this backdrop that the Government of Maharashtra, in partnership with the World Bank, has conceptualised the Project on Climate Resilient Agriculture (PoCRA) for about 5000 villages in 15 districts of Maharashtra.

The **Project Development Objective (PDO)** is to enhance climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra. The project is built around a comprehensive, multi sector approach that focuses specifically on building climate resilience in agriculture through scaling up tested technologies and practices. The project implement plan (PIP) document that describes the entire project process has been divided into five sections. Section 1 describes the context in which the project was conceptualised. Section 2 deals with the project objective, design, guiding principles and the project area, principle of prioritisation of clusters and beneficiaries. Section 3 describes the project components and activities as well as the implementation arrangements. Section 4 deals with the monitoring and evaluation framework with key indicators and mechanism of tracking progress. Section 5 covers the various compliance requirements i.e. financial management framework, procurement strategy, environment and social management framework. A comprehensive set of annexure has been provided containing cost tables, technical specifications of various activities as well as the terms of references.

Project Strategy: PoCRA is a first of its kind climate resilience project undertaken in the agriculture sector in India. The project follows a unique triple-win strategy to address the twin objectives of enhancing climate resilience and enhancing farm productivity of small holders. This includes the following:

- **Enhanced water security at farm level** - through the adoption of latest technologies for increasing water use efficiency in agriculture, increase in surface water storage capacity , groundwater recharge, and in situ water conservation to address on-farm water availability and reduce the risks associated with intra- and inter seasonal climate variability;
- **Improved soil health** - through the adoption of good agricultural practices to improve soil fertility, soil nutrient management, and promotion of soil carbon sequestration; and
- **Increased farm productivity and crop diversification** - through the adoption of climate-resilient seed varieties (short maturity, drought resistant, salt tolerant) and market-oriented crops with a clear potential for income security derived from the integration of farmers in corresponding value-chains.

Project Area: The proposed project will be implemented in 8 districts of Marathwada (Aurangabad, Nanded, Latur, Parbhani, Jalna, Beed, Hingoli, Osmanabad), 6 districts of Vidarbha (Akola, Amravati, Buldana, Yavatmal, Washim, Wardha) and Jalgaon district of Nashik Division. In these districts, the project will cover about 4000 villages characterized by high climate-vulnerability (based on IPCC approved methodology taking into consideration 26 parameters divided across 3 sub-components of vulnerability i.e. exposure, sensitivity and adaptive capacity). The project will also include about 1,000 villages located in the Purna river basin and showing high levels of soil salinity and sodicity. These villages are spread over Akola, Amravati, Buldana, and Jalgaon districts.

Project components: The project will have the following components and subcomponents:

- Component A: Promoting Climate-resilient Agricultural Systems
  - A.1: Participatory development of mini watershed plans.
  - A.2: On-farm climate-resilient technologies and agronomic practices.
  - A.3: Climate-resilient development of catchment areas

- Component B: Climate-smart Post-harvest Management and Value Chain Promotion
  - B.1: Strengthening Farmer Producer Companies
  - B.2: Strengthening emerging value-chains for climate-resilient commodities
  - B.3: Improving the performance of the supply chain for climate-resilient seeds

- Component C: Institutional Development, Knowledge and Policies for a Climate-resilient Agriculture
    - C.1: Sustainability and institutional capacity development
    - C.2: Maharashtra Climate Innovation Centre
    - C.3: Knowledge and policies

- Component D: Project Management.

Short Description of Components:

A. Promoting Climate-resilient Agricultural Systems: Key objective of this component is to enhance climate-resilience in agricultural production systems through a series of activities at the farm level. This will be complemented by interventions in the catchment areas of mini watersheds.

A1. *Mini-watershed based planning:* The preparation of the mini watershed plans for about 670 selected clusters is a critical activity under PoCRA to finalize the village level specific interventions under the project. This planning will be carried out in a participatory manner with the assistance of the village community and will be taken up in a phased manner. The PMU has identified Yashwantrao Chavan Academy of Development Administration, Pune (Yashada) as a knowledge partner for finalizing the contours and process of micro plan preparation.

A2. *Climate Smart Agriculture and Resilient Farming Systems:* This component will focus on climate resilient technology transfer, Cropping system / Crop diversification / Alternate cropping systems / Contingency planning, integrated farming systems, carbon sequestration through carbon enhancement measures such as agro-forestry systems, soil health enhancement and soil and water conservation measures. In addition the project will try to mitigate the problem of salinity in some of the project areas. Planned adaptation is essential to increase the resilience of agriculture sector against climate change.

A3. *Promoting efficient and sustainable use of water for agriculture:* This component primarily deals with surface and groundwater management for improving water use efficiency. The community will be encouraged to manage their water resources in a sustainable manner through simple water balance exercises. As one of the innovative watershed management initiatives, the project will adopt a systematic approach to manage the groundwater through efficient utilization of water. The project will partner with state ground water agency and other line departments to focus on watershed development, surface water management, groundwater recharge and management, soil moisture management, assessment of village

/ cluster level water balance to prepare crop-water budgeting, providing protective irrigation through sprinklers and drip irrigation systems.

B. Climate Smart Post Harvest Management and Value Chain Promotion: This component will build on existing Farmer Producer Companies (FPCs) as a major driver of change in the selected commodity value chains. The interventions under this component have been designed to achieve the PDO by: (i) increase in farmers' participation in selected value chains, and (ii) promoting practices and technologies in post-harvest management and value-addition that support climate adaptation and/or mitigation.

B1.1. *Strengthening Farmer Producer Companies*: This component will build on the initiatives of GoM about FPCs as the agents of change. Project will support the existing FIG/FPO/FPCs through activities tailored to the growth potential of existing FPCs.

B1.2 *Establishment of Custom Hiring Centres (CHC*): CHCs shall be established at cluster level to promote farm mechanization for coping up with climate variability in the project area. Farmer producer Companies along with FIGs and SHGs shall be encouraged to establish such Custom Hiring Centres for the benefit of the farmers in the project area.

B2. *Strengthening climate-resilient value-chains:* This component will support viable investments in the prioritised commodities and/or fruit crops value chain through product aggregation, handling, transformation, value addition, and marketing. ICT-based market information systems will help the farmers in taking informed decisions about their produce.

B3. *Improving the performance of the supply chain for climate-resilient seeds:* Adequate supply of seeds with features such as short duration, tolerance to drought, salinity and heat, is a key priority for the project in its strategy to build climate resilience in the agriculture sector. The project will work with emerging FPO/FPCs and the Maharashtra State Seed Corporation (Mahabeej) to promote production of such seeds and creation of seed hubs.

C. Institutional Development, Knowledge and Policies for a Climate-Resilient Agriculture: The key objective of this component is to promote climate resilience through a long-term adaptive management of agriculture, soil and water resources. The project envisages extensive capacity development of the small farmers as well as the project functionaries. These capacity development programmes will be carried out by Yashada, VANAMATI, RAMETI, and KVKs. KVKs will also support extension activities through a farm field school approach. A number of institutions and agencies have been identified as potential knowledge partners for PoCRA. They will help in bringing in

knowledge, tools and good practices to the project. The project will assist the farmers through a technology enabled platform for comprehensive agro-met advisory and real-time contingency planning. *Information, Education, and Communication (IEC) strategy* shall be developed to familiarise all stakeholders about the project approach, activities, guidelines and outcomes. A *Climate Innovation Centre (CIC)* shall be established at state level for dissemination of innovative ideas, support agri-entrepreneurs, providing services, and policy analysis and advocacy, etc.

D. Project Management: There will be a three tier project governance mechanism.

A **high level steering committee** has been constituted to provide conceptual, strategic and policy guidance for the design and implementation of the project activities, review progress, approve annual work plan and budget, ensure inter-departmental convergence, etc.

A **Project Technical Advisory Committee** has been constituted to give technical advice and to suggest appropriate solutions to the technical problems arising during the implementation of the project.

Project Management Unit (PMU): A project management unit has been constituted to conceptualize, prepare the project documents and to implement the project. The PMU is headed by a project director to provide necessary guidance, coordination and oversight.

At the field level, the project districts fall under three *divisions* i.e. Amravati, Latur and Aurangabad. The Divisional Joint Directors of Agriculture will provide necessary coordination and oversight. At the *district level*, the District Superintending Agriculture Officers will coordinate the project activities. At the subdivision level, the Sub Divisional Agriculture Officers would be responsible for carrying out all the activities in the clusters within his area. Agriculture Assistants at village level will be responsible for actual implementation of project activities with the help of cluster assistants.

In the *project villages*, Village Climate Resilient Agriculture Management Committee (VCRMC) will be the building block of PoCRA. The members of this committee will be selected by the Gram Sabha and will represent various stakeholders at the village level. The VCRMC shall (i) prepare participatory village micro-plans, (ii) select beneficiaries for individual benefit activities, (iii) plan and execute community works as per approved annual action plan, (iv) be responsible for the maintenance of assets, and (v) facilitate social audit of the project activities.

A robust **monitoring & evaluation framework and project management information system** (MIS) would capture all the important outputs and outcomes. In addition, it will also provide PMU with real time information of physical progress (outputs) and financial milestone vis-à-vis outcome indicators.

Key performance indicators to be monitored are (i) Farmers adopting improved agricultural technology, (ii) Improved water-use efficiency at farm level, (iii) GHG Accounting, (iv) increase in farm income, and (v) Direct project beneficiaries. In addition, there will be intermediate level outcome and output indicators for each components and activities.

Financial Management System: The objective of financial management system of PoCRA is to ensure effective management and utilisation of project resources for achieving the project objectives. The fund allocations and expenditure will be through the computerised state treasury system of Budget distribution System. The predominant method of fund channelization to individual beneficiaries will be through Direct Benefit Transfer (DBT).

Procurement System: The project will have a largely decentralised system of procurement as a large part of work is to be executed by the community. The Project shall adhere to World Bank's New Procurement Framework comprised of policies and World Bank Procurement Regulations for IPF Borrowers" (July 2016) ("Procurement Regulations"). Accordingly, a separate Procurement Manual has been prepared describing Procurement Strategy, Procurement Approach, methods of procurement and procedures of procurement of Goods, Works, Non Consulting services and consulting services.

Environment Management Framework: The *Environment Management Framework* (EMF) is prepared taking into account the key concerns of different stakeholders and their suggestions on different project components. The environment management plan (EMP) reflects in detail about different mitigation measures that the project will take to improve the current environmental conditions that are expected to benefit the community in general and farmers in particular like integrated pest and nutrition management.

The ***Social Management Framework*** **(SMF)** has been prepared taking into account the key concerns of different stakeholders and their suggestions on different project components. The SMF includes a component wise social management plan, tribal people planning framework, and a gender action plan. In addition, the project has evolved a proactive inclusive criteria for indigenous people, landless and women households, not only as the project beneficiaries but also for the planning and social audit.

There is also a provision for **citizen grievance redressal system** to register grievances and address them at different levels.

The component wise expected investment for the project will be as follows:

COMPONENT WISE PROPOSED COSTS

Project Component	Proposed Cost	
	(INR Crore)	(US$ Million)
A. Promoting Climate Resilient Agricultural Systems	**2,805.20**	**433.00**
B. Climate Smart Post-Harvest Management and Value Chain Promotion	**334.40**	**51.60**
C. Institutional Development, Service Delivery and Knowledge	**166.11**	**25.64**
D. Project Management	**371.01**	**57.27**
Price Contingencies	**210.10**	**32.40**
Total Project Cost	**3,886.80**	**600.00**

2 BACKGROUND

2.1 COUNTRY CONTEXT

The economy of India is the fifth-largest in the world measured by nominal Gross Domestic Product (GDP) and the third-largest by purchasing power parity. While India is averaging a growth rate of about 7 per cent per annum, the share of agriculture in the GDP is declining. As per the analysis of the Census 2011 data[1], the number of farmers ('Main' cultivators) decreased by 15 million since 1991 and 7.7 million since 2001. One of the major reasons why more and more people are leaving agriculture sector is because of high climate variability and inadequate adaptive capacity resulting in low productivity and income. More than 70% of the annual rainfall is concentrated between months of June-September. While a good monsoon ensures good harvest for food crops, a deficient monsoon results in yield loss and reduces economic security while excess monsoon too results in crop loss due to waterlogging and flooding. The majority of farmers in India have very little ability to respond adequately to these weather fluctuations. Climate variability has been the source of misery for much of rural India as well as for Maharashtra. Water availability for irrigation is reducing due to population rise, rapid urbanisation and competing claims of industries. This in turn reduces productivity and sometimes results in crop failure during prolonged dry spells. Without proper awareness about climate change, the farmers fail to safeguard their livelihoods. Inadequacy of critical agricultural infrastructure, irrigation systems, and lack of market access further reduces the ability of the farmers to improve the productivity and income.

India has set a target of 4 per cent growth in agriculture during the 12th plan period. However this would be tough unless the challenges of climate variability and change are accounted for with adequate investment. The small and marginal holdings taken together[2] (below 2.00 ha.) constituted 85.01 percent in 2010-11 against 83.29 in 2005-06. For the poor farmers often with small land holdings or holdings with unirrigated conditions, clustered along the poverty line, a small climatic shock could impose large and irreversible losses, plunging them into destitution. This has been the case with many states and Vidarbha and Marathwada region in Maharashtra are particularly vulnerable for this kind of

[1] As per Census of India (2011), 95.8 million are cultivators for whom farming is their main occupation. However the number of people dependent on agriculture could be more than 600 million if we add allied activities like fisheries.

[2] Agricultural Census, 2011.

phenomenon. Highlighting the threat of climate change and importance of water as a scarce resource, the Prime Minister of India has given a call to better manage this crop-water balance with a slogan 'per drop more crop'. This makes sense as a water-efficient agriculture holds the promise for smallholder farmers profitably shifting from low value crops to high value farming aiming for high returns per unit of water used. Therefore, improving water productivity in both irrigated (surface and ground) and rain-fed agriculture (including watershed systems) would ensure improved resilience of agricultural systems against climate vulnerability.

2.2 STATE AND SECTORAL CONTEXT

Maharashtra is spread across 3,07,731 km^2 area in the western and central part of the country and has a long coastline stretching nearly 720 km along the Arabian Sea. Maharashtra is the third largest State in India accounting for 9.4% of the total geographical area of the country. It is the second most populous State with a population of about 112 million (2011 Census). The State witnesses tropical monsoon climate. The rainfall distribution varies widely in this vast land mass. The seasonal rains from the south-west monsoon are very heavy and the rainfall is over 400 cm on the Sahyadri crests. The Konkan on the windward side is endowed with heavy rainfall, declining northwards. East of the Sahyadri, the rainfall diminishes to a meagre 40 cm in the western plateau districts, with Solapur and Ahmednagar lying in the heart of the dry zone. The rains slightly increase eastwards in the Marathwada and Vidarbha regions.

Based on socio-political and other geographical considerations, the State is divided into five main regions: Vidarbha (north-eastern region), Marathwada (south-central region), Khandesh (north-western region), Konkan and Western Maharashtra. Administratively, the State has 36 districts which are divided into six revenue divisions viz. Konkan, Pune, Nashik, Aurangabad, Amravati and Nagpur. The state has been a pioneer in adoption of Panchayati Raj structure. In the rural areas, there are 34 Zilla Parishads, 351 Panchayat Samitis and 27,709 Gram Panchayats. The urban areas are governed through 26 Municipal Corporations, 230 Municipal Councils, 104 Nagar Panchayats and seven Cantonment Boards[3].

[3] Website of the State Election Commission, Maharashtra

Agriculture is the primary source of livelihood in the State. The state has 22.6 million ha of land under cultivation (gross cropped area[4]) and area under forest is 5.21 million ha. More than 30% of the area of the State falls under rain-shadow region where scanty and erratic rains occur and about 84% of the total area under agriculture is rain-fed and dependent only on the monsoon. The proportion of irrigated area in the State is only around 16%, as opposed to the national average of 38%. Average land holdings are 1.44 Ha with 40% of landholdings in less than one-hectare 'marginal' category.

The yield of dominant crop in the state as compared to the all-India level is given below:

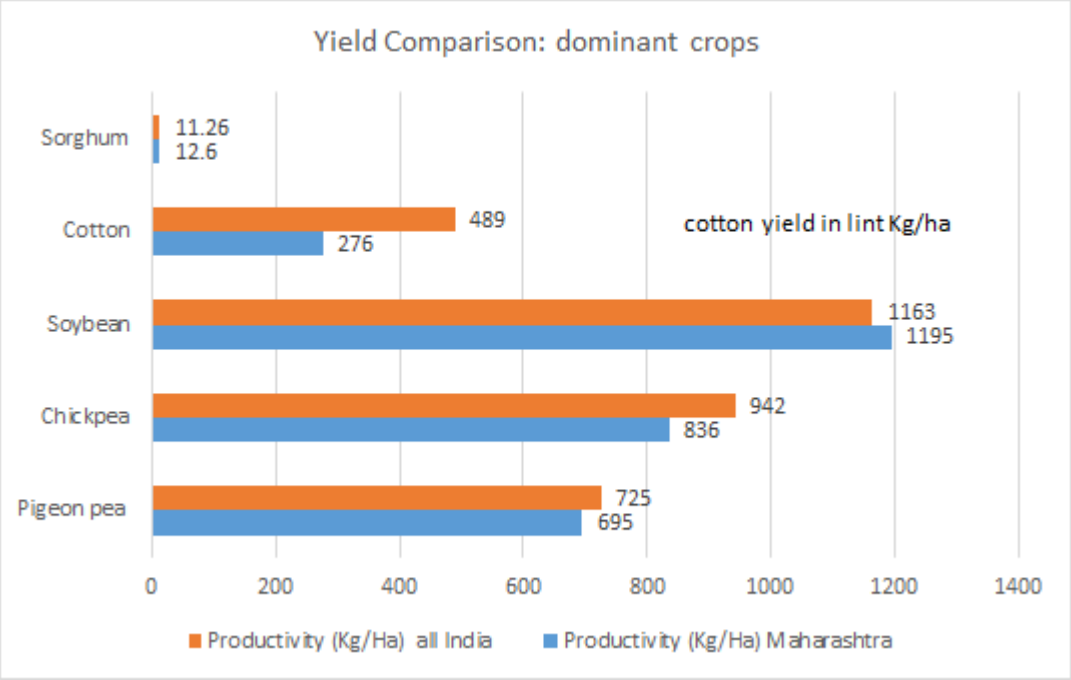


Figure 1 *Yield comparison of major crops 2015-16 (in kg/ha)*

Source: Agriculture statistics, Government of India

Maharashtra is one of the pioneers in farmer-friendly regulatory reform. The Maharashtra Groundwater Development and Management Act, 2009 is focused on water accounting with watershed as the planning unit, crop planning and groundwater use plan with community involvement in the lower most unit of the watershed.

The state has received 1st rank amongst the states on Agricultural Marketing and Farmer Friendly Reforms Index by Niti Aayog for implementing reforms in agricultural marketing, land lease and forestry

[4] RKVY, Mahrashtra

on private land. The state has about 839 farmer producer companies, one of the highest in the country, providing unique opportunity for public-private partnership opportunity for developing and strengthening a climate resilient value chain.

Per capita GDP of the state is Rs1,52,853 (2014-15) which is higher than the national average[5]. The overall literacy rate in the State is 82.3 per cent. The literacy rate in the state for the SC and ST is 79.7 per cent and 65.7 per cent respectively against the national averages of 73 per cent, 66.1 per cent and 59 per cent respectively. According to Niti Aayog (the erstwhile Planning Commission) of India, Maharashtra has 30.7% population living below the poverty line as on 2005. As per India Human Development Report 2011, the Human Development Index for India is 0.467 whereas; it is 0.572 for the State. Most of the project area falls below state average of HDI. For industries, Maharashtra ranks higher in terms of Gross Value Added (GVA) as per the Annual Survey of Industries.

The state has three major regions on the basis of administrative legacy and socio economic development indicators. These regions are: Vidarbha - comprising of 11 districts in the eastern part of the state, Marathwada - comprising of 8 districts in the central parts of the state, and the rest of Maharashtra - comprising of 17 districts on the north and western side. A High Level Committee constituted by the state to look into the issue of Balanced Regional Development and regional inequities observed that there has been some progress in the Human Development Indicators (HDI) across regions and the pattern of growth at the regional level has not been too dissimilar, in the last decade. However, water-stressed talukas of the state and talukas dominated by tribal still is one of major reasons to pull the HDI values down. The data also reveals that per capita income in Marathwada is 40 percent lower than that of Rest of Maharashtra (RoM). Similarly Per Capita Income of Vidarbha is 27 percent lower than that of RoM. This ratio has gradually deteriorated in Marathwada and Vidarbha during past 10 years.

The biggest challenge for the state is to pull farmers out of the current crises of high production cost and low profitability due to price fluctuation and lack of agri-business opportunities. To achieve food and nutritional security, the issues related to growing water scarcity, degrading land resources, high cost of cultivation, stagnant farm productivity, and the impacts of climate change need to be systematically addressed.

Maharashtra accounts for about 13 percent of all state GSDP of the country. The GSDP of the state is growing at 11.1 percent per annum from 2004-05 to 2014-15 decade. The primary sector expanded at a

[5] (https://en.wikipedia.org/wiki/List_of_Indian_states_and_union_territories_by_GDP_per_capita)

CAGR of 1.7 per cent between 2011-12 and 2014-15. In 2014-15 the share of tertiary sector was 61.5% and secondary sector was 26.8%.

The workforce distribution shows the high dependence of the Marathwada and Vidarbha region in the agriculture sector. Low irrigation coverage and erratic monsoon in several talukas in this region has negatively impacted the farm livelihood and enhanced the vulnerability. The Table 2 shows more than 70 percent of the workforce in these regions is dependent on agriculture.

Table 1 Workforce Dependent on Agriculture

Division	Region	Cultivators/ Total Workers	Agricultural Workers/ Total Workers	Total workforce dependent on Agriculture/ Total Workers
1	2	3	4	5=(3+4)
Konkan	RoM	18.9	10.26	29.16
Nashik	RoM	36.02	30.69	66.72
Pune	RoM	35.73	19.96	55.69
Aurangabad	Marathwada	39.23	34.6	73.83
Amravati	Vidarbha	26.24	49.27	75.51
Nagpur	Vidarbha	24.62	34.91	59.53

Source: Census 2011

Both categories include main and marginal workers.

Total food grain production in the state is estimated at about 9.91 million tonnes in 2014-15. During 2014-15, production of pulses and oil seeds in the state was recorded at around 1.75 million tonnes and 2.12 million tonnes, respectively. The major crops grown in the state are cotton, soybean, pigeon peas and chickpeas and jowar. Area under different crops has been given in the figure below:

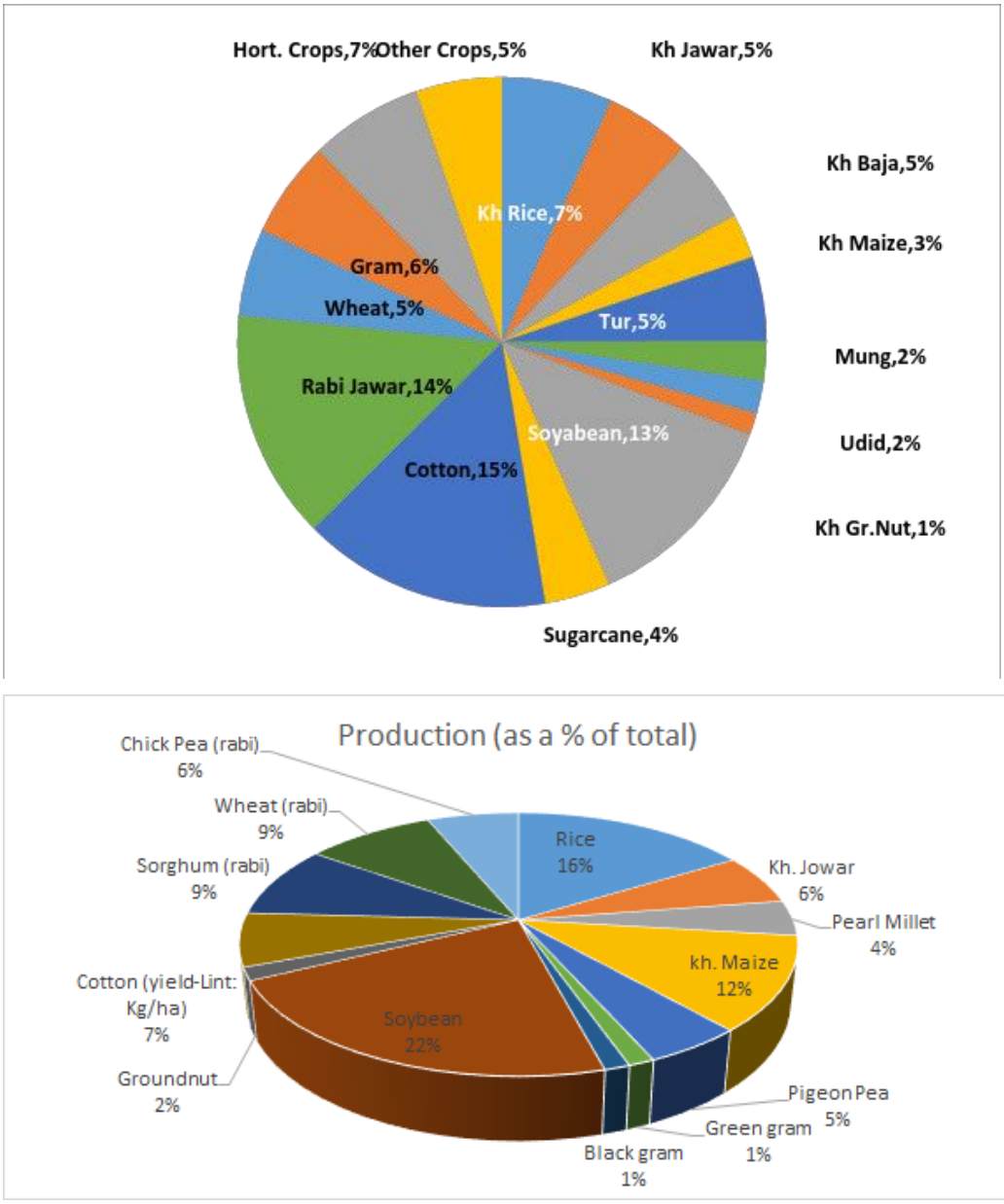


Figure 2 *Area under different crops in Maharashtra (in %age)*

Source: Department of Agriculture, 2014-15 (average 2006-7 to 2010-11)

The crop-wise area, average annual production, and average productivity are given in the table below:

Table 2 Area, Production, and Productivity of Major crops in Maharashtra

Area, Production & Productivity of Major Crops in Maharashtra (Av. of 2010-11 To 2014-15)				
No	**Crop**	**Area (000' ha)**	**Production (000'tonnes)**	**Productivity (kg/ha)**
1	Rice	1521	2852	1875
2	Kh. Jowar	860	1084	1260
3	Pearl Millet	857	755	881
4	kh. Maize	740	2010	2716
	Total Kharif Cereals	**3978**	**6700**	
5	Pigeon Pea	1220	848	695
6	Green gram	432	224	519
7	Black gram	363	218	600
	Total Kharif Pulses	**2015**	**1290**	
	Total food grain	**5993**	**7990**	
8	Soybean	3193	3816	1195
9	Groundnut	248	278	1120
	Kharif Oilseed	**3441**	**4093**	
10	Sugarcane	978	85086	87000
11	Cotton (yield-Lint: Kg/ha)	4129	1140	276
	Total Kharif	**14541**	**98309**	
12	Rabi Sorghum	2630	1546	588
13	Wheat	1013	1557	1537
14	Chick Pea	1319	1103	836
	Total Rabi	**4962**	**4206**	

2.3 VULNERABILITY, LONG-TERM CLIMATE CHANGE AND THE RATIONALE FOR THE PROJECT

The key parameters relating to agriculture vulnerability are temperature and precipitation. Both are undergoing rapid changes due to anthropogenic and climatic reasons. Other biophysical factors that affect productivity in agriculture are soil and water conditions. There are inherent structural constraints largely in the domain of social structure, access to resources, asset base, demography and dependency and counter-dependence that determine the sensitivity and adaptive capacity of different regions to these climatic aberrations. Together these factors contribute to the vulnerability of various regions. The growth in agriculture is highly fluctuating due to high climate variability and change associated with monsoon dependency, inadequate irrigation infrastructure, and poor resource base, and cropping patterns. This has severe repercussion on the food security of the nation, as the state is a major producer of pulses, oilseeds, food grains, and horticulture products.

The state has developed an adaptation action plan for climate change[6] which identifies the sectors and regions most likely to be affected by long-term climate changes over the next 30 to 70 years. As per the available projections, climate change will increase rainfall variability and droughts in the coming years. Considering the projected long-term adverse impacts of the climate changes in the sectors of agriculture and water as well as the impacts of the climate shocks over the last few years, the GoM has decided to enhance the resilience of the vulnerable regions through a community led multi-pronged strategy. The state has taken a progressive decision to address the climate stress adopting several strategies and one such approach is to partner with World Bank to develop a drought proofing and climate resilient strategy for agriculture. Improved resilience of agriculture production systems is expected to be achieved under the project through improving soil organic carbon, higher water use efficiency, reducing crop water footprints through diversification, and increased adoption of technologies and practices for optimizing and sustaining productivity. The project is expected to serve as a best practice model for other states more as a long term and sustainable measure to address climate variability, drought and climate change.

The GoM has identified 5000 villages of 15 districts for such interventions. These districts are from Marathwada (8) and Amravati (5) divisions and Wardha and Jalgaon districts.

This project will give the state a distinct advantage to influence the drought adaptation planning process not only in the state but also in the country to bring back agriculture to its normalcy in the event of

[6] Maharashtra State Adaptation Action Plan for Climate Change, 2014

climate variability and change. Since the state is a pioneer in several reforms in agriculture sector, this is not going to be implemented as a standalone sectoral investment project and has potential to create necessary enabling environment for its effective implementation and best practices to be followed in other states. The project offers a unique opportunity for establishing and managing institutional partnerships in agriculture especially in seed production (of resilient varieties), enhancing the adoption of several on-farm water use efficiency measures correlated with net withdrawal potential and cropping system.

2.3.1 Biophysical Characteristics of the project area (land, soil, water, precipitation, temperature)

Most of the bio-physical characteristics of the project districts are captured in three agro-climatic zones out of the nine zones of the state. The project areas lie mostly in scarcity zone, assured rainfall zone and moderate rainfall zone.

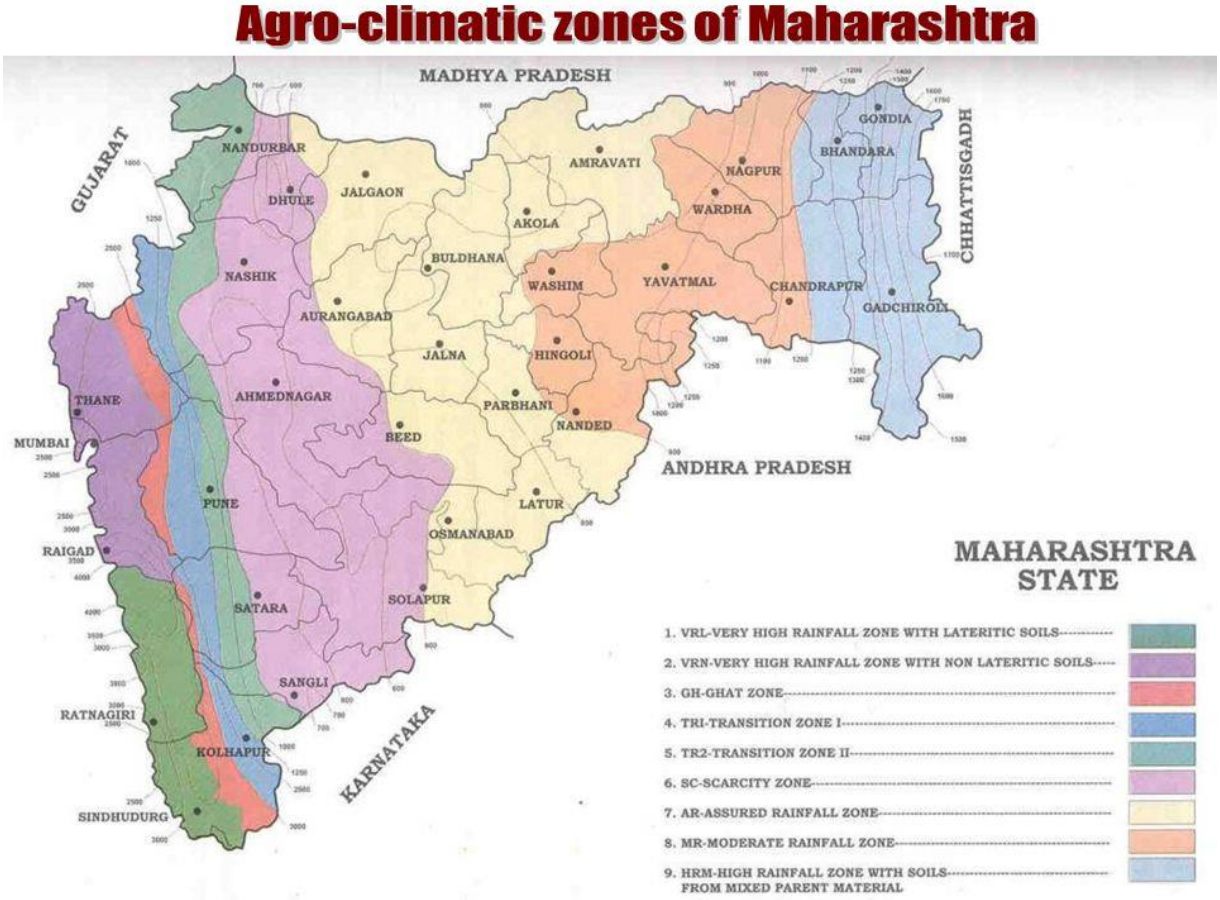


Figure 3 Agro-climatic Zone and theirs characteristics

Table 3 *Targeted area as per Agro-climatic Zone*

	Name of the Zone	**Geographical spread of the zone/ Districts and talukas included**	**Climatic conditions**	**Average annual rainfall**	**Soil type**	**Crop and cropping pattern**
1	Western Maharashtra Scarcity Zone/ Scarcity Zone	This zone covers geographical area of 73.23 Lakh ha. Comprises parts of Aurangabad, Jalgaon, Beed & Osmanabad districts. The gross & net cultivated area is 58.42 and 53.0 lakh ha respectively	Suffers from very low rainfall with uncertainty & ill distribution. Occurrence of drought is noted once in three years. Dry spell varies from 2-10 weeks. Water availability 60-140 days which is affected due to 1) delayed monsoon	Less than 750mm in 45 days. Two peaks of rainfall, 1) June/ July 2) September. Bimodal pattern of rainfall.	General topography has slope between 1-2%. Infiltration rate is 6-7 mm/hr. The soils are vertisol. Soils have Montmorillonite clay. Poor in nitrogen, low to medium in phosphate & well supplied in potash.	Because of bimodal distribution of rainfall, two cropping systems are noticed. During Kharif, shallow & poor moisture retentive soils are cultivated. Medium deep, moisture holding capacity soils are diverted to rabi cropping. Kharif cropping 25-30%. Crops- bajra, jowar, groundnut, safflower, pulses etc. Productivity is rather low in both the seasons.

2	Central Maharashtra Plateau Zone /Assured Rainfall Zone	Comprises parts of Aurangabad, Jalna, Beed & Osmanabad districts. Major parts of Parbhani & Nanded complete Latur Buldhana & parts of Akola, Amravati, Yavatmal, and Jalgaon. Area accounts to 75 lakh ha. Gross cropped area is 67.8 lakh ha. Forest accounting for 9% of gross cropped area.	Maximum temperature 41^0C. Minimum temperature 21^0C	700 to 900 mm. 75 % rains received in all districts of the zone.	Soil colour ranges from black to red. Type- 1) vertisols 2) entisols & 3) inceptisols. PH 7-7.5	Jowar is a predominant crop occupying 33% of gross cropped area, cotton-22.55%, oilseeds 5.17%, pulses 7.63 %. Kharif jowar /bajra followed by gram, safflower. Area under paddy is increasing. Pulses- tur, mung, udid, gram & lentils. Oilseeds- groundnut, sesamum safflower & niger. Sugarcane & summer crops are taken as per availability of irrigation.
3	Central Vidarbha Zone /Zone of Moderate Rainfall	The zone includes entire Wardha, major parts of Yavatmal districts. Largest agro climatic zone encompassing 49.88 lakh ha geographical area & 35.73 lakh ha net cropped area.	Max temperature 33-38^0 C Min temperature 16-26^{0}C Average humidity 72 % in rainy, 53 % in winter, 35% in summer.	1130 mm.	Black soils derived from basalt rock. Medium to heavy in texture alkaline in reaction. Low lying areas are rich and fertile.	Cropping patterns involves Cotton, Kharif Jowar, Tur, Wheat other Pluses & Oilseeds

Past climatic trend

Maharashtra is divided into four major parts: Coastal Maharashtra, Vidarbha, Madhya Maharashtra and Marathwada. In Maharashtra, rain-fed agriculture dominates and accounts for about 80% of the area under crops. The state of Maharashtra is influenced by the southwest monsoon and the state is facing water scarcity almost every year recently. It can be observed from Table 1 that in 3 out of the 5 recent years, Marathwada and Vidarbha received less than 30% of long term rainfall.

Table 4 Rainfall trends during the last five years compared to the historical mean

	Marathwada	Vidarbha	Madhya Maharashtra
2015	-40%	-11%	-3%
2014	-42%	-14%	-6%
2013	+9%	+42%	+21%
2012	-33%	+8%	-25%
2011	-7%	-6%	+4%

Marathwada is one of the most drought prone regions of India. Even in a good rainfall year such as 2013, when the rest of India received good southwest monsoon rainfall of 106%, Marathwada region received only more than 9% of the average rainfall. This proves that even in the best of the years, Marathwada region doesn't receive enough rainfall (Table 1). The mean rainfall in Marathwada region is 68.7 cm with a standard deviation of about 20. The Vidarbha region, which is to the extreme east of the Maharashtra state, also faces the problem of water scarcity every year.

Climate Change and Maharashtra

According to IPCC (2014), there is adequate scientific evidence to show that climate change is already occurring, leading to increased climate variability and extreme events (droughts and floods), changes in hydrological cycle, reduction in agriculture production, enhanced pest and disease incidence, and so on.

In Maharashtra the climate variability is very high leading to high variability in rainfall pattern and agriculture production, especially arising out of droughts and El Nino.

UK Met office study concluded that in Maharashtra, increased temperatures and altered seasonal precipitation patterns (both in amount and timing) could affect the hydrological systems and agricultural productivity. Further, according to the study, increased risk of severe weather events may have a devastating impact on agriculture, water resources, forestry and the well-being of the population. Climate projections and impact assessments made for India show that Maharashtra, like the rest of India, is projected to experience increase in rainfall variability, moisture stress, and occurrence of droughts, pests and diseases, significant reduction in crop production and increased food production variability.

A report by the National Bank for Agriculture and Rural Development (NABARD) recommends to the state government to initiate policies and measures to adapt to climatic changes, which would be detrimental to the agriculture sector in 14 districts affected by severe periodic droughts across Vidarbha and Marathwada. Further, CRIDA (of ICAR) has concluded, "The districts in Marathwada and Vidarbha face very high risk to climate change". Thus, there is a need to promote resilience or adaptation to current climate variability and climate change, especially in the rain-fed Marathwada and Vidarbha region of Maharashtra.

In the rain-fed Marathwada and Vidarbha region of Maharashtra, crop productivity and food production is highly variable / vulnerable to current climate variability and the on-going as well as long term climate change. The crop productivity could decline and the variability of agriculture production could increase, due to climate variability and climate change. Thus, there is a need to develop climate resilient agriculture or cropping systems and agronomic practices to ensure higher and stable farm productivity.

Future climate projection for the state

As per the Indian Network for Climate Change Assessment (INCAA) report using A1B scenario, downscaled regional climate projections indicate a 3 to 7% overall increase in all-India summer monsoon precipitation in the 2030s with respect to 1970s. In the western coastal region the same trend is repeated, increase is projected to be to in the tune of 6 to 8% i.e., of 69 to 109 mm. India-wide warming is being projected for 2030s to the scale of 1.7 to 2 degree C. Winter temperatures increases may be more prominent compared to summer temperatures. This is seen in case of all simulations for 2030, 2050 and 2080. The percentage increase/decrease in rainfall as compared to baseline (2030) has been given in the figure 3 map below. Rate of change of current summer monsoon (June - September) in the region has been given in the figure below:

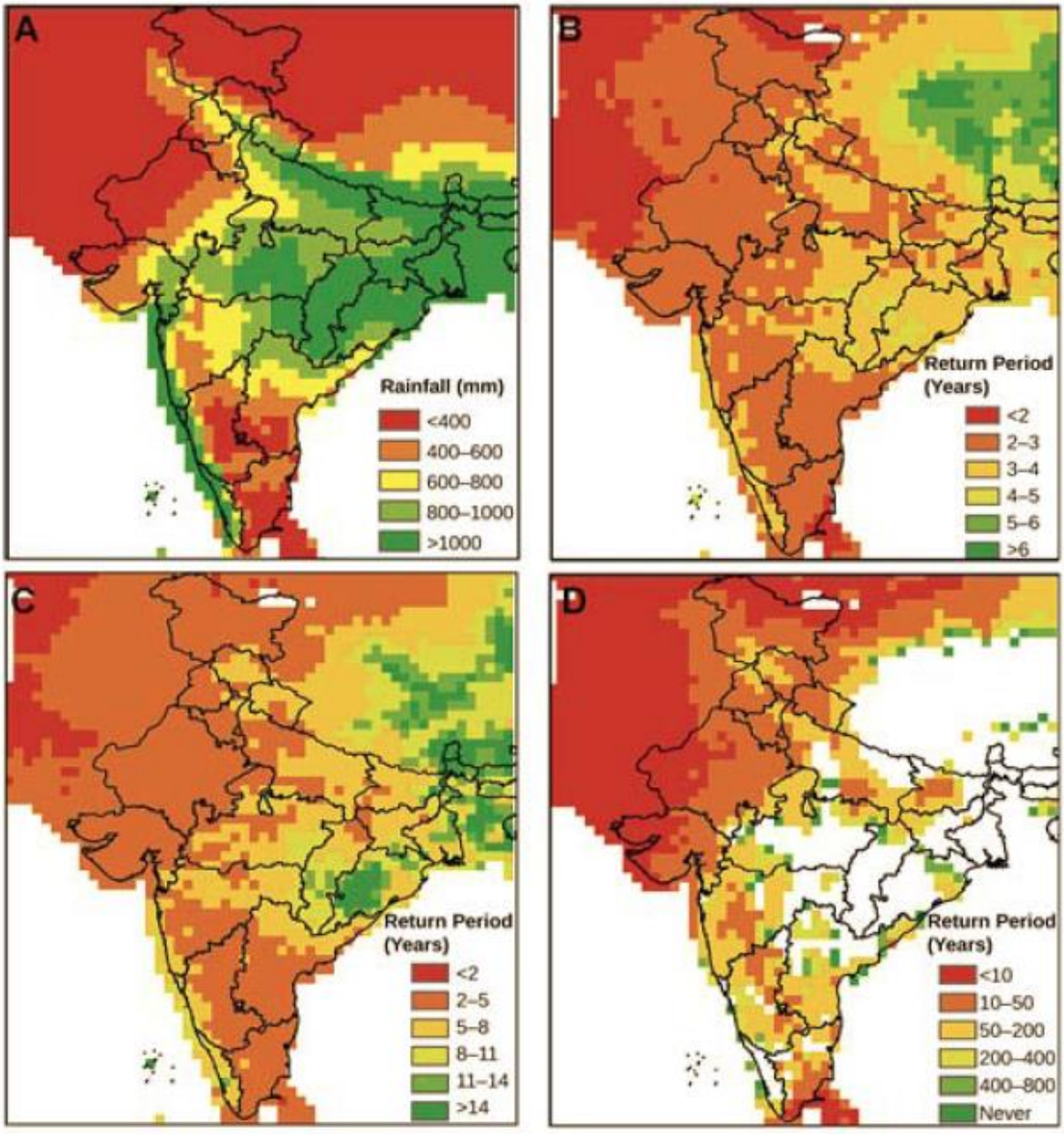


Figure 4 *Regional variations in mean and annual rainfall in India (1987-2012)*

Source: Indian Meteorological Department[7]

[7] *Source*: IMD data, available at http://www.tropmet.res.in/static_page.php?page_id=53

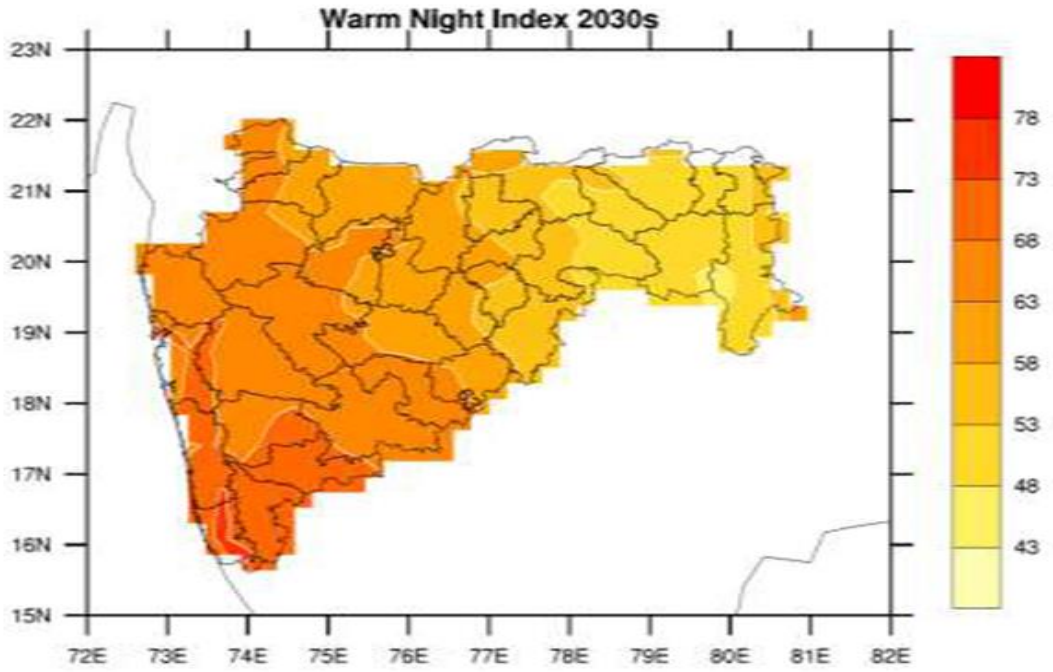


Figure 5 *Spatial variability of future monsoon in Maharashtra*

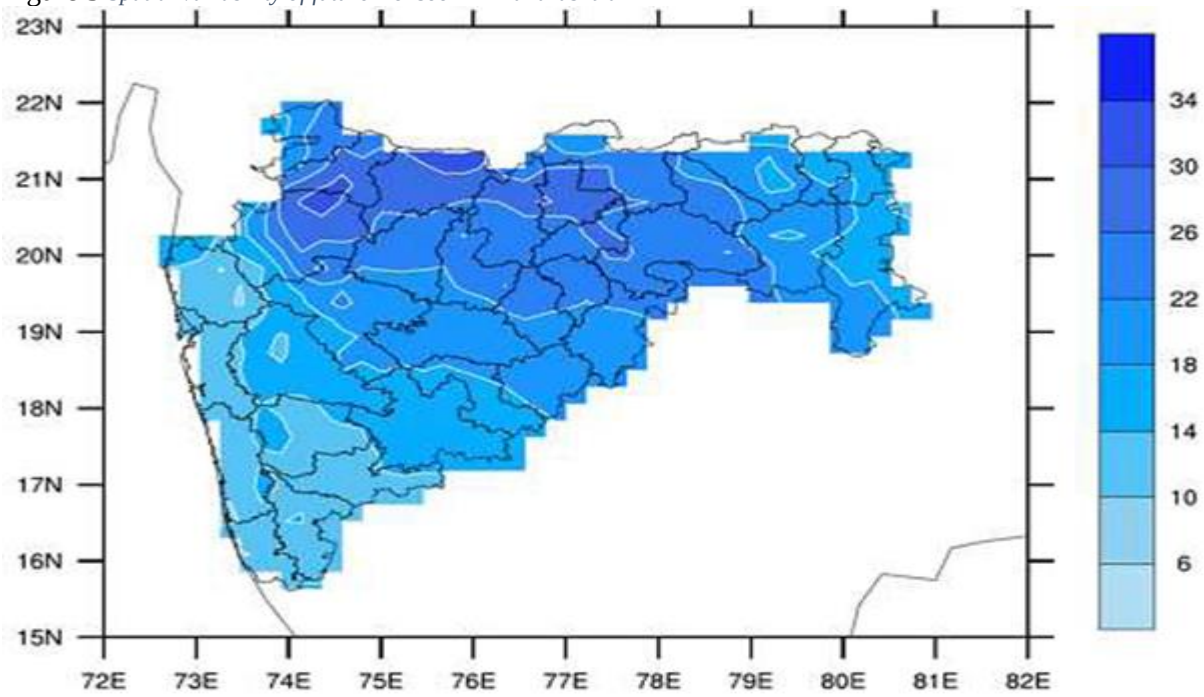


Figure 6 *Spatial variability of future monsoon in Maharashtra*

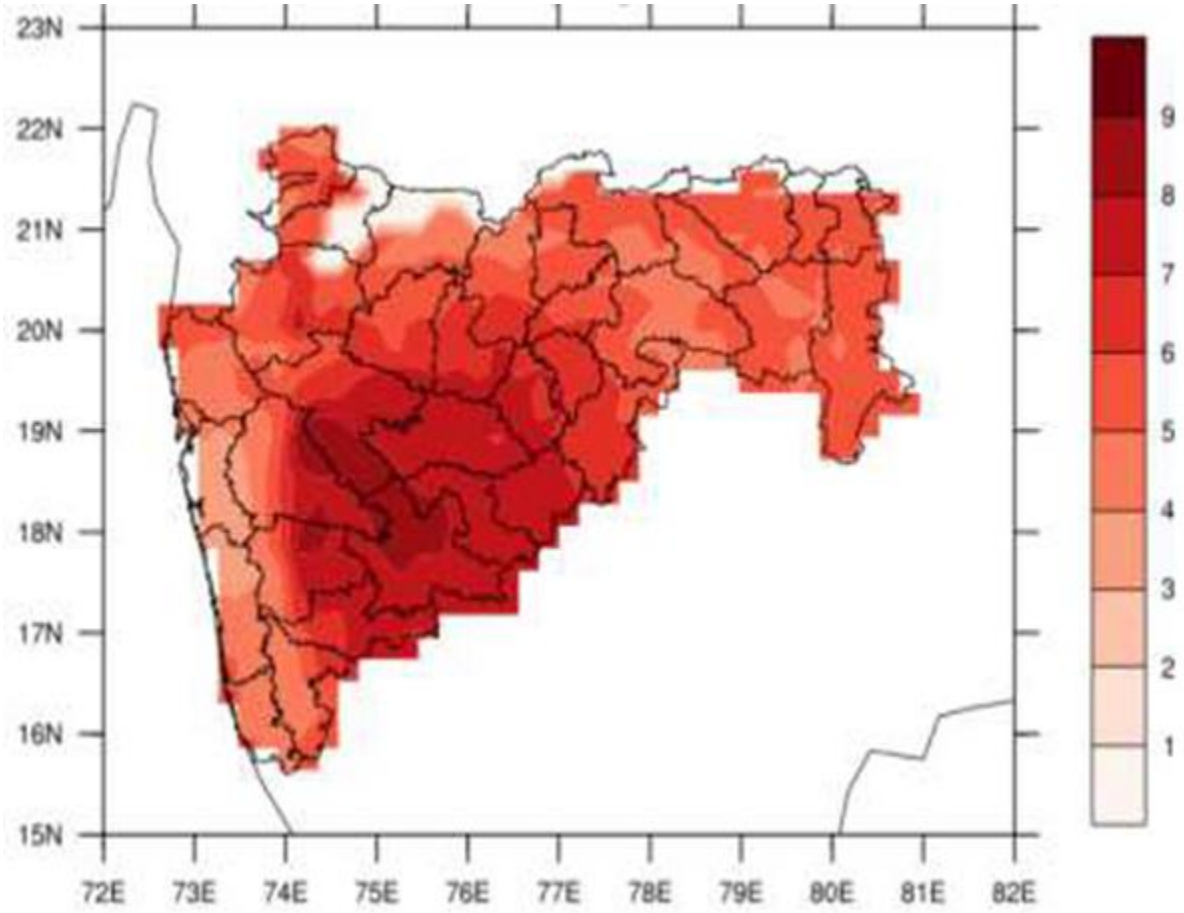


Figure 7 *Projected Increase in Number of Dry Days by 2030 in Maharashtra*

Source: State Climate Action Plan, Maharashtra

2.3.2 Socio-economic Characteristics of the project area (Demographic, Socio-economic, etc.)

As per the Socio Economic Caste Census (2012) estimates, in 73.13% of the households in the project districts, the monthly income of the highest earning member is less than INR 5000.

The following table highlights the social group-wise farm operational holdings.

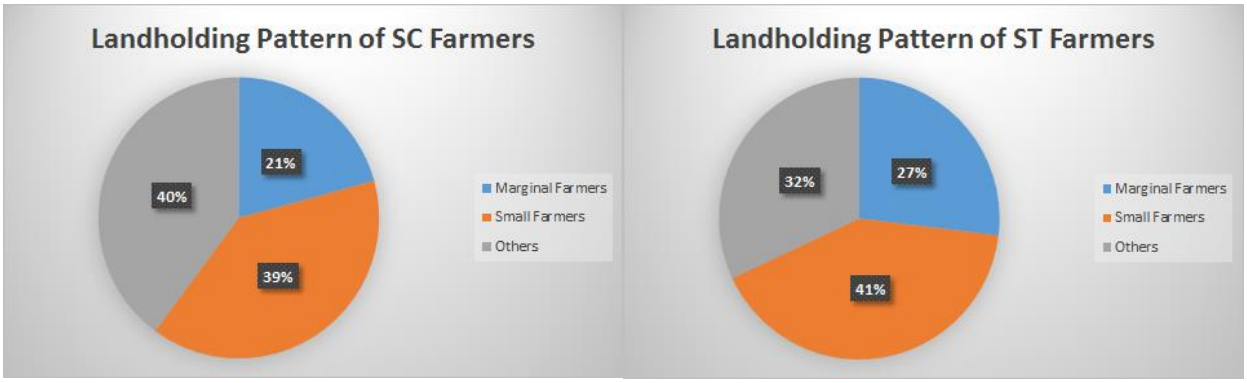


Figure 6 *Farm operational holding in the project districts as per the social groups*

The SC-ST groups hold about 10% of all the operational farm holdings in the project districts.

The agrarian stress in Maharashtra is pretty complex. Maharashtra experienced its worst drought since 1971 and rainfall was 59.4% of the normal as a result the agriculture sector saw a further decline of 2.7%. After two back to back droughts when the rainfall was 94% of normal the sector registered 12.5% growth in 2016-17 (Economic survey 2016-17). However, this did not reduce the farm sector stress. This was due to high indebtedness including the failure of PACS, rising input cost and market failure resulting in distress sale, migration and farmer suicide.

2.3.3 Environmental Characteristics (Salinity, water quality, etc.)

Salinity of soil is a historical problem in the Purna Alluvial tract spread over about 932 villages of Akola, Amravati, Buldhana, and Jalgaon districts.

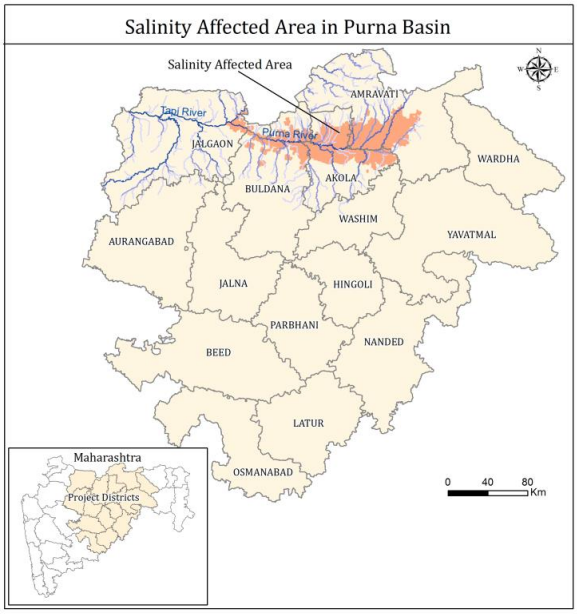
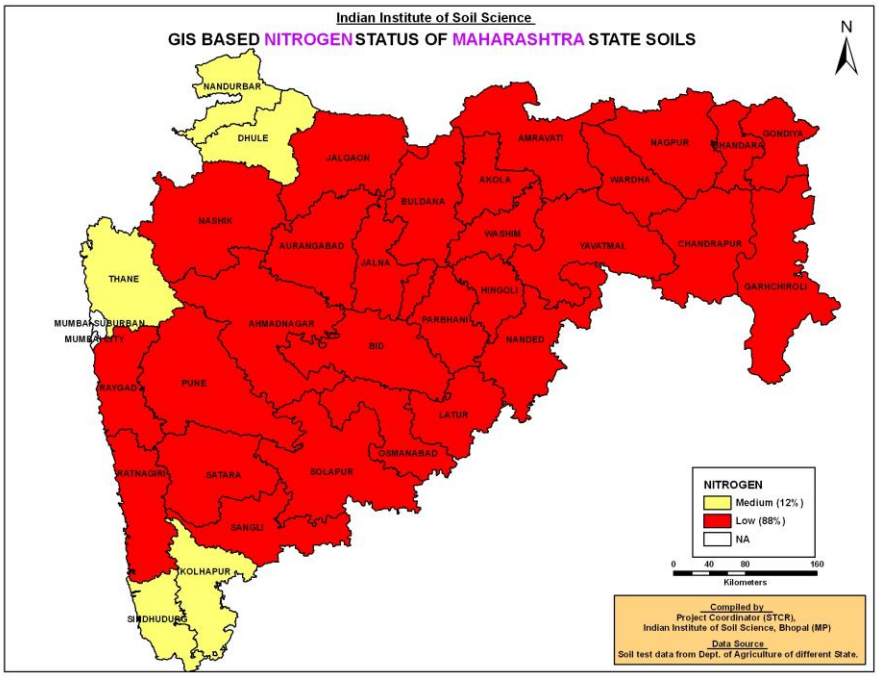


Figure *9 Salinity Affected area in Purna Basin*

The soil salinity problem in Purna river basin is due to the typical geological structure. Salinity of groundwater is also historical phenomenon in this alluvial tract. The affected area is about 4.70 lakh ha, out of which about 3.96 lakh ha is cultivable.

The soils are formed from basaltic alluvium and are characterized by high clay content (50-70 %), alkaline in reaction, calcareous with slow permeability. The soils have low hydraulic conductivity and thus become susceptible for poor drainage. The problem is further aggravated due to sodium and clay causing dispersion resulting into impairment in physical properties of soils like bulk density, hydraulic conductivity, and porosity and infiltration rate. Majority of the soils in the state have low nitrogen and phosphorus availability while they are adequate in potash.


Indian Institute of Soil Science
GIS BASED NITROGEN STATUS OF MAHARASHTRA STATE SOILS
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DHULE
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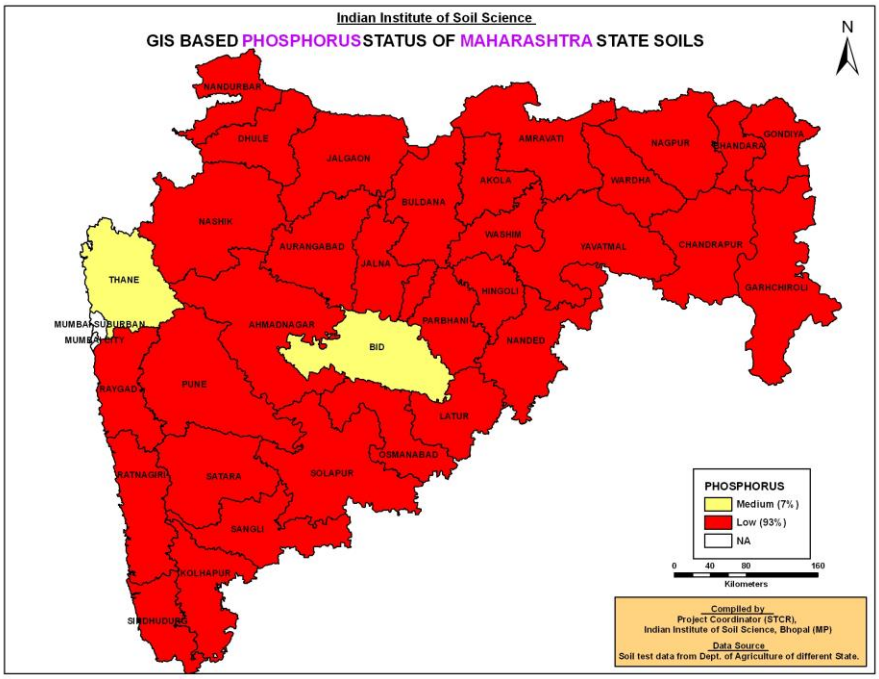
BULDANA
NASHIK
WASHIM
AURANGABAD
YAVATMAL
CHANDRAPUR
JALNA
THANE
HINGOLI
GARHCHIROLI
MUMBAI SUBURBAN
AHMADNAGAR
PARBHANI
MUMBAI CITY
BID
NANDED
RAIGAD
PUNE
LATUR
OSMANABAD
RATNAGIRI
SATARA
SOLAPUR
SANGLI
KOLHAPUR
SINDHUDURG
NITROGEN
Medium (12%)
Low (88%)
NA
0 40 80 160
Kilometers
Compiled by
Project Coordinator (STCR),
Indian Institute of Soil Science, Bhopal (MP)
Data Source
Soil test data from Dept. of Agriculture of different State.


Indian Institute of Soil Science
GIS BASED PHOSPHORUS STATUS OF MAHARASHTRA STATE SOILS
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PHOSPHORUS
Medium (7%)
Low (93%)
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Kilometers
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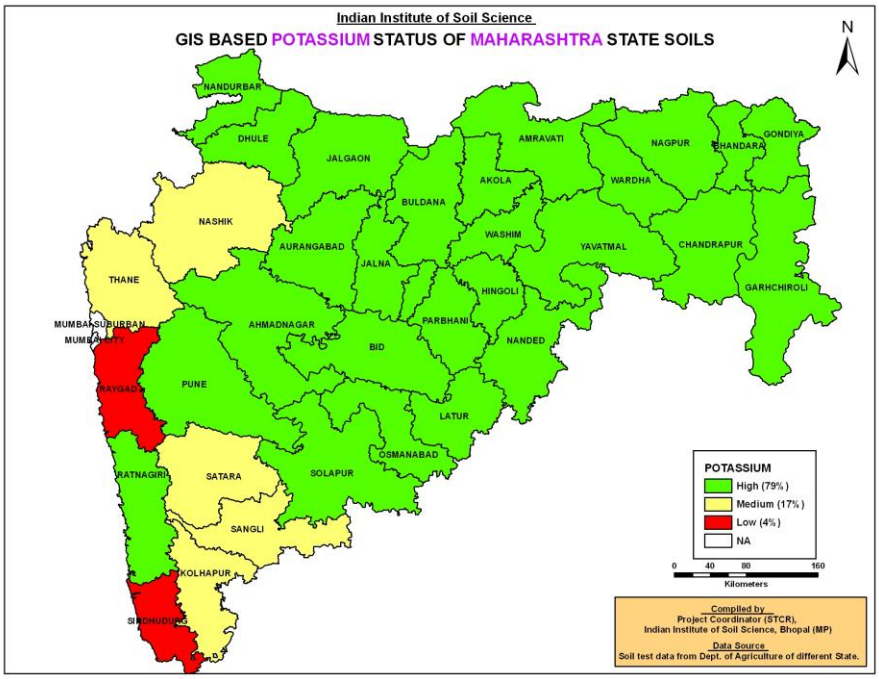
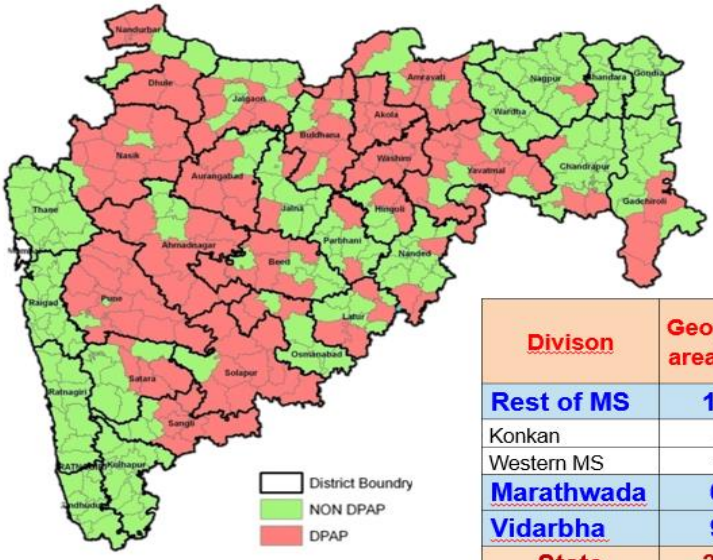


Figure 10 District wise soil fertility status

2.4 KEY CHALLENGES

Key challenges to address this climate variability and change lie in helping the farmers to have assured source of irrigation. The recent data shows that in 2015, about 195 talukas of 26 districts had 50% - 75% of the average rainfall while 57 talukas had less than 50% of normal rainfall. Similarly, in 2014, 192 talukas of 21 districts had 50% - 75% of the average rainfall while 36 talukas has less than 50% of the normal rainfall. In 2015 and 2016, about 70% villages were affected by severe drought in the state. Unreliability of weather, long dry spells, and early onset / withdrawal of monsoon has completely upset the farm calendar and agricultural economy and severely eroded the adaptive capacity of the farmers. Variability of rainfall has turned out to be a major roadblock to build resilience in the agriculture sector in rain-fed areas.

Out of 355 talukas in the state, 148 talukas are drought prone. In the project districts, 79 talukas are drought prone.



Coverage	
Districts	25
Tahasils	148
Area	159 Lac Ha.
% to state	52 %

Divison	Geographical area (Lakh ha)	DPAP Area (Lakh ha)	%
Rest of MS	**145.91**	**85.19**	**58**
Konkan	29.79	0	**0**
Western MS	116.13	85.19	**73**
Marathwada	**64.43**	**32.14**	**50**
Vidarbha	**97.23**	**41.91**	**43**
State	**307.58**	**159.23**	**52**

Figure 11 *Drought-prone areas of the state*

Source: Planning Department, Maharashtra

2.5 PARTNERSHIP WITH THE WORLD BANK

Maharashtra is one of the most progressive state to initiate regulatory reforms for rainfed agriculture development and is ranked first amongst the states in the country by Niti Aayog. In Maharashtra, poverty is mostly concentrated in rain-fed regions. The strategy of the GoM as well as the World Bank's Country Partnership Strategy lay stress on reduction in poverty which calls for achieving rapid, inclusive growth by expanding agriculture productivity and ensuring sustainable development through improved natural resources management (soil and water). In particular, the CPS emphasizes the need to foster farmer centered extension systems as well as provide efficient and competitive markets. The proposed project is also in alignment with the National Mission on Sustainable Agriculture. The project is also aligned to the strategies identified in the State Adaptation Action Plan on Climate Change (strategy outlined under agriculture and water sector). Maharashtra has launched a series of initiatives such the Jalyukta Shivar Abhiyaan, farm pond on demand scheme, MACP, PMKSY, etc., to make the state drought-free by 2019. As a part of the programme every year 5,000 villages will be targeted to make them free of water scarcity. This project will coordinate and establish synergies with this movement in vulnerable Marathwada and Vidarbha region and it will also build on the lessons learnt from other ongoing World Bank supported projects in Uttarakhand, Telangana, Odisha and Rajasthan.

3 PROJECT DESCRIPTION

Many parts of the state have been facing droughts on a recurrent basis since decades. While investment in irrigation infrastructure has been a priority for the state as a long term drought mitigation strategy, a major area of the state (about 82%) remains rain-fed with no access to water for protective irrigation. In case of a drought, the state has been adopting a short term, multi-pronged strategy to reduce its impact on the farmers. Waiver of interest rates and rescheduling of the payment of crop loans, supply of fodder for cattle, providing drinking water by tankers and other means, providing food grains at highly subsidized rates, and enhancing allocation for Rural Employment Guarantee Scheme (MGNREGS) are some of the measures which have been adopted by the GoM in the past to provide relief to the farmers and other affected people.

The GoM has now taken a progressive decision to develop a drought proofing and climate resilient strategy for the agriculture sector as a long term and sustainable measure to address the likely impacts due to climate variabilities and climate change. Given that climate change will increase rainfall variability and droughts in the coming years, the GoM has decided to focus on Climate Resilient Agricultural systems as its long term strategy. In this backdrop, the Project on Climate Resilient Agriculture (PoCRA) has been formulated by the Government of Maharashtra. This is the first large scale climate resilient agriculture project in India.

The project will be implemented in 15 districts in Maharashtra and cover about 4,000 villages affected by drought and about 932 villages additionally affected by saline and sodic soils. The estimated cost of the project is USD 600 mn and will be funded by the World Bank and the GoM in the ratio of 80:20.

3.1 PROJECT DEVELOPMENT OBJECTIVE

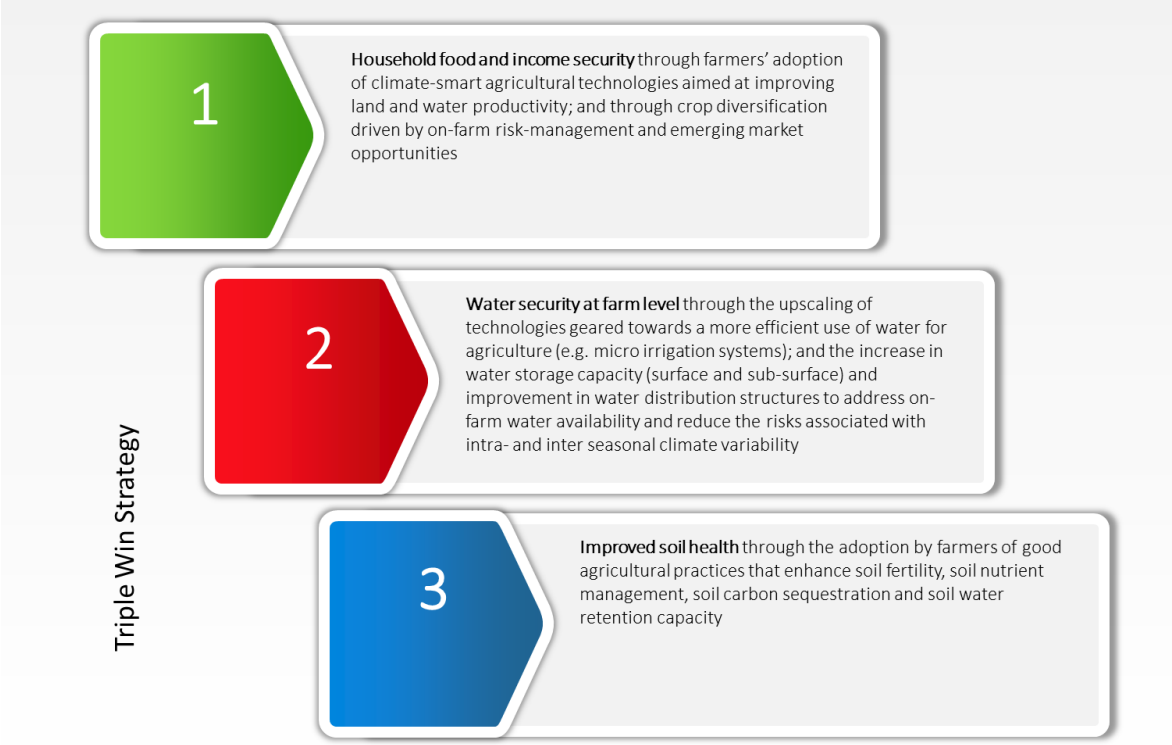
The Project Development Objective (PDO) *is to enhance climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra.*

This project would introduce transformational changes in the agriculture sector by scaling-up climate-smart technologies and practices at farm and (micro) watershed level, that would contribute to drought-proofing and management of lands in the state's most drought and salinity/sodicity-affected villages. The project would focus on smallholders (farmers up to 2.0 ha of farmland) with particular focus on

vulnerable population whose livelihood is impacted by changing climate conditions and climatic uncertainties.

Farm productivity improvement will be achieved through triple-win climate-adaptive solutions.

Figure 9 Triple-win concept



3.2 PROJECT GUIDING PRINCIPLES

The key guiding principles under the project are: (a) enhancing resilience through the introduction of cropping patterns and agronomic practices that improve water productivity, (b) sustainable and efficient use of water resources, including improved on-farm water use efficiency, (c) enhancement of soil health by increasing soil organic carbon and better management of saline soils, (d) increased private sector participation in the development of climate resilient value chains, and (e) improved adaptive capacity of the smallholders by providing weather information, techno-managerial support for aggregation and supporting innovation to achieve project objective.

3.3 PROJECT STRATEGY

The key strategies for climate resilience emanate from the critical gaps in adaptation:

- **Strategy 1**: Develop resilient cropping systems and practices for current climate variability, potential El Nino, and climate change, since the rain-fed areas under the project are impacted by all the three events.
- **Strategy 2**: The impact of climate change and climate variability is **location and context specific**. Thus the project strategy has to focus on natural resource management and developing cropping systems and practices for a "***Cluster of Villages"*** which are aligned with a mini-watershed (MWS). This would ensure a multiplier effect because of the interdependence of these villages.
- **Strategy 3**: The recommended package of practices for improving resilience will be further boosted by periodic farm level advisories which will be prepared considering the local area weather forecast, cropping pattern, crop condition, and soil health at the level of the ***Cluster of Villages***.
- **Strategy 4**: Building resilience in rural communities would require diversification of farming systems, livelihoods and incomes. Thus, the resilience package in the project would include: "Cropping systems + Agroforestry + Horticulture + Afforestation +Diverse Livestock Systems + Sustainable value Chain activities".
- **Strategy 5:** The resilience will be enhanced by promotion of drought tolerant seed varieties. Better management of water through micro-irrigation and protected cultivation with climate controlled structures such as polyhouse and shade net. Timely agricultural operations will be aided by farm mechanization services run on custom hiring basis.
- **Strategy 6:** Improved productivity levels will be supported by efficient post-harvest infrastructure on custom hiring basis, managed by farmer producer companies, to increase the share of farmers in the final price of agriculture commodities.

Key elements of the project strategy will revolve around the following:

Water and Agriculture: The project would focus on interventions combining farm-level activities aimed at enhancing water productivity through improved water-use efficiency, with (micro) watershed activities aimed at enhancing water storage capacity (improved rainwater harvesting techniques) and boosting groundwater recharge (aquifer replenishment). This is important because unsustainable water-related activities at farm and community level are emerging as a major challenge resulting from inadequate water conservation and irrigation practices.

Cluster level watershed plans: The project will develop comprehensive mini-watershed plans in conformity with the National Guidelines on Watershed Development. These watershed plans will take into account the hydrological boundaries of the clusters of villages. Mini-watershed plans will be backed by a detailed groundwater management plan for the project districts; such plan can be developed on the basis of: (i) groundwater draft and recharge (including methods adopted); (ii) safe and sustainable water yield from wells and aquifers for present and future use; (iii) previous changes in the level of aquifer water storage; (iv) hydrological relevance, feasibility and sustainability of current practices for micro-irrigation with farm ponds; (v) water use efficiency and water productivity of micro-irrigation practices; (vi) use of community farm ponds as micro-irrigation structures based on surface and groundwater regimes; (vii) water balance; and (viii) use of micro-irrigation solutions like drips and sprinklers to provide protective irrigation to crops at critical stages. The exercise will also have both adaptation and mitigation co-benefits aimed at ecosystem resilience.

Agro-met and farm advisory: The project will seek to set up a comprehensive agri-met data collection, processing and management system as well as agriculture technology transfer. This data would be utilized to create farm level advisories and contingency plans in partnership with CRIDA, SAUs, KVKs, and technology partners. It will also use the extension network of ATMA for knowledge and technology transfer to the farmer's fields.

Value chain development: It is important that all the gains expected from different activities proposed under PoCRA are beneficial to the farmers. This can only be feasible if there is resilient value chain linking relevant stakeholders. Project will actively pursue investment in community infrastructure (farm pond, custom hire centres, seed hub, crop diversification, nursery, protected cultivation, and storage), branding and market-linkage, etc.

Participatory planning and implementation: The long term sustainability of the project development objectives would be ensured by the participation and involvement of the community institutions in the planning, implementation and monitoring of the project activities. The project would help set up a **village climate resilient agriculture management committee (VCRMC),** representing different interest groups with focus on vulnerable sections of the village, including women. The members of the VCRMC would be appointed by the Gram Sabha and it would act as a sub-committee of the Gram Panchayat. The project will provide technical and social mobilisation support to VCRMC through field functionaries of the agriculture and allied departments, and resource agencies. The project would adopt a flexible, non-prescriptive, process-oriented approach to enable the communities to determine the scope of project activities, their timing, pace and sequencing. The project would be responsive to community priorities in terms of investments and would learn from implementation experience in relation to the project activities and implementation modalities. The participatory planning will result in:

- *Ownership:* The project would attempt ownership of the project by village community through the involvement of Gram Sabha, VCRMC and other village level institutions. The ownership would improve accountability and sustainability of the project activities.
- *Transparency:* All proceeding and records of the project will be accessible to all the stakeholders. Some specific provisions to ensure complete transparency are: (a) approval of the micro plan by the Gram Sabha, (b) social auditing would be a key tool at the cluster level displaying annual physical and financial achievements under the cluster development plan (applicable and relevant to the village); this can be through wall paintings on a public place accessible to all, (c) The VCRMC shall present the accounts of the project to the Gram Sabha at least once in a quarter, and (d) all the details of the works with costs / photos, etc. would also be available on the website of the project.

- *Cost effectiveness:* The project will ensure efficiency and effectiveness in all its interventions. This will be achieved through community mobilization and involvement.
- *Participation of vulnerable groups:* VCRMC shall have adequate representation of the vulnerable groups like SC, ST, women, disabled, and marginal farmers. The cluster development plan will also incorporate provisions to benefit women, the poor, landless labourers, marginal farmers, members of the Scheduled Castes and Tribes.

3.4 PROJECT AREA

The proposed project will be implemented in the 15 districts in Marathwada (Aurangabad, Nanded, Latur, Parbhani, Jalna, Beed, Hingoli, and Osmanabad), Vidarbha (Akola, Amravati, Buldhana, Yavatmal, Washim, Wardha,) and Jalgaon district of Nashik Division. Out of a total of 18,768 villages in the districts selected, the project will cover about 4000 villages characterized by high climate-vulnerability. The project will also include about 1,000 villages located in the Purna river basin and showing high levels of soil salinity and sodicity. These villages are spread over Akola, Amravati,

Buldhana, and Jalgaon districts.

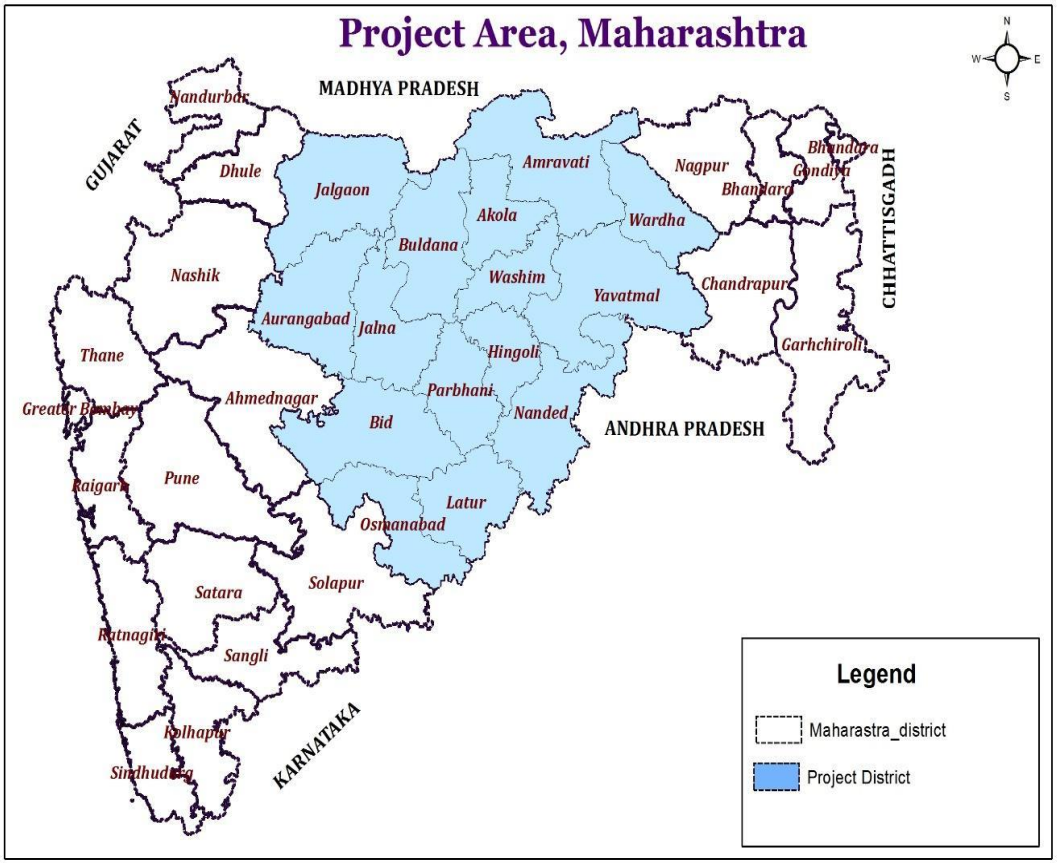


Figure 12 PoCRA Project districts

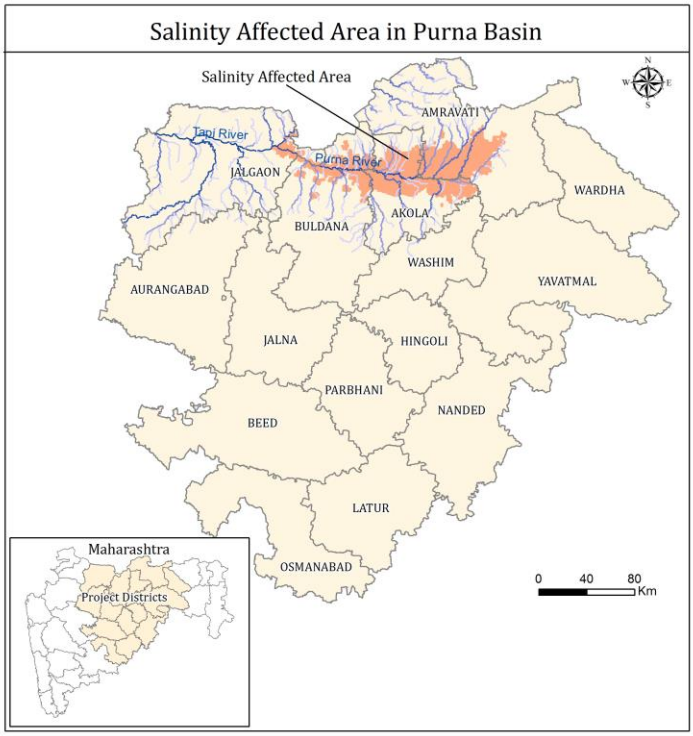


Figure 13 Saline affected areas in PoCRA

A brief profile of project districts is given below.

Table 5 Profile of the project districts

District	Number of Villages	Total Geographical Area (in Ha)	Population	Operational area (in Hectares)	Number of Operational landholders
Aurangabad	1353	1038517	2081621	691785	529861
Jalna	970	775120	1581617	592658	410342
Beed	1368	1087387	2070751	866225	651783
Latur	948	715054	1829216	640681	388916
Osmanabad	732	748478	1376519	693517	356579
Nanded	1603	1061923	2447394	826968	582200

Parbhani	843	621916	1266280	568266	347918
Hingoli	711	478059	998612	358910	213103
Buldhana	1443	963305	2037398	697338	430188
Akola	986	540742	1094165	418794	242253
Washim	789	507430	985747	374668	196424
Amravati	1997	959263	1851158	717590	415858
Yavatmal	2137	1351550	2174195	838025	378684
Wardha	1376	575804	877474	438569	196210
Jalgaon	1513	1091351	2887206	777177	438634
Total	**18768**	**12515900**	**25556621**	**9501173**	**5778953**

The state has 4,534,836 Below Poverty Line (BPL) card holders[8] under the public distribution scheme (PDS) out of which 45% are concentrated in these 15 project districts.

3.5 VILLAGE SELECTION CRITERIA

The villages in the project districts have been grouped into clusters having alignment with the mini watersheds identified by the GSDA. This has been done to ensure that the interventions made under the project contribute to comprehensive treatment of the mini watershed as per the principle of 'ridge to valley'. These clusters have been prioritised on the basis of a combined vulnerability index as per the criteria set out below.

Since the project is focused on climate resilience, the climate change vulnerability approach adopted by CRIDA (ICAR) has been considered for the selection of villages. IPCC – 2011 has defined vulnerability as follows.

[8] PDS MIS, Govt of Maharashtra

Vulnerability (V): The extent to which a natural or social system is susceptible to sustaining damage from climate change. Vulnerability is a function of:

- **Exposure:** Long-term changes in climate conditions
- **Sensitivity:** Degree to which a system will respond to a change in climate
- **Adaptive Capacity:** Ability of a system to adjust to actual or expected climate stresses (Wealth, technology, education, information, skills, infrastructure, access to resources, and management capabilities)

V = f (Exposure, Sensitivity, Adaptive Capacity)

The following table highlights the criteria to select the villages based on climate vulnerability of the clusters to which they belong.

Table 6 Vulnerability based targeting

Climate Change Vulnerability Indicators for selection of clusters under PoCRA				
	Indicator	Rationale	Nature of Relationship	Weightage assigned
A	**Sensitivity**			
1	Ratio of Net sown area to geographical area	A relatively higher area under cultivation implies higher relative importance of Agriculture and also that more area would be affected	Direct	2%
2	Ratio of Degraded land to Geographical area	Productivity levels would be low and highly risky, if crops are grown on degraded and wastelands	Direct	6%
3	Drought proneness (Frequency of droughts in last ten years)	Incidence of more frequent droughts implies more sensitivity to climate change	Direct	12%

Climate Change Vulnerability Indicators for selection of clusters under PoCRA				
	Indicator	Rationale	Nature of Relationship	Weightage assigned
4	Ratio of area operated by small & marginal farmers to total land holding	Smaller farm size limits marketable surplus and opportunity to diversify the cropping pattern and the low investment capacity of farmers make agriculture more sensitive to any climatic shock	Direct	8%
5	Ground water Index (based on Ground water prospect)	Groundwater prospect is an indication of further scope to harness ground water resources for irrigation. Low groundwater prospect means less scope for future and hence higher sensitivity	Direct	12%
B.	**Adaptive Capacity**			
1	SC / ST population	Population belonging to SC/ST being relatively poor, also less educated, poorly integrated with mainstream economy and heavily-dependent on natural resources for their livelihoods	Inverse	5%
2	Head of the household having income < Rs 5000 per month	More the poverty, lower will be the capacity to adapt to climate change and variability.	Inverse	7%
3	Ratio of agriculture workers to total population	This indicates a relatively higher importance of agriculture in the livelihoods of population compared to other sectors	Inverse	3%

Climate Change Vulnerability Indicators for selection of clusters under PoCRA				
	Indicator	Rationale	Nature of Relationship	Weightage assigned
4	Gender gap (gap between literacy rates of total population and the female population	Higher gap indicates lower gender equity	Inverse	3%
5	Livestock Population (No. of livestock per household)	This is an indicator of diversification of agriculture and enhances the ability to cope with climatic aberrations	Direct	8%
6	Agrarian distress	Agrarian distress due to crop failures, low prices, arrears of loans, non - profitability etc. indicates more vulnerability	Direct	9%
C.	**Climate Exposure indicators** (Projected change (%) in all parameters during mid-century (2021-50) or end-century (2071-98) relative to the baseline (1961-90)**)**			25%
1	Change in annual rainfall		Direct	
2	Change in June rainfall		Direct	
3	Change in July rainfall		Direct	
4	Change in number of rainy days		Direct	
5	Change in maximum temperature		Direct	
6	Change in minimum temperature		Direct	

Climate Change Vulnerability Indicators for selection of clusters under PoCRA				
	Indicator	Rationale	Nature of Relationship	Weightage assigned
7	Change in incidence of extremely hot days		Direct	
8	Change in incidence of extremely cold days		Direct	
9	Change in frequency of occurrence of frost days		Direct	
10	Change in drought		Direct	
11	Change in incidence of dry spells of >= 14 days		Direct	
12	Extreme rainfall events		Direct	
13	Change in 99 percentile rainfall		Direct	
14	Change in no. of events with > 100 mm rainfall in 3 days		Direct	
15	Change in max rainfall in 3 consecutive days as % to annual normal		Direct	

The values of the climate exposure for the project districts were taken from CRIDA and were considered uniform throughout the district.

For the indicators having direct relationships, the index for any indicator (n) of a cluster (i) was calculated as:

Index(n) = {i (n) - Min (n)}/{Max (n) - Min (n)}

For the indicators having inverse relationships, the index for any indicator (m) of a cluster (j) was calculated as:

Index(m) = {Max (m) - j (m)}/{Max (m) - Min (m)}

Combined vulnerability index for each of the clusters was calculated by aggregating individual indices after multiplying them with the weightage assigned to the respective indicators.

Clusters were prioritized within each district and taluka on the basis of their combined vulnerability index. The methodology of village selection was approved by the selection committee formed by GoM. The list of clusters and the villages contained therein was approved by the GoM and is given in Annexure -I

3.6 GUIDING PRINCIPLES FOR PLANNING, ACTIVITY PRIORITIZATION, SEQUENCING, AND BENEFICIARY TARGETING

The following table indicates the overarching principles for project planning, activity prioritization, beneficiary targeting, and sequencing.

Table 7 *Guiding principles for beneficiary selection and pattern of project sequence*

Guiding Principles	**Process**
Microplanning – as an integral part of Mini-watershed Plan for each cluster	The village and cluster level project planning will be carried out with the involvement of the community and institutions. Participatory planning will help in mapping resources and problems and identify constraints and possible activities for intervention. Care would be taken to involve all the sections of the stakeholders as well as the vulnerable sections of the society. The project micro plan as well as the annual plans will be approved by a resolution of the Gram Sabha. During the planning process, the project would assist the community by capacity building, providing technical knowhow and IT support.
Activities determination	The activities to be incorporated in the micro plan will: ● follow participatory planning process principles ● adhere to the watershed treatment principles ● indicate benefit sharing mechanism ● follow inclusive criteria

Guiding Principles	Process
Individual beneficiary targeting	Most vulnerable farm households in a village to be identified by the village community for assistance under the project and following categories will be given priority for project activities targeted to benefit individuals: ● Marginal farmers • ST/SC farmers • Women farmers • Disabled farmers • Other farmers ● Small farmers • ST/SC farmers • Women farmers • Disabled farmers • Other farmers
FPOs/ FPCs/ FIGs/ SHGs	All existing FPOs/ FPCs/ FIGs/ SHGs in the project area would be encouraged to participate in the project to take forward the project objectives of enhancing farmers' profitability through a collective approach.
Pattern of assistance	Project assistance will be provided for comprehensive watershed treatment, technology adoption for climate resilient agriculture production systems and post-harvest management. The interventions meant to benefit the common lands and activities would be fully funded by the project while those benefiting individuals or groups would be given assistance in the form of matching grants. The pattern of assistance has been indicated in subsequent parts of the PIP.
Sequencing	The project activities would be sequenced in a manner so as to fully harness the potential of infrastructure already created as well as keeping in mind the capacities of the target groups and available opportunities. Ridge to valley approach would be adhered to while treating the watershed.

3.7 PROJECT PHASING

The selected clusters will be taken up for project interventions in a phased manner. The project activities would be completed in 3 years' time in a cluster after initiation of the project activities.

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Total
Number of Clusters	130	350	190				670

4 PROJECT COMPONENTS

Component A: Promoting Climate-resilient Agricultural Systems

Figure 98 Key sub-components under Component A

The objective of this component is to enhance climate-resilience in agricultural production systems through a series of activities at the farm level. This will be complemented by interventions in the catchment areas of mini watersheds. The component will finance the development of mini-watershed plans and their implementation in the selected clusters. This component will enhance resilience in smallholder agriculture through technology transfer and watershed treatment by: (i) promoting the adoption of Climate Resilient Technologies (CRT) aimed at improving farm productivity through measures to enhance soil health and water-use efficiency; and (ii) improving water use efficiency through conjunctive water use for agriculture. This would result in better farm productivity which would sustain during the periods of climate shocks.

The component will have three key sub-components as indicated in figure 14:

COMPONENT A1

Participatory development of mini watershed plans

4.1 COMPONENT A1: PARTICIPATORY DEVELOPMENT OF MINI WATERSHED PLANS

4.1.1 Introduction

Participatory micro-planning process is a key feature of this project not only to understand the risk and vulnerability due to the climate change but also to plan adaptation strategy at the local level. All plans will have concurrence of locally agreed inclusive criteria. This will help in enhancing community participation for building resilience to address climate vulnerability. It will also create strong ownership of the project in the long run.

A village level micro plan will be developed in participatory manner and further consolidated into Cluster Micro plan. The micro plan will cover:

1. Cluster Profile- Socio Economic, Geo-physical, Agriculture, Livestock
2. Constraint Analysis- Water status, Soil health, Crop production, Marketing, Social, Gender
3. Causal analysis of crop wise yield gaps
4. Causal analysis of commodity value chain gaps
5. Opportunity mapping- resources & opportunities
6. Scope for major interventions like Water conservation & water harvesting structures, Soil & salinity management, micro Irrigation, Plantation, Production technology , Mechanization, Agribusiness infrastructure, FPO/ FPC strengthening etc.
7. Training and Skill needs analysis of farmers
8. Special needs of small holders, SC/ST farmers and Women farmers.

Based on the outcome of participatory micro plan, a detailed cluster development plan will be developed. CDP will be the basic unit of planning for this project and it will give account of activities under Components A, B & C to be implemented in the cluster. Each CDP will be backed up by a technical sanction by the SDAO and Gram Sabha resolutions of the participating villages.

The PMU will contract external entities to mobilize communities and farmers and develop the mini watershed plans on a participatory basis in close collaboration with local agencies. Watershed plans will subsequently undergo a rigorous quality review and validation process before being submitted to the relevant authority for funding clearance. The activities and investments derived from the plans will require a prioritization and sequencing within and across clusters to leverage the available infrastructure.

4.1.2 Activities

Activity	Sub-Activity	Who will do	Output	Indicator
Identification of Clusters (mini-watershed) in the project area. Alignment of mini watersheds with village boundaries and supply of resource maps for preparation of mini-watershed plans	Mapping of Mini Watersheds with various parameters (bio-physical, socio-economic)	● MRSAC ● GSDA ● IIT Bombay ● CRIDA	Maps of clusters	No. of maps
	Vulnerability index based mapping of the project area & selection of vulnerable clusters		List of vulnerable villages	Vulnerability index
Institutional arrangement	Formation VCRMC	● Gram panchayat ● Cluster Assistant ● Agriculture Assistant	Village level committee	No. of committees
Training on micro-planning process	The project/agency staff/village functionaries to be trained on the micro-planning process	● Yashada	Training sessions	No. of department /agency staff / facilitators/volunteers trained
Preparation of village micro plans	Community mobilization, focussed group discussion, resource mapping, household survey. Approval by women and general Gram sabhas	● VCRMC and Gram Sabha ● Project staff ● SAUs/ KVKs ● GSDA and other line departments	Village micro plans	No. of cluster micro plans prepared

Quality and Investment Review of the micro-plans	Analysis Error check Consolidation		Micro plans	No. of plans reviewed
Preparation of Cluster Development Plans	Technical feasibility. Estimates of the activities as per the guidelines	• External resource agencies • VCRMCs	Cluster Development Plans	No. of CDPs prepared
Finalization and technical sanction of the CDP	Technical sanction of the CDP	Department of Agriculture PMU, POCRA	Approved Cluster Development Plans	No. of plans approved

4.1.3 Approach

Comprehensive plan will be developed at village level / micro-watershed level so that it can be used as an instrument for convergence with other schemes / departments.

The typical participatory micro-planning process is given in the figure below.

Figure 94 Typical steps in a microplanning process

COMPONENT A2

CLIMATE SMART AGRICULTURE AND RESILIENT FARMING SYSTEMS

4.2 COMPONENT A2: CLIMATE SMART AGRICULTURE AND RESILIENT FARMING SYSTEMS

4.2.1 Introduction

This component is focused on climate resilient technology transfer, demonstration of carbon sequestration through various carbon enhancement measures and soil water conservation measures. In addition the project is trying to mitigate the problem of salinity in some of the project areas. Planned adaptation is essential to increase the resilience of agricultural production to climate change.

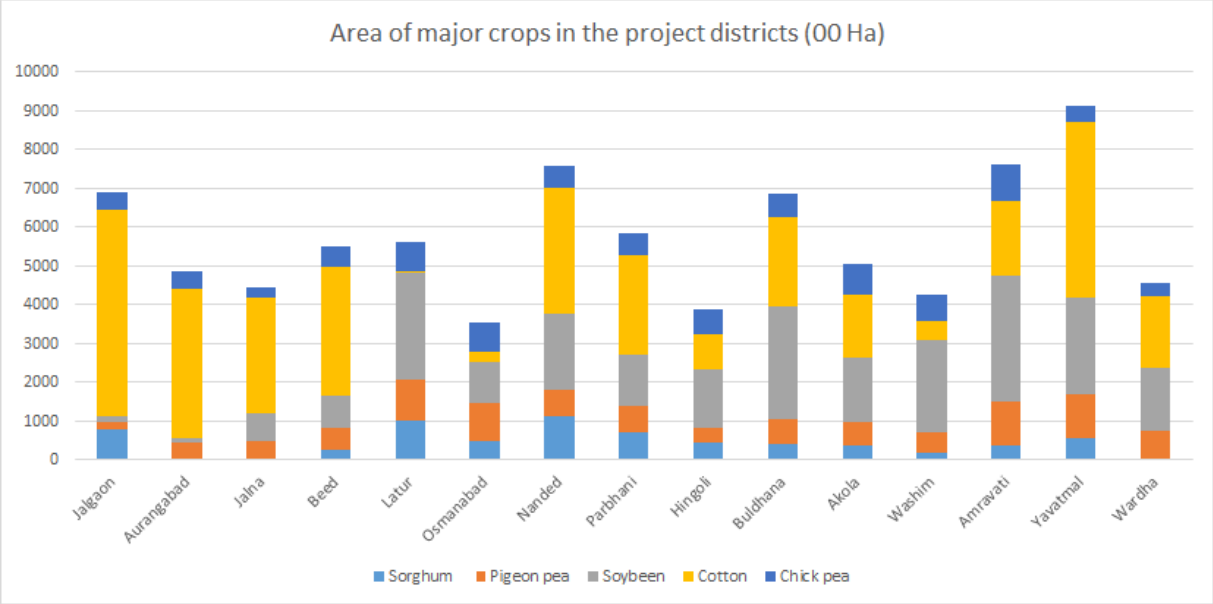
The farmers in the project area of Maharashtra have been facing irregular & inadequate rainfall, temperature variation, soil salinity, low fertility leading to low yield and crop loss. Planned adoption of customised climate resilient agriculture system shall help them to reduce their yield variability and enhance farm production under adverse climatic conditions.

4.2.2 Situation analysis

The major crops grown in the Marathwada region are jowar, bajra, pulses, groundnut, soybean, cotton, horticulture, etc. The main cash crops of Vidarbha region are cotton, orange, soybean, and gram. Both cotton and soybean are still favoured by the farmers for their evolved value chain and ecosystem. Therefore even though the current resilience of these crops is fraught with risk, a full diversification out of this cropping system may not be feasible. The project prioritised the following crops for project interventions (a) Cotton, (b) Soybean, (c)Pigeon pea, (d) Chickpea, (e) Sorghum, (f)Mango, (g) Citrus, and (h) Capsicum (protected cultivation).

The area, production, productivity and the existing varieties of the selected crops are enumerated below.

Figure 13 Average area and productivity of selected crops in the project districts (2010-11 To 2014-15)



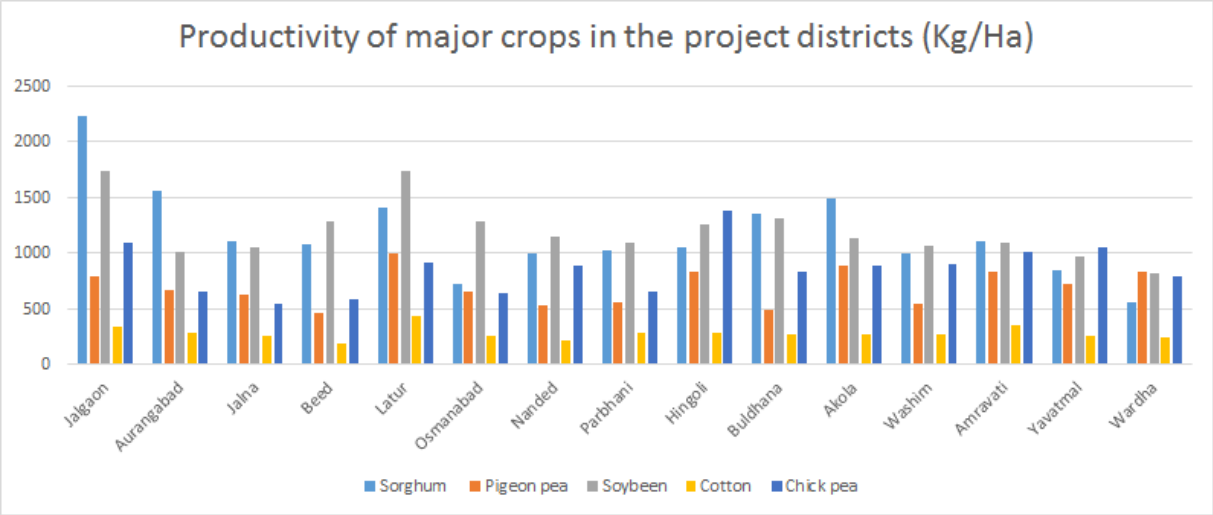


Figure 16 Area and productivity of major crops in PoCRA districts

Source: Crop statistics, Department of Agriculture, GoM

Key issues the component is addressing

Based on the situation analysis the following issues emerge:

Terminal drought, long dry Spell, disease and pests, unavailability of improved varieties of quality Seeds are the key reasons for low productivity of field crops whereas lack of proper drainage, low adoption of pruning technology account for low productivity of some of the fruit crops. Alternate bearing, low density planting, lack of pruning, lack of quality planting material are the key reasons for low productivity of Mango in the state. Lack of irrigation facilities during the period of soil moisture stress is one of the key reasons for crop failure.

This component will focus on supporting the transfer and adoption of climate-smart agricultural technologies by smallholder farmers, IPM and related practices aimed at enhancing farm productivity in the high climate variability context. The component will support bulk production as well as promotion of drought- and salinity-tolerant crop varieties, support crop diversification and appropriate farm mechanization to better cope with climate variability in the project area. The project will emphasize on promotion of field crops like Cotton, Soybean, and Pigeon Pea in Kharif, Chickpea and Sorghum in Rabi, high value vegetable crops like Capsicum, and fruit crops. It will also enhance the carbon sequestration through afforestation and promotion of fruit crops. Soil organic carbon would be improved by promoting conservation agriculture. It will also aid the saline and sodic soil management in the affected villages.

4.2.3 Objective

The key objective of this component is to maximize the crop productivity by promoting the transfer of climate-smart agricultural technologies at farm level.

This component aims at achieving this objective as follows:

i. By supporting the transfer and adoption of climate-smart agricultural practices by smallholder farmers through on-farm demonstration that will be done through a farmer field school approach (CSAP-FF) (a) Using drought- and salinity-tolerant crop varieties of Cotton, Chick Pea, Pigeon Pea, Soya bean, Rabi Sorghum, and high value vegetables (b) Supporting crop diversification to better cope with climate variability in the project area (c) Promotion of IPM , INM and related practices aimed at enhancing farm productivity in the high climate variability context (d) Promotion of appropriate farm mechanization.
ii. Enhancing soil health through carbon sequestration by (a) afforestation in upper reaches (b) promoting plantation of horticultural crops like Mango, Guava, Custard apple and Citrus (Orange, Sweet Lime & Kagzi lime) (c) conservation agriculture.

iii. Improving saline and sodic soil in the affected villages by (a) organizing demonstrations of improved agronomic practices for saline soils (b) promoting appropriate soil amendment (c) improving drainage.

iv. Promoting protected cultivation to address micro-climate variability by (a) introducing shade-net houses (b) poly-houses (c) poly tunnels in select crops along with micro-irrigation system.

v. By promoting integrated farming system especially to meet the inclusive criteria to involve common interest groups of landless, women, scheduled castes and tribes covering activities like (a) small ruminants (b) backyard poultry (c) sericulture (d) apiculture (e) inland fishery

4.2.4 Activities

To achieve the objectives of the component, following activities and sub-activities shall be carried out with specific output and indicators.

Activity	**Sub-Activity**	**Who will do**	**Output**	**Indicator**
Demonstration of Climate resilient Varieties of field crops through a farmer field school approach	Finalizing the package of practices suitable to the selected crop and plot Visit of scientists Training of farmers Documentation	-KVK-Scientist -ATMA -Selected farmers -Cluster Executive	Conduct of farmer field schools	No of farmers who participated in farmer field school training Increase in Yield
Enhancement of carbon sequestration through the plantation of fruit trees	Use of Government and private nurseries to enhance the area under drought/salinity tolerant varieties of fruit crops such as Mango, Orange, Citrus (Sweet Lime & Kagzi Lime), guava and	Department of Agriculture VCRMC Farmers	Plantation of fruit trees of recommended varieties	Ha. Under new plantation (crop wise)

	custard apple. The perennial fruit crops enhance carbon sinks.			
Afforestation in the upper reaches of watershed and on the boundaries of farmers' lands	Digging continuous trenches (CCTs) Plantation of seedlings / seeds	Department of Agriculture VCRMC Farmers	Afforestation suitable to local climate	Hectares under new afforestation
Improvement of saline and sodic soil	Demonstrations of Climate resilient technologies, including BBF, green manuring, contour cultivation Application of gypsum	Department of Agriculture VCRMC SAU	Improvement in soil characteristics Improved agronomic practices through demonstrations	Area intervened
	Subsurface drainage wherever the land slope permits good drainage		Farm land reclaimed	Area covered with sub surface drainage
	Farm pond with inlet & outlet and grass cultivation on burms & inlet channel		Increased water availability	Cum. water stored
	Providing water pumps and sprinklers		Application of water for protective irrigation	Area covered under protective irrigation
Promotion of Protected Cultivation for Vegetable crop	Promotion of Shade net house	Department of Agriculture VCRMC Farmers	Shade-net house system with piping materials	Sqm. of Shed net house established
	Promotion of Poly house and polytunnels		Polyhouse and poly-tunnels systems with planting material	Sqm. of Poly house and polytunnels established

Integrated farming system	Identification of suitable activity	Department of Agriculture VCRMC Farmers	Provision of Small ruminants, Back yard poultry, Sericulture, and Apiculture	No of families assisted

4.2.5 Approach

"Resilience" is the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions (IPCC, 2012).

The project would follow the following approach for various activities and sub-activities stated above:

A2.1 Demonstration of climate resilient technologies through farmer field school (FFS) approach:

The project plans to have farmer field school approach to transfer climate resilient technology transfer for the clusters. Farm Field Schools would be operationalized at village level. These would be set up in the field of outstanding or achiever farmers. Farm Schools provide the vital link between the progressive / achiever farmers and others in a village. The list of such farmers having potential for organising farm schools in the village for different crops will be identified jointly by Cluster Assistant, Agriculture Assistant and Farmer Friend and will be approved by VCRMC. Plan of Farmer Field Schools for each season will be approved by DPMU. "Trainers/ Facilitators/Teachers" in the FFS could be progressive farmers, extension functionaries or experts belonging to Government or Non-Government Sector or KVK/ SAUs. In addition to technical support through Farm Schools, knowledge and skill of selected farmers will also be upgraded through training at district/ state level and exposure visits, etc. Also the FFS Students/ Farmers would have the responsibility of providing extension support to neighbouring farmers growing the same crops. Activities of FFS would be to operationalize Front Line Demonstrations of Climate Resilient Technologies in one or more crops. These demonstrations would focus on Integrated Crop Management including field preparation, climate resilient seed, seed treatment, IPM, INM, mechanization, protective irrigation, harvesting management etc. Farm Field Schools would provide season long technical backstopping/ training to target farmers by having an interactive session once at least during each of the 6 critical stages in a cropping season. While selecting the trainee farmers, about 50% representation would be given to small and marginal farmers. Preference will be given to members of CIGs / FIGs. Farmers will visit FFS as per specified schedule or as may be necessary.

Trainers/Facilitators visit FFS at the specified intervals or as may be necessary. Knowledge and skills of trainers would be upgraded on a continuous basis through training.

The partner agencies (SAU-KVK) and ATMA will be involved in this process to provide a comprehensive model in clusters through the life-cycle of the project. The FFS approach will also be followed for saline and sodic soil affected clusters.

A comprehensive list of some of the climate resilient technologies , the project has identified with the help of ICAR- CRIDA, ICAR-CSSIR, ICRISAT, State Agriculture Universities (SAUs) and KVKs and are planned to be disseminated to the farmers is given in table below:

Table 8 Key climate resilient technology package identified for PoCRA

Climate Resilient Technologies to be promoted under PoCRA			
Technology	Resilience Feature	Expected benefits	Suitable Crops
1. Contour cultivation	Resilience to soil erosion, moisture stress & soil nutrient loss	Helps in conservation of moisture around root zone of crops. Arrests soil and nutrient loss.	All field crops, vegetable crops and tree species
2. Cultivation by broad bed furrow (BBF) method	Resilience to moisture stress, poor soil drainage, nutrient (fertilizer) loss	Ensures optimum moisture and aeration at root level, helps drain out water in excess rainy condition, saves seed, ensures proper fertilizer placement in root zone, helps develop optimum microclimate under crop canopy, helps in proper intercultural operations, reduces cost of cultivation.	All field crops both in Kharif and Rabi season

3. Intercropping	Resilience to risk due to crop failure, moisture stress, pest incidence	Ensures optimum use of soil moisture & nutrients, overcomes risk due to aberrant climatic variabilities, helps in effective pest management, and reduces financial risk in farming.	Cotton, soybean, pulses, sorghum & pearl millet
4. Use of improved seed varieties	Resilience to moisture stress due to dry spell & drought, pest epidemic, infestation by wilt & soil borne pathogens	Higher yields than existing varieties, helps escape drought condition due to shorter durations, tolerance to moisture stress, resistance to pest & disease infestation fetches good price due to better consumer preference.	All crops
5. Seed treatment	Resilience to biotic stress	Protection from soil born pathogen and pests, enhances good root development.	All field crops
6. Integrated Nutrient Management	Resilience to abiotic stresses including soil salinity, nutrient deficiencies, susceptibility to pest & disease	Enhances crop health, higher yields, enhances quality of produce, resistance to biotic & abiotic stresses, enhances quality of produce, enhances consumer preference, helps to fetch better market price.	All crops
7. Integrated Pest Management	Resilience to pest & disease epidemic, environmental hazards	Protection from pest & disease attack, reduction in use of chemical pesticide, helps in production of residue free agriculture commodities, reduces environmental hazards, enhances quality of produce, enhances consumer preference in domestic and export market, helps to fetch better market price.	All crops

8. Furrow opening	Resilience to moisture stress,	Helps in conservation of moisture around root zone of crops during dry spell.	Cotton, soybean, pulses, sorghum & pearl millet
9. Foliar spray of 2% Urea at flowering and 2% DAP at boll development	resilience to poor nutrition & moisture stress		Cotton
10. Protective irrigation through farm pond	resilience to moisture stress during dry spell & drought condition	Overcomes moisture stress during critical stages, improves nutrient uptake, and enhances increase in yield.	All crops
11. Conservation tillage	Resilience to moisture stress, soil & nutrient loss	Enhances level of soil carbon, soil fertility & water holding capacity, better crop health and higher yields, enhances quality of produce, resistance to biotic & abiotic stresses, and enhances quality of produce.	All crops
12. Incorporation of biomass	Resilience to soil organic carbon (SOC) loss	Enhances level of soil carbon and soil fertility, Enhances water holding capacity of soil, leading to better crop health and higher yields, tolerance to moisture stresses.	All crops
13. Mulching	Resilience to moisture stress	Helps to overcome moisture stress, enhances development of microbes & earthworms around root zone, increases SOC level, enhances availability of nutrients to plants, better root development, protection from soil borne pathogens.	All crops

14. Cultivation of citrus crops on broad ridges	Resilience to poor soil drainage & soil borne diseases	Enhances proper microclimate around root zone, helps in retaining optimum soil moisture, avoids contact of water with stem collar, and prevents infection by phytophthora & other soil borne pathogens.	Mandarin orange, Sweet orange and Kagazi Lime
15. Canopy management in fruit crops	Resilience to stress management	Enhances fruit bearing capacity, enhances quality of fruits, and reduces cost of harvesting.	Citrus, Mango, Pomegranate & Guava

Key Guiding Principles:

The FFS would be organized with the following principles.

- A series of climate resilient practices as validated by NICRA in the state will be replicated in this project i.e. use of short duration varieties, use of BBF planting, Contour cultivation, maintenance of plant population, IPM & INM, Intercropping, protective irrigation, foliar spray of anti-transpirants, etc.
- The technologies to be demonstrated will be packaged by experts from SAU & KVK with involvement of project personnel, technical officers from Agriculture Department and ATMA. The achiever/ host farmers undertaking demonstration would be supported for critical inputs as prescribed by SAUs.
- VCRMC in consultation with farmer interest groups will prepare a list of progressive/ achiever farmers growing the major crops and who are willing to share the technologies used.
- VCRMC would select the farmers representing various sections of the farming community who need to be oriented in these practices and share the same with the cluster assistant. Thus crop wise selected group of farmers will be enrolled to FFS.
- Every village will have one FFS for each of the major crops
- The selected farm would be taken up for three years in succession for FFS
- Facilitation of the FFS would be done by the facilitator trained for the purpose.

- Overall technical backstopping of each FFS will be done by KVKs with the help of scientists & experts from KVK, SAU, and NRCs through regular visits at minimum 6 times during crop life/ season.
- To document the results obtained and yield achieved, harvesting of the crop on achiever farmers' field will be carried out in presence of Project staff, experts from KVK/ SAU.
- A field day will be organized at the time of harvesting to create more awareness about the climate resilient technologies among other farmers.

Table 9 *Component Implementation Plan for Promotion of climate resilient farming systems through FFS*

Activity	Who will do	How	Remark
Training of trainers/ facilitators	-RAMETI -SAU -KVK	Cluster assistants, selected Agriculture Supervisors, Agriculture Assistant, BTM will be trained for facilitation of FFS	
Planning phase	-SAU -KVK -ATMA -Cluster Assistant -Agriculture Assistant	VCRMC to recommend the list of Achiever Farmers, Cluster Assistant & Agriculture Assistant to finalize the list of farmers, plots and crops, KVK to finalize the package of practices	Inclusive criteria to be adhered to as far as possible
Demonstration phase	-KVK-Scientist -ATMA -Selected farmer -Cluster Assistant -Agriculture Assistant	Layout of plots, Farm operation and record keeping, field days for groups of farmers, discussion on records	KVK scientists to train and discuss the package of practices with other farmers
Harvest phase	-KVK -Selected farmer -Cluster Assistant -Agriculture Assistant	Recording of harvest, other parameters set out during the planning phase	Opinion survey of farmers
Follow up phase	-Cluster Assistant -Agriculture Assistant -Krushi Mitra -Selected farmer -M&E Agency -Communication specialist	The cluster level reports on post demonstration adoption, constraints and opportunities to be captured	PMU to document successful demo, lesson learnt and produce guidance note for scale up

A 2.2: Enhancing carbon sequestration - Greenhouse Gas Accounting for project:

The World Bank Environment Strategy (2012) adopted a corporate mandate to account for the greenhouse gas (GHG) emissions for investment lending. The quantification of GHG emissions is an important step in managing and ultimately reducing emissions, as it provides an understanding of the project's GHG mitigation potential. Further, Paris Agreement also mandates reporting of assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions to achieve the goals of Article 2.

It is proposed to incorporate agriculture, water and nutrient management, agroforestry, etc., practices to build resilience in semi-arid agriculture while reducing the GHG emissions and enhancing carbon stocks.

The World Bank has adopted the Ex-Ante Carbon-balance Tool (EX-ACT), developed by FAO in 2010, to estimate the impact of agricultural investment lending on GHG emissions and carbon sequestration in the project area. EX-ACT is a land-based appraisal system that allows the assessment of a project's net carbon-balance, defined as the net balance of CO2 equivalent GHG that are emitted or sequestered because of project implementation compared to a no project or without project scenario. The summary of GHG accounting for the project is given in Annexure...XXXX

Figure.17 .EX-Ante Carbon Balance Tool (EX-ACT).

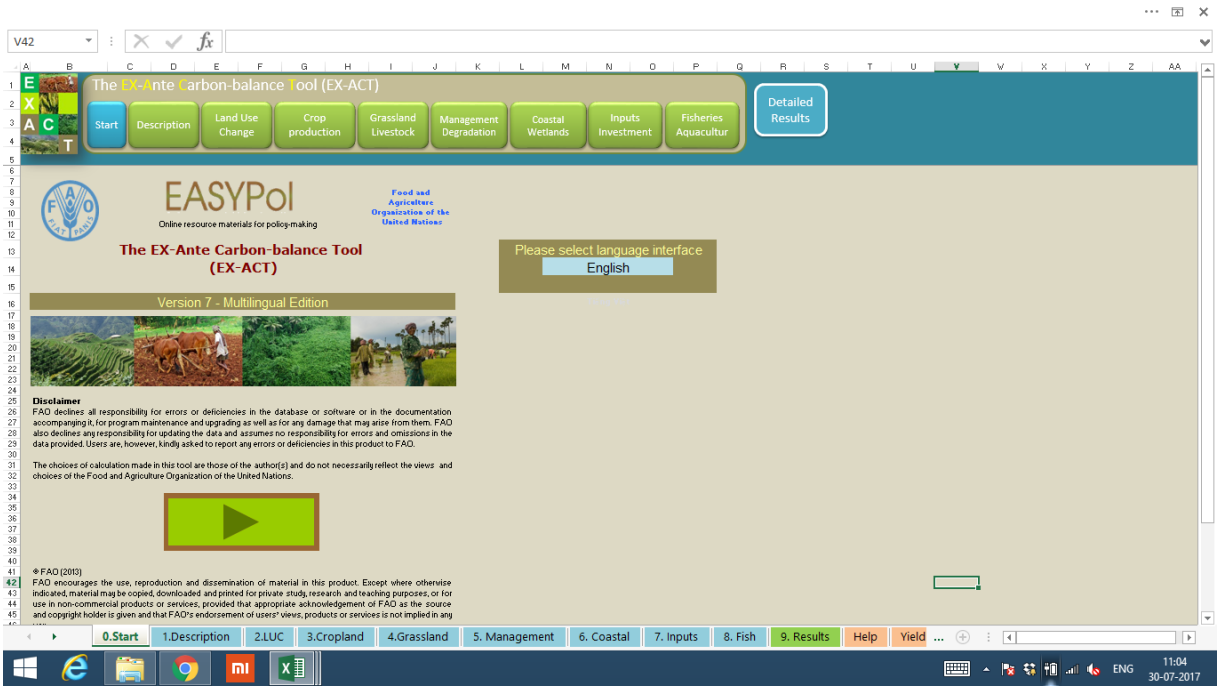


Figure 17 EX-Ante Carbon Balance Tool (EX-ACT)

Enhancing Carbon Sequestration through Plantation

Project area has huge non-arable land on the upper reaches of the mini-watersheds and the lands are moderately degraded. The degraded agricultural soils have lower soil organic carbon (SOC) stock than their capacity. Furthermore, depletion of the SOC pool also leads to degradation in soil quality and declining agronomic/biomass productivity. Therefore, conversion to restorative land uses (e.g., afforestation, improved pastures) and adoption of recommended management practices can enhance SOC and improve soil quality. These Carbon enhancement modules (CEM) and carbon enhancement

practices (CEP) help in sequestration of atmospheric carbon in the soil.

The project will make a conscious attempt to:

- identify the potential of non-arable land and possibility of bringing it to plantation
- identify and demonstrate a potential agroforestry model for creation of the Carbon sink that must be reflected in mini / micro watershed plans in terms of Carbon stocks
- reduce overall GHG emission or to create a sub-project by IPCC method, if feasible
- As an integral process of catchment treatment, tree plantation both on community land and individual land is planned. While the plantation in community land will be undertaken by VCRMC with 100 percent financial support by project as laid down in GoM guidelines for other schemes and the support is phased in 3 years.

Agroforestry: The project will aim to identify and demonstrate a potential agroforestry model for creation of the Carbon sink that must be reflected in mini / micro watershed plans in terms of Carbon stocks. Locally appropriate species of forest plants will be procured from government and approved private nurseries. The plantation in community land will be done through participatory approach to establish norms for grazing restriction or controlled grazing on treated areas, especially in areas under afforestation treatment and ban on tree felling. Plantation on peripheries of the farmlands will be promoted.

Horticulture plantation: As part of the Carbon sync creation, diversification will be promoted by the project-particularly the long rotation crops. This will be demonstrated in selected parcels. Drought/salinity tolerant planting materials of Mango, Citrus (Orange, Sweet Lime & *Kagzi* Lime), Guava, Custard Apple and Pomegranate shall be promoted in the project areas. Project will support the procurement of quality planting material from accredited horticulture nurseries.

Key guiding principles:

- Potential clusters for Mango, Citrus (Orange, Sweet Lime & Kagzi Lime), Guava, Custard Apple and Pomegranate will be identified by the department preferably in fallow land, with patches identified during micro planning and having reasonable water sources for perennial crops as well as market potential.

- Project will ensure adoption of the package of practices developed by the centres of excellence (Citrus and Mango) and SAU.
- MRSAC soil profiling data with soil health status data will be integrated to advise suitability of plantation crops and their nutrition management.

Table 10 Steps for SoC estimation

Step 1	Select a land-use category or project activity
Step 2	Define the project boundary and map the land-use category or project area
Step 3	Stratify the project area or land use category
Step 4	Select the plot method or agricultural farms
Step 5	Select Carbon pools and frequency of measurement
Step 6	Identify indicator parameters to be measured
Step 7	Select sampling method and sample size
Step 8	Prepare for fieldwork and data recording
Step 9	Decide on sampling designs
Step 10	Locate and lay sample plots
Step 11	Measure the indicator parameters in field and conduct laboratory analysis
Step 12	Analyse data and estimate C-Stock / CO_2 emissions

Enhancement of soil organic carbon (SOC) will be achieved by adopting species recommended by ICAR and also as per the guidance provided in the World Bank Tool Kit for soil carbon enhancement.. Besides its value as a source of plant nutrients, organic matter has a favourable effect upon soil physical properties. The influence of organic matter (OM) on soil properties and consequently on plant growth is far greater even though the percentage of organic matter (OM) is less in the soil. Several activities under the project have been identified for enhancing the soil organic carbon.

Project activities enhancing carbon stock:

The potential synergy expected in the carbon enhancement modules (CEM) and Carbon Enhancement Potential (CEP) of different activities as applicable in this project has been given in the table 18 below.

In addition it is necessary that the project systematically tracks the carbon benefits accrued in this project. The baseline data shall be collected by the M&E agency. The steps for estimation of carbon stock have been given in Table 11.

Table 11 Carbon benefits envisaged in the POCRA project

Project components/Activities	Nature
Watershed development (A1)	CEM
Soil water conservation (A2)	CEM
Agro-forestry (A2)	CEM
Efficient irrigation (A3)	CEM
Cropping systems (A2)	CEM
Fruit Orchards and Gardens (A2)	CEM

Project components/Activities	Nature
Mulching (A2)	CEP
Reduced or zero tillage Contour bunding (A2)	CEP
Organic manure application; Green manure application (A2)	CEP
Farm ponds Tank silt application (A3)	CEP
Intercropping/multiple cropping (A2)	CEP
Cover cropping (A2)	CEP

Note: CEM (Carbon Enhancement Measures), CEP (Carbon Enhancement Potentials)

2.3 Improvement of Saline and Sodic soils:

This activity will involve improved agronomic practices, use of soil amendment, and protective irrigation with improved water use efficiency and subsurface drainage management through a farmer group demonstration approach. The activity will be taken up under the guidance of ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal and in partnership with PDKV, Akola.

The other activities under this will be (a) to take up agronomic practices that include introduction of drought and saline resistant varieties and their management practices (b) farm ponds (c) installation of water pumps and sprinklers.

Guiding principles

- All villages affected by salinity in the project districts will be tackled under this component.
- Micro Plans of the cluster of villages will be prepared focusing on the salinity management issues and needs
- Management of saline and sodic soil in the project area will broadly follow ICAR-CSSRI recommendations.
- Farmers who are willing to adopt the improved technologies will be identified and their groups will be formed in each village by VCRMC
- Farm Field Schools as per the guiding principles described at A2.1 will be organized to demonstrate the improved agronomic practices and utility of soil amendments for salinity management & soil health improvement in addition to the proven technologies under NICRA.
- Integration of Farm ponds, water lifting devices and micro irrigation systems will be done to demonstrate impact of the technologies
- Subsurface drainage, dilution, gypsum application if required will be encouraged in the selected areas

A 2.4: Protected Cultivation

This sub-component intends to demonstrate high value crops under controlled environment. This includes support for poly houses and shade nets. The project will support one or two such demonstrations in a cluster. The key benefits of protected cultivation will be through better soil moisture management, higher yield and quality enhancement, lesser pest and disease incidents, and off season cultivation. This will be in conformity with many principles of precision farming recommended by ICAR.

Guiding principles:

- FFS approach described above shall be used to demonstrate the technology (poly houses, poly tunnels, shade-nets)
- Preference will be given to the clusters where there is a clear value chain linkage
- High value crops appropriate for the project area will be promoted.

- The project will promote climate controlled structures conforming to Bureau of Indian standards (BIS) (i) IS 14462: 1997 - Recommendations for layout, design and construction of greenhouse structures (ii) IS 14485: 1998 - Recommendations for heating, ventilating and cooling of greenhouse (iii) IS 15827: 2009 - Plastics films for greenhouses – specifications. The specifications are given in annexure-II

A2.5 Integrated farming system

Some of these options will be taken up as part of inclusive criteria in selected areas for the identified vulnerable households during the micro-planning process.

i. ***Promotion of small ruminants and backyard poultry***

- Small ruminants like goat and sheep rearing will be promoted in the project area
- Back yard poultry will be promoted as an income generation activity for women
- Focus will be on landless, tribal and women beneficiaries

ii. ***Fishery***

- Fishery activity can be taken up in community / village ponds or tanks in a given cluster
- The landless and women (who collectivise themselves as a common interest group) who depend on these water bodies would be given priority
- Short seasonal tanks with effective water spread area (25 % of the actual water spread area) can be identified in the clusters for fishery activities. The project will provide necessary input, knowledge and logistical support.

iii. ***Sericulture***

- Sericulture is agro based business having potential for employment generation and rural development. Geography and weather of project area is suitable for sericulture.
- The project will promote sericulture among the marginal farmers group, individual farmers, SHGs, FIGs who are interested in sericulture. This will also help farmers to build alternate sustainable income source.

iv. ***Apiculture***

- Beekeeping is very helpful for farmers practicing horticulture and floriculture. The project will help small and marginal farmers, SHGs, FIGs who are interested in beekeeping. This will also help farmers to build alternate sustainable income source and also create employment opportunities in project area.

COMPONENT A3

Promoting efficient and sustainable use of water for agriculture

4.3 COMPONENT A3: PROMOTING EFFICIENT AND SUSTAINABLE USE OF WATER FOR AGRICULTURE

4.3.1 Introduction

This component primarily deals with surface and groundwater management for improving water use efficiency. This component will help in undertaking crop-water budgeting and water security at the farm level which will be a key driver for climate resilience. This is one component which intends to create common assets that will have long term climate resilience for all in the project area. PoCRA will implement this in partnership with several partners agencies i.e. GSDA, IITs, SAUs and private sector. Details of subcomponent activities are outlined below:

This sub component will focus on the following:

- Watershed development
- Surface water management
- Groundwater management
- Soil moisture management
- Assessing the village / cluster water balance
- Protective irrigation
- Efficient water management practices

4.3.2 Situation Analysis

Some of the project districts viz., Akola, Aurangabad, Hingoli, Jalgaon, Latur, Osmanabad, Parbhani have relatively deeper groundwater levels (>10 m) and the mean groundwater level is below 15 m in these districts. However, in Akola, Jalgaon, and Latur, the coefficient of variation is relatively higher (>70%), which suggests that there is high spatial variability and there could be regions with both deeper as well as shallower groundwater levels in these districts with respect to the mean level and may present higher uncertainty in the spatial variability of groundwater levels. On the other hand, in Hingoli, Jalna, Wardha, and Washim the coefficient of variation is lower than 40% and hence it suggests that uncertainty in the spatial variability of groundwater level with respect to the district mean is relatively lower. In most of the PoCRA districts the mean groundwater levels are below 10 m indicating that the groundwater is relatively in good situation. A large fraction of the monitoring stations is dug wells, which also suggest

that the groundwater table is shallow (*Shekhar, 2017*)[9]. The report further suggests that it appears feasible to utilize the groundwater resources for development of key plans in PoCRA districts. The approach towards this would be to develop the groundwater resources in the rain-fed areas of the PoCRA districts for one supplementary irrigation combining with Kharif rainfall through state-of-art irrigation technologies, which will limit least use of groundwater resources. Since this additional development proposed would result in additional increase to the stage of groundwater development in the watersheds, the complementary approach that needs to be addressed would be to reduce the current irrigation drafts in these watersheds in higher intensive cultivated areas through improved irrigation methods, reduce use in non-Kharif seasons and alteration in cropping choices in such a manner that the stage of groundwater development is maintained overall in the watersheds at or around the current levels.

Purna basin covers 4.70 lakh ha. of saline land having shrink-swell black soils with low hydraulic conductivity. Poor quality of groundwater (saline) has resulted in low cropping intensity of 112% in this region. Several studies (Raja et.al.) have concluded that the river water is suitable for irrigation with moderate salinity and low sodicity. The dug well and bore well waters have high salinity in pre- and post-monsoon seasons but show perceptible variations with medium to high sodicity in pre-monsoon and low to medium sodicity in post-monsoon samples. These waters are unsuitable for irrigation and require management techniques such as artificial recharge and other soil-management measures.

Reducing existing yield gaps and increasing crop productivity in the semi-arid areas of Maharashtra requires first and foremost an increase in the supply of water for agriculture, especially during the period of soil moisture stress. To that effect, proposed activities (demonstrations, knowledge sharing and skills development, building farm/community assets) will: (i) help significantly scale up the adoption by small and marginal farmers of micro irrigation systems (specifically, drip and sprinkler irrigation systems) and associated water storage, delivery systems and drainage facilities; and (ii) improve water availability through a sustainable management of water resources at farm, community and mini watershed level. This sub component will also promote "protective irrigation" and support efforts to monitor the quality of the water available for agriculture.

[9] Hydrology & Hydrogeology of the PoCRA districts and Summary of Observations. Prof Sekhar Muddu. IISc Bengaluru

Key issues/challenges:

Maharashtra is an agriculturally advanced state and contributes significantly to the agriculture growth of the nation. The key challenges faced by farmers include the following:

- High variability of monsoon has caused significant disruption to agricultural growth resulting in low productivity and indebtedness.
- Even in assured rainfall zone, there has been sub-optimal rainwater management
- As per the economic survey of Maharashtra (2013-14), despite substantial investments made in irrigation sector over the last six decades since independence, approximately 80% of the agricultural land in Maharashtra remains outside formal irrigation systems provided by the State. Even though recently state has made large scale investment in water harvesting structures, the area under irrigation remains very low.
- Large scale private investment in bore wells has only resulted into over-exploitation of groundwater.

4.3.3 Objective

The key objective of this component is to support activities aimed at achieving on-farm water security by maximizing the use of surface water for agriculture, managing groundwater resources in a sustainable manner, retaining and enhancing soil moisture, and enhancing water-use efficiency and water productivity ("more crop per drop").

4.3.4 Activities

To achieve above objectives, following activities and sub-activities shall be carried out.

Activity	Sub Activity	Who will do	Output	Indicator
In-situ Soil conservation	Before rain, land configuration like compartment bunding, across/ contour trenches are constructed	● KVK ● SAUs ● Project staff ● Other line	Configured land	Area promoted with in-situ soil conservation measures before rain

	After rain – sowing across/contour, opening of furrows and use of BBF are taken up	department staff ● VCRMC ● Farmers / groups	Improved cultivation practices	Area cultivated with in-situ soil conservation measures
Catchment area treatment	CCT, Deep CCT,		Water recharge Soil conservation	Area treated
Drainage line treatment	Gully plug Loose boulder structures Earthen nala bund Cement nala bund		Soil conservation Water conservation Water storage	No. of bunds constructed Cum water stored
Construction of new water harvesting structure	Community farm ponds Individual farm ponds (with or without lining) Open dug well		Increased water storage	No. of water harvesting structures (category wise)
Rejuvenation of existing water harvesting structures	Repair of existing water harvesting structure Desilting of such structures		Increased water storage capacity	No. of structures rejuvenated

Recharging groundwater	Artificial recharge of open Well and bore well,		Increased discharge	No of well and bore well recharge structures constructed
Micro irrigation systems	Drip irrigation systems Sprinklers		Increased water use efficiency	Area covered
Protective irrigation	Water pumps and pipes			Number of units

4.3.5 Approach

Based on the situation analysis above, this component will address a range of water management and soil conservation issues, with particular focus on improving water use efficiency for enhancing resilience of agriculture. Core activities related to water conservation include scaling up drip irrigation, establishing farm ponds and restoring/ recharging groundwater and opening of furrows will be in conformity with guideline suggested by SAUs and department. Each mini-watershed plan will identify investments based on the finding of map provided by GSDA with 1: 50000 scale. The project will devise user friendly tool developed by implementing partners (IIT and GSDA) to prepare water budget and village water security plan. Data from AWS and advisory outlined in section* will be used for the planning and customisation of interventions. The watershed approach as specified in the common guidelines given in the Annexure -III

A3.1 Catchment treatment

Based on the contour survey and the site conditions, continuous contour trenches (CCT) & deep CCT will be constructed. The seeds or seedlings of trees of suitable local varieties will be planted on the downward slope side. The technical design / details of these measures and method of survey are given in Annexure-IV The catchment treatment works will be done by VCRMC.

A3.2 Drainage line treatment

Drainage line treatment includes both vegetative and structural measures such as gully plugging, brush wood check dam, loose boulder check dam, dug out ponds and gabion structures.

Loose Boulder Structures are part of upper nala treatment with objectives to reduce the water flow rate, reduce soil erosion, and trap silt for slowing down the rate of siltation in water bodies in the lower reaches of the watershed. It enhances conversion of waste land into cultivable land. LBS induce water recharge. Plantation around the LBS helps in increasing vegetative cover.

Earthen Check Dams or popularly known as **Earthen Nala Bunds (ENB)** have proved to be most effective soil and water conservation structures as well as drought mitigation measures in all watersheds in Maharashtra. ENB is suitable for both flood control as well as gully control. Velocity of runoff is greater in nala or gully due to heavy rainfall which erodes shores and increases adjacent pan of nala. Earthen nala bunds are placed in gully or nala to restrict its widening. Water stored in ENBs percolates to wells and tube wells located in the lower part of the catchment. Also it helps the Kharif crop to overcome moisture stress due to dry spell through 'protective' irrigation. To some extent ENBs act as drinking water source for cattle.

Cement Check Dam popularly known as Cement Nala Bunds (CNB) have proven to be low cost water storage structures during various water conservation programmes implemented by central & state governments. With the major objectives to harvest surface runoff, recharging of groundwater, retain water carrying capacity of stream, the construction of CNBs is done in the lower part of the watersheds. The details of these structures have been given in Annexure VII.

A3.3 Construction of water harvesting structures

Farm ponds for protective irrigation

Construction of farm pond is a flagship scheme of Government of Maharashtra. It is seen that substantial runoff is available in cotton growing area in the season to construct one farm pond of 1 to 2 TCM capacity for every 2 to 4 ha of cultivable area. Farm ponds help to provide protective irrigation. The project is proposing construction of more than 50,000 farm ponds where natural depression exists or near a water source both in drought prone and saline tracts. The impact of farm ponds has been given in the figure below, reflecting its benefits:

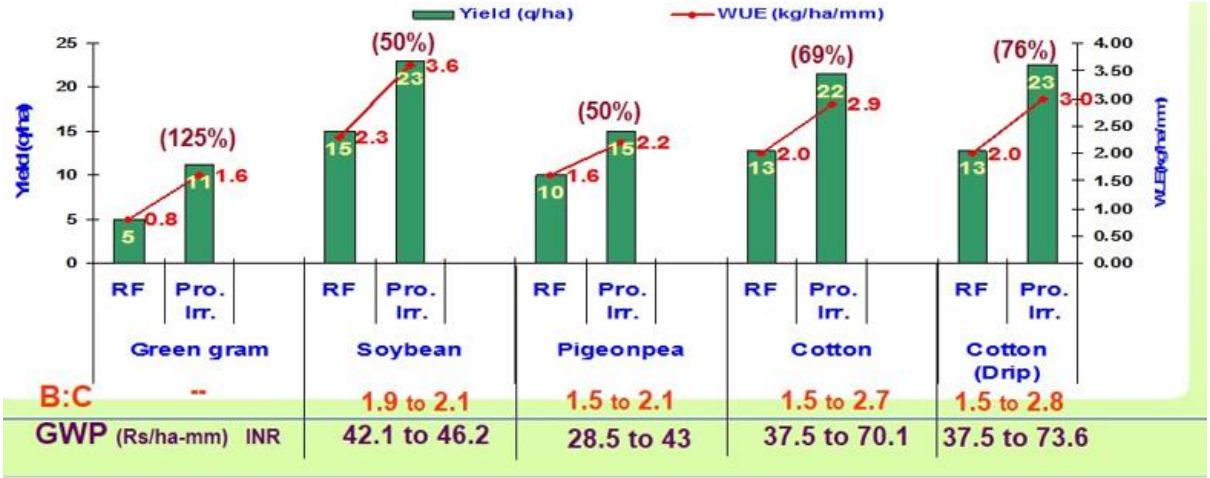


Figure 18 *Water use efficiency through farm ponds for selected crops (PDKV)*

Most of the farm ponds also recharge groundwater as water percolates down in unlined ponds and help in raising water tables in nearby wells. Many farmers have laid polythene cover for the stored water in the ponds to help conserve water for irrigation during Rabi season / summer periods. This is more evident in loose soil areas where water percolation is very fast and hence the storage gets depleted soon. The project will promote both the models but the farmers will be required to adhere to crop-water budget.

In saline tract of Purna river basin, adoption of Brushwood Spillway has been recommended that reduces the silt deposit by 48% and enhances life span of the farm pond by 90%.

Guiding principles for the farm ponds

- GSDA will guide PoCRA on net-withdrawal capacity in cluster based on which the number of farm ponds can be given technical sanction.
- The net-withdrawal capacity will depend on available run-off which will be estimated for each cluster
- Project will encourage Community farm ponds

The most common farm pond size is 30 meter X 30 meter X 3 meter. The technical specifications and designs including options of farm ponds (including community farm ponds) is given in Annexure -V

A3.4. Rejuvenation of water harvesting structures

Situation analysis shows that rehabilitation structures (earthen and cement nala bunds) are becoming deficient over the years of operation. These structures will be revived to its original potential through active community participation (i.e., reducing silt load). The protocol for rejuvenation will be based on the existing policy of GoM. The details of this policy are given in Annexure -VI

Nala Bunds and Earthen Check Dams arc very important structures in the watershed based approach. Proper maintenance of these structures is of paramount importance. As part of the comprehensive watershed treatment all drains, gully plugs, check dams and retention walls, etc. will be treated using the structures and specifications (in Annexure -VII

A3.5 Construction of ground water recharge structures

Attempts will be made to identify available natural depressions in the project cluster to convert them into recharge structures. Rejuvenation structure will be created around existing bore wells and open dug-wells to maximize the conservation of runoff water. All tanks, ponds and water harvesting structures will be modernised to improve their storage capacity. However, the net-withdrawal potential (as determined by GSDA) of the area has to be estimated and that should be the main driver for recommending investment in these structures in a cluster.

Assessment of Water Balance in mini-watershed

One of the important aspects of ensuring resilience is to assure availability of soil moisture at the critical stages of the crops. Since most of the project clusters are in rain-fed areas, management of rainwater becomes critical. Host of factors like rainfall pattern, total rainfall, geomorphology of the watersheds, groundwater recharge potential, surface water & soil moisture management and cropping pattern have impact on the resilience. The long term climate change projections indicate increased moisture stress on agriculture sector. Therefore a scientific planning of this critical resource with stakeholder participation engagement is the key to ensuring enhanced water and crop productivity.

The project aims to build a framework, i.e., a series of tools and analyses designed to help water availability assessment and water budget using both supply side analysis of surface and groundwater resources and demand side analysis of current water use.

The developed framework will be used to enable hydrological analysis for 790 mini watersheds in the project. The water balance computation for the salinity affected areas will also be reviewed.

Water Budgeting exercise at micro watershed level will include the hydrological analysis and crop evapo-transpiration of prevailing village cropping pattern in addition to other sector water needs. The water balance will address spatial and seasonal aspects of water availability (surface water and groundwater) at village level based on current water use.

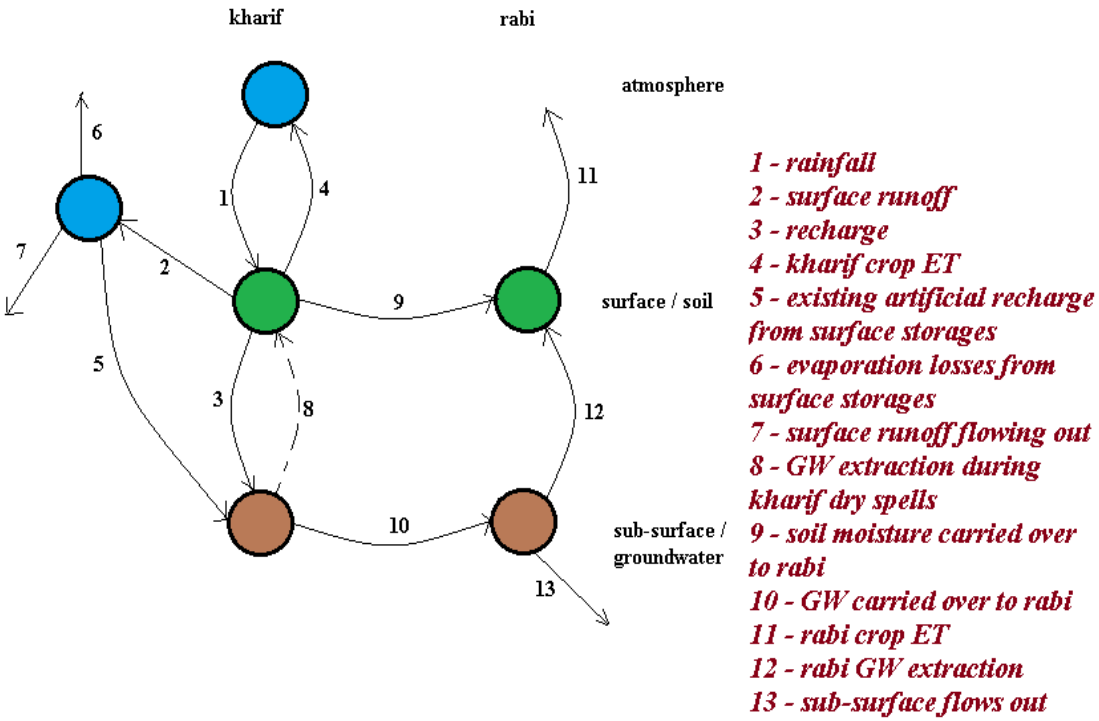


Figure 19 Water budgeting

Methodology for Water balance assessment

The project will consciously promote water balance assessment and develop social norms during the micro-watershed planning process for incentivising and dis-incentivising specific crops and agronomic practices to achieve the goal of water use efficiency. The methodology for village level water budgeting will be developed based on protocols prepared in the past and ongoing research. It will take into account seasonal water availability (supply) and extraction (demand).

The components of the water budget are as follows:

a. Surface runoff
b. Groundwater recharge
c. Recharge from other structures
d. Crop Evapotranspiration
e. Groundwater extraction
f. Sub-surface flows in and out

A3.7 Micro-irrigation systems (MIS)

It has been recognized that use of modern irrigation methods like drip and sprinkler irrigation is very effective for efficient use of surface as well as ground water resources. The table below shows the comparative efficiency.

Table 12 *Comparative Irrigation Efficiency*

Irrigation Efficiencies	Method of Irrigation		
	Surface	Sprinkler	Drip
Conveyance Efficiency	(Canal) 40-50 (Well) 60-70	100	100
Application Efficiency	60-70	70-80	90
Surface water moisture evaporation	30-40	30-40	20-25
Overall efficiency	30-35	50-60	80-90

Source: Sivanappan (1997)

Guiding principles for micro irrigation

- Micro-irrigation systems with requisite BIS standards would be eligible for project support.
- Krushi Mitras will guide the farmers to make online application through the website of the department.
- Assistance for installation of drip and sprinkler irrigation system shall be limited to 2 ha. per beneficiary
- The subsidy is to be calculated as per the unit cost for different spacing given under the scheme guidelines issued by GOI.
- Based on the suitability, the prioritization of beneficiaries will be done by VCRMC.
- The vendors shall train the eligible farmers on the proper use and maintenance of the system.

Judicious use of water for agriculture crops is possible with irrigation at proper stage of crops and in proper quantity. When the availability of water goes below the requirement, farmer has to take a conscious decision for water use at the critical growth stage of the crops. The project is making effort to make rain-fed farming more economical by creating awareness and also supporting the practice of protective irrigation. The project may use the harvested rainwater to be used effectively using the water lifting devices for Kharif crops that regularly face such stress i.e. cotton, soybean, pulses and cereals.

COMPONENT B

Climate Smart Post Harvest Management and Value Chain Promotion

4.4 COMPONENT B: CLIMATE SMART POST HARVEST MANAGEMENT AND VALUE CHAIN PROMOTION

This component will build on existing Farmer Producer Companies (FPCs) as a major driver of change in the selected value chains. Successful implementation of the activities in this component will help achieve the PDO by: (i) contributing to an increase in farmers' participation in selected value chains through the support to FPCs/FIGs and the strengthening of FPC linkages with other actors in the value chains and (ii) promoting practices and technologies in post-harvest management and value-addition that support climate adaptation and/or mitigation.

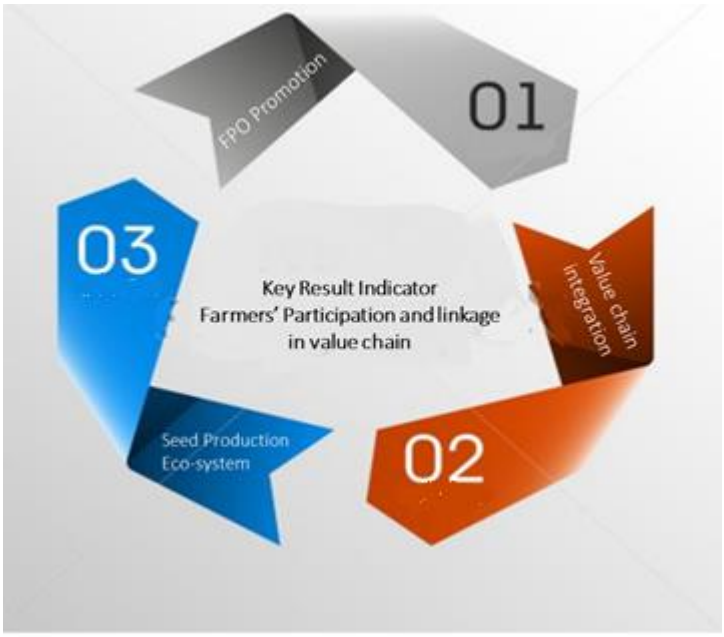


Figure २० Key sub-components under Component B

4.4.1 Introduction

As part of the value chain development the interventions under this component will extend beyond a production cluster. Therefore creating value chains around select crops is an important element of this project. The climate change impact and resilience are also intertwined elements in this value chain.

A value chain promotion intervention can range from improving business operations at production, processing, storage level or the relationship between different actors or the access to knowledge, information and innovation. Successful value chain interventions that achieve poverty reduction goals can be beneficial to climate change adaption, as they build farmers' assets and institutional linkages.

The sustainability of the food value chain revolves around three dimensions.

1. *Economic dimension*, which focuses on activities that each actor or service provider provides that is Commercially feasible (profitable) or services that are financially viable.

2. *Social dimension*, which refers to social and cultural aspects regarding societal acceptance of the distribution of benefits and costs associated with the increased value that has been created.

3. *Environmental dimension*, which refers to the sustainable use of inputs and resources throughout the chain as well as any impact on biodiversity, the amounts of greenhouse gas (GHG) emissions released, and the carbon sequestration and reduction potential of GHGs in the process of value creation.

Effective climate interventions in value chain promotion shall include the following three elements:

a) *Climate-proofing*: Specific interventions to make key stages of the value chain more climate resilient in ways that is beneficial to farmers e.g. watershed investments that can address longer term risks, crop diversification etc.
b) *Supply chain efficiencies*: Measures such as waste reduction or inventory management that increase efficiency, deliver higher profitability (and hence higher adaptive capacity in a general sense) to farmers and small business in the value chain, and generate mitigation co-benefits.
c) *Knowledge management:* Timely access to information relating to weather forecast, agro-advisories, market trends, post-harvest services and their providers, and, sharing of best practices is the key to developing a resilient value chain.

The overall framework has been given in the table below although project will work with existing FPOs to strengthen their link to the value chain:

Table 13 Framework for developing a climate resilient value chain integration

Phase	**Key activities**	**Process**
Inception	During micro-planning create awareness about the project and also what is a value chain	Participatory Planning exercises
Phase I (3-4 months after the project commencement and after the baseline study is completed)	Mapping process, functions, actors, geography, resources, governance structure and vulnerability to climate risks	Key experts meetings
Phase I: (6-8 months) Climate risk analysis I (horizontal integration)	Understanding climate impact and responses within each segment of the value chain (focus on key actors' perceptions and narratives)	Dialogue theatres at the production, transformation and marketing levels (new product and new market) using a SWOT framework
Phase II (12 month-24 months) Climate risk analysis I (horizontal integration) when some of the project interventions grounded	Understanding climate impact and response chains across the different segments of the value chain (focus on risk transmission/distribution as perceived by key actors)	Multi-stakeholder dialogue (possibly national and regional scale)
PROJECT WILL INTERVENE in the existing FIG/FPOs/FPCS in the clusters who are at least 2-3 years in operation		

Phase III (24-36) Scale development (aggregation along the value chain)	Creation of Aggregation Centre, Storage, Logistics Hub, Platforms, Networks of related enterprises	Incubation, Core investment, PPP/PPCP models. Existing FPCs promoted under different schemes can be linked to the project after their fresh assessment
Phase IV Development of Platform (spread from Phase I from 6-48 months)	Creation of Farmer Producer Companies along the value chain and provide linkage	Linkages with commodity chain, industry associations
Phase V (spread over from phase II 12 months-60 months)	Grading, Quality Control, Branding (GI, Organic, Carbon Neutral)	Marketing and Advertising and Buyer Seller platforms on a global scale

This component will develop a set of comprehensive climate-sensitive interventions and investments to promote value addition to a select number of commodity chains. It will provide end-to-end solutions for adopting climate-smart agricultural technologies for improving and sustaining crop productivity. This component will also promote market access and support increased participation of organized small and marginal farmers in existing and emerging value chains.

4.4.2 Situation analysis

Department of Agriculture has been bringing the farmers together in the form of Farmer's Interest Group (FIG), Farmer's Activity Group (FAG), Commodity Interest Group (CIG) or a simple Farmers SHG. These groups are federated either into a cooperative or a Farmers Producer Company to give desired scale either for input buying or output marketing. There have also been attempts to have tie ups with processing industries to whom raw material can be catered. Chapter XI A of the companies Act 2002 enables registration of producers companies. There are several agencies promoting FPOs in the state. The activity has been spearheaded under World Bank assisted MACP project, small farmer agri-business consortium (SFAC) and NABARD. As on 30 June 2017, 1211 FPCs are registered in the state out of which 581 are in project districts. The details are given in the table below:

Table 14 Farmer Producer Companies in Project districts as on 30th June 2017

Sl No.	**District**	**No. of FPC**
1	Akola	25
2	Amaravati	54
3	Aurangabad	61
4	Beed	46
5	Buldhana	42
6	Hingoli	19
7	Jalgaon	33
8	Jalna	34
9	Latur	57
10	Nanded	27
11	Osmanabad	60
12	Parbhani	20
13	Wardha	39
14	Washim	22
15	Yavatmal	42
	Total	581

A quick survey of 148 FPOs in the project district gives the following picture:

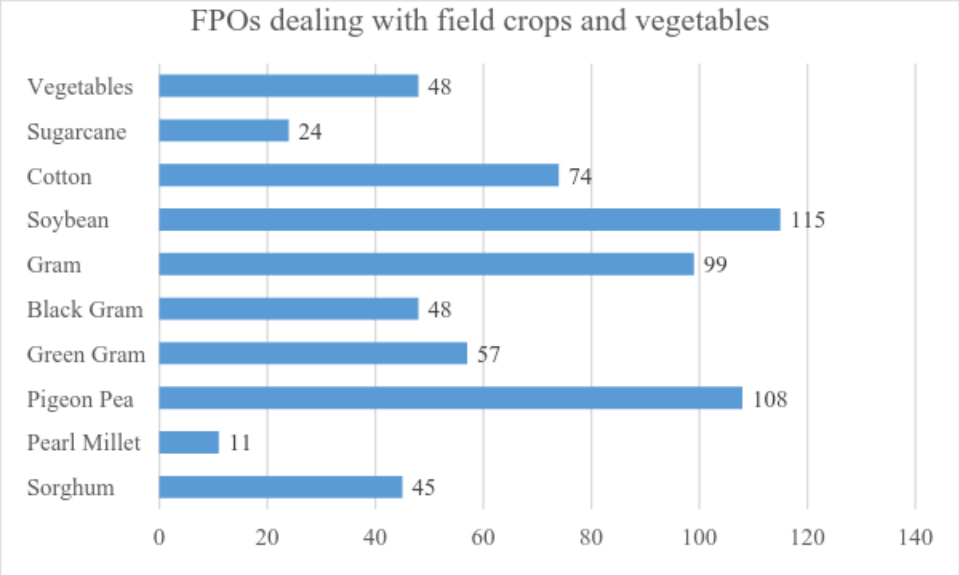


Figure 21 *FPOs dealing with field crops and vegetables*

Soybean, pigeon pea, gram, and cotton are the major field crops where FPOs are active.

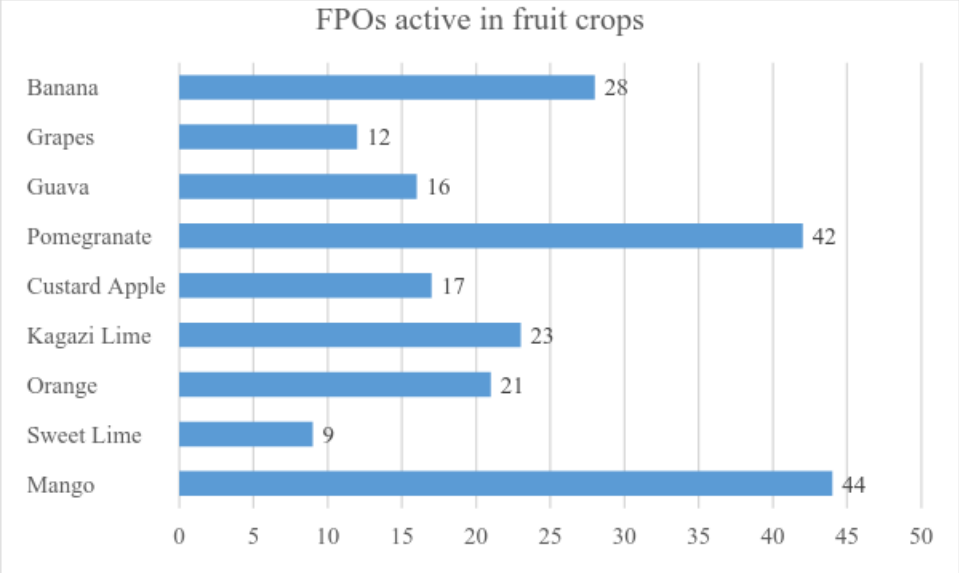


Figure 22 *FPOs dealing with major fruit crops*

Types of businesses the FPOs are involved in have been detailed out below:

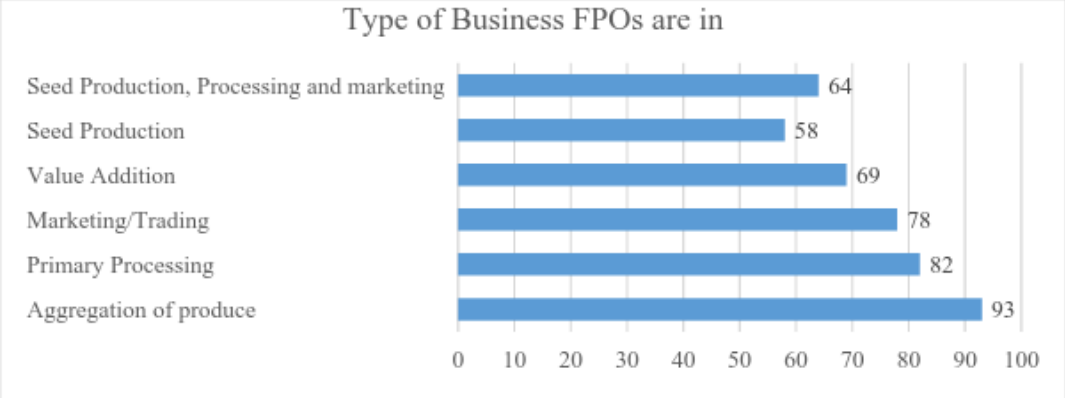


Figure 23 *Agribusiness categories in which FPOs are active*

FPOs are predominantly active in aggregation of produce, their primary processing and trading. 58 FPOs are also involved in seed production.

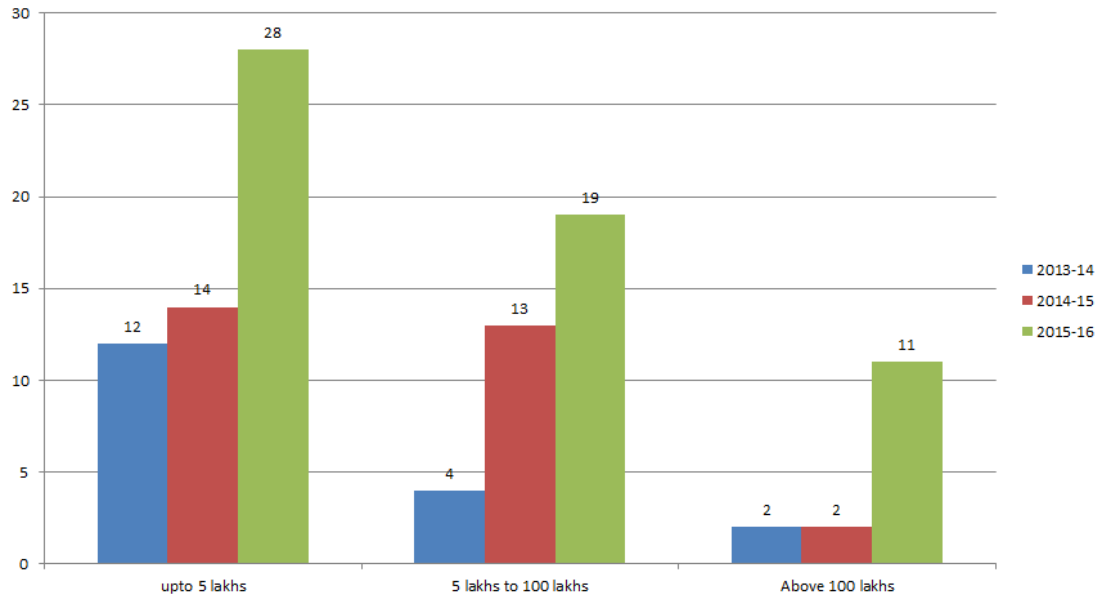


Figure 24 *Turnover of FPCs during last 3 years (2013-14,2014-15 & 2015-16)*

Maharashtra is the highest producer of coarse cereals and cotton and ranks second in sugarcane production in the country. The state has unique strength in production of grapes, mangoes, banana, pomegranate, oranges, tomato, and onion. Though the production of these fruits and vegetables has increased many folds, lack of adequate post-harvest practices results in substantial loss in value of these commodities. Maharashtra is also a major cereals and pulses producer. Inadequate availability of post-harvest facilities at the village level leads to loss to cereals and pulses producers.

The state has 306 main markets and 612 sub-markets of APMCs. In the state, 264 main markets and 54 sub-markets have been computerized and connected through internet to MSAMB. Major commodities traded through APMCs comprise rice, pigeon pea, green gram, black gram, chickpea, soybean, cotton, onion, potato, vegetables and fruits. Marketing channels of horticultural crops are different and may vary, mostly including pre-harvest contractors; the routing may involve farmer cooperative societies, APMC market- to varying degrees and direct deals with traders/commission agents of distant markets, by some farmers.

The seed industry in Maharashtra is fairly segmented, with the main focus of private seed companies being on the high value - low volume seeds (e.g. GM and hybrid varieties of cotton, vegetables, maize etc.), while the market for low value - high volume seeds (e.g. cereals, pulses and oilseeds) is dominated by public sector seed corporations. It is estimated that the direct contribution of quality seed alone to total agricultural production is about 15–20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs. Seeds contribute about 8-12% of the cost of production. Adequate and timely supply of seeds of short duration varieties and having features of drought and salinity tolerance, is an essential strategy of this component. Production cycle of breeder seeds (by SAUs) to the commercialization of certified seed is a multi-year cycle (3-4 years), resulting in shortage of getting a relevant climate resilient seed especially for the field crops on time. The other problem is associated with the poor preparedness of the farmers to respond to bumper harvest as no transit storage or clearing market exists to get remunerative price. There are also gaps in post-harvest management of produces especially in the horticultural scopes.

The situation analysis also shows that considerable untapped potential exists in the sector. If the institutions like FPOs are strengthened to establish and showcase a few value chains of select commodities through aggregation and market access, it is possible to improve the farm income.

4.4.3 Objective

The objective of this component is to build climate resilience beyond farm gate and provide end-to-end solutions focusing on selected agricultural value chains that are key to the farmers' livelihood (food security), have clear market opportunities (income security), and have the potential to create jobs in rural areas.

This component aims at achieving the following objectives through;

i. Developing a set of comprehensive climate-sensitive interventions and investments to promote value addition and prevent losses in a select number of commodity chains using existing farmer producer organisations.
ii. By providing end-to-end solutions for adopting climate-smart agricultural technologies and processes to strengthen the emerging value chains of field crops and horticultural crops
iii. By improving the seed supply chain

4.4.4 Activities

To achieve the objectives of the component, following activities and sub-activities shall be carried out with specific output and indicators.

Activity	**Sub-Activity**	**Who will do**	**Output**	**Indicator**
Promotion and strengthening of existing Farmer Producer Companies	Develop business plan and build capacities around select value chains	-Project staff -Line departments -Specialized resource agency -SFAC -NABARD -MSAMB	Support to existing FPCs	Number of business plans around select value chain
Strengthening of farmer Consumer market Linkage	Buyer-Seller Meet as part of the professionalizing of FPOs Initiatives for direct marketing	-Project staff -Line departments -Specialized resource agency -private sector	Buyer-Seller meets organised in every district	Number of Buyer-Seller Meets organised

Promotion of Farm Mechanizatio n and custom hiring centres	Establishment of Custom Hiring Centre for farm machineries	-Project staff -Krushi Mitra -Lead Farmer / Farmer Groups / FPCs	Establishment of Custom Hiring Centres	Number of Custom Hiring Centres established Area serviced through CHC
Support to FPCs for product aggregation, handling, transformation & marketing	Construction / procurement of Godown/ small warehouse Ripening chamber Primary processing units Vegetable/ fruits carrier/ ve Market outlet (Environment controlled) Vending cart Refer van Precooling chamber Cold storage	-Project staff -Line departments -Specialized resource agency -Private sector -Warehousing corporation -NABARD -SFAC -Private sector		Number of units
Improving the performance of seed supply chain	Production of foundation and certified seed of drought/salinity tolerant crop varieties of Soybean, Pigeon pea, Chick pea & Sorghum	SAU Mahabeej Project staff	seed production in 55000 hectares area	% of certified seeds produced against target & distributed
	Seed processing equipment Training Strengthening Seed Testing infrastructure	SAU Mahabeej Project staff	Establishment of seed processing infrastructure	% of achievement of against target

4.4.5 Approach

The following approaches have been envisaged for this component:

i. **Promotion of farmer producer companies and linking with the value chain**: A comprehensive database of all existing FPOs /FPCs and their activities will be compiled and their assessment would be carried out to get an understanding of the level of their current operations.

ii. For climate smart post-harvest management, emphasis shall be given for establishment of aggregation centres with Grading and Packaging facility in the project area. The aggregation centres shall provide facilities to the farmers for sorting, grading, weighing and proper packaging of their farm produce. Farmer Producer Companies and interested FPC/FIG/SHGs shall be encouraged for establishment of aggregation centres with sorting, grading, weighing and packaging facility.

iii. Primary processing units like Mini Dal Mill/ Oil expellers/ vegetable and fruit based primary processing units/ Cotton bale making units shall be established in the project area for value addition of the farm produce which shall help farmers for fetching better price, long shelf life and better marketability of their farm output. Farmer Producer Companies and interested FPC/FIG/SHGs shall be encouraged for establishment of primary processing units.

iv. The project will support existing Godowns/warehouses for transit storage and will also support constructions in the project area where such structures are not available for storage of agri produce with appropriate treatment. FPC/FIG/SHGs shall be encouraged for establishment of Godowns / Warehouses.

v. Existing FPOs shall be strengthened and encouraged to actively participate in value chain development of selected crops like Cotton, Chick Pea, Pigeon Pea, Soya bean, Rabi Sorghum, Capsicum, Mango, Guava, Custard apple and Citrus.

vi. For strengthening farmer Consumer market linkage, effective buyer-seller meets shall be organised in the project area. For obtaining best result from buyer-seller meet, following steps to be followed;

- Assessing the volume and type of agri-commodities to be available for sale in different months in the production clusters of the project district

- Identifying potential buyers. The potential buyer may be wholesaler / processor / consumers/ industrial buyer / corporate buyer / institutional buyer / hostels / hotels, etc.
- Appraising the potential buyers on the availability status of agri commodities in the project area and also assessing their requirements regarding the type and volume of agri commodities
- Facilitating inspection of material and facilities for satisfaction of the potential buyers if required
- Facilitating negotiation of both the parties
- Completing the contract/agreement process
- Farmer Producer Companies shall be encouraged to participate in marketing and sale of agri commodities of their member farmers and other farmers under the project.

vii. The project will **promote custom hiring centres**, so that small and marginal farmers are able to access the costly machines on rent to achieve desired farm productivity without compromising soil health and water use efficiency.

viii. One of the critical elements of this project is to make available climate resilient quality seeds to the farmers on time. Without improving the **seed supply chain**, the adaptation to climate variability and drought will be challenging. The project will support creation of seed hubs linking FPOs, Universities and also other public sector players like Mahabeej and private sector. The project will also make an attempt to leverage on the support available for breeder seed production through national programmes, and would support new varieties recommended under these programmes.

COMPONENT B1

Strengthening Farmer Producer Companies

4.5 COMPONENT B1: STRENGTHENING FARMER PRODUCER COMPANIES

This component will build on the outcomes of other GoM programs and projects that have focused on FPCs as agent of change (e.g. MACP). Project will intervene with existing FIG/FPO/FPCs in the project clusters who have been in existence at least for about 18-24 months. A rapid appraisal exercise, with mapping, profiling and capacity needs assessment of the 581 FPCs in the project area (most of them in early development stage), will provide the basis for a series of activities tailored to the growth potential of existing FPCs.

B1.1 Strengthening of Farmer Producer Companies:

There are several initiatives under which the farmer producer organisations have been promoted and set up. The component will also support the development of farmer-group based organizations into entrepreneurial, market-oriented, financially sustainable companies with the capacity to perform selected value-adding activities and deliver a range of services. The component will support viable mechanisms to further consolidate and set up new business linkages for FPCs with private sector (e.g. exporters, seed companies, farm machinery, agro-input suppliers, and financial institutions).

Farmer Producer Organizations have a vital role to play in the transfer of knowledge, quality production, input supply, marketing and promoting value added products, organizing growers for these purposes. Project will attempt to strengthen the Commodity specific Farmer Groups and Farmer Producer Organizations in the project area. FPOs shall be encouraged to actively participate in value chain development of selected crops like Cotton, Chick Pea, Pigeon Pea, Soya bean, Rabi Sorghum, Capsicum, Mango, Guava, Custard apple and Citrus.

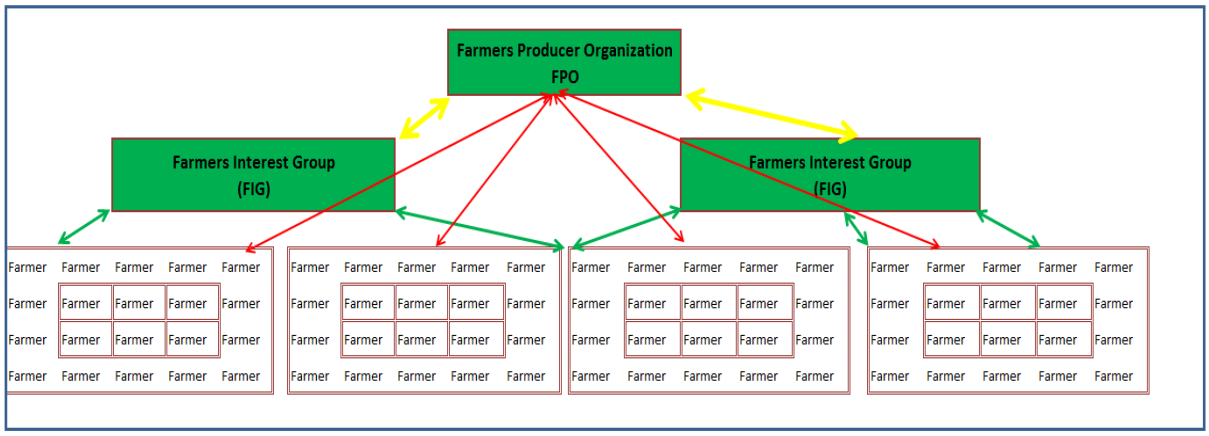


Figure 25 Building blocks for FPO/FPC

Areas of assessment while choosing FPOs for strengthening:

Following steps to be followed for assessing a Farmer producer Organization in the project area;

Farmer Sensitisation: It is important to find out whether the farmer members are properly sensitised at the village level and this process involves all categories of farmers (especially to check whether the voices of small and marginal farmers and their issues have been considered) at the village level.

Selection of Farmers/FIGs: Whether the small and marginal farmers have been prioritised for interventions and support based on their interest to get associated in the process into FIG. The project will provide a perfect platform to enhance their value share and natural progress to form a FPO/FPC. It will also support the FIG or a group of FIGs to be commercially sustainable and profitable.

Share Capital: FPOs would be encouraged to generate share capital from the farmers for financial operation. Supporting them for maintaining proper books of accounts, estimating break even volume, cash flow issues will be a first step towards mentoring them as part of the strengthening process,

FPO Governance : The governance process of FPOs would be carefully looked into to assess its representational character. Typically, selection/election of FIG leaders (President/Secretary) by FIG members is required who become the executive members of the proposed FPO. The executive members shall choose Board of Directors of the proposed FPO by selection/election in the democratic process. If this is missing and it is just a family member grouping or groupings of very large and influential farmers, project would assign such FPOs a low priority as compared to the ones who have higher representation of small and marginal farmers as described in the overarching beneficiary selection criteria.

Key guiding principles:

- Any pre-existing FPO/FPC/FIGs in project cluster to be tapped first.
- In the absence of any such FPO in a cluster, linkage will be established with neighbouring cluster which has an FPO.
- The focus would be to promote FPOs having a strong linkage with any commodity value chain
- A proper assessment of FPOs will be conducted and also where FIGs are available they will be strengthened based on the assessment of gaps.
- Project will give priority assistance to FPO/FPCs who have built with base of framer interest groups as per the GoI/SFAC guideline for FPO formation and have representation of small and marginal farmers in their board.
- The FPOs will be assisted by the project in the preparation of a comprehensive business plan. This may include aggregation centre, primary/secondary processing, primary storage, sale centres, etc. that is aimed at cost reduction and value enhancement.
- The plan will focus on various aspects of aggregation, market linkage, value addition, etc. the key objective of the plan shall be ensuring higher profit through value addition and reduction of cost of production
- Synergy with project activities will be built in the following areas i.e. seed production, nursery raising, input buying and selling, etc.
- The project will also help the FPOs to access, debt, equity contribution and matching grant in helping them building a good governance practice for which it would provide a coaching support.
- Suitable service providers who have experience in the FPO promotion, business planning, and value chain development shall be mobilized to coach the FPOs as part of this strengthening exercise.

B1.2 Establishment of Custom Hiring Centres (CHC)

CHCs shall be established at cluster level to promote appropriate farm mechanization for coping up with climate variability in the project area. Farmer producer Companies along with FIGs and SHGs shall be encouraged to establish such Custom Hiring Centres for the benefit of the farmers in the project area. Custom Hiring Centres shall be responsible for promoting Mechanized farming in the sector.

CHCs help in inter-culture, harvest and post-harvest operations. It is emerging as a major community based institution to employ unemployed youth in agriculture and allied sectors. The use of farm machinery helps in in-situ moisture conservation, soil health enhancement, and efficient application of nutrients as well as productivity enhancement and cost reduction. Typical custom-hiring centre will have the illustrative economics as shown in Table-24 below, however a detailed feasibility based on the demand has to be done at cluster level consulting the farmer groups.

Table 15 *Economics of a model custom hiring centre*

SN	Implement	Initial Cost, Rs.	Annual Use, h	Operating Cost, Rs/h	EFC, ha/h	Operating Cost, Rs/ha	Proposed Hiring Charges, Rs/ha	Area Covered per day, ha	Profit per day, (8-hrs), Rs/day	BEP (Days)
1.	Rotavator	72,347	240	586.74	0.3	1956	2500	2.4	1306	56
2.	Seed Drill	41,000	360	412.0	0.45	915	1375	3.6	1656	25
3.	BBF Planter	37,500	360	409.54	0.4	1024	1125	3.2	323	116
4.	Power Weeder	75,000	480	100.62	0.12	805	1125	1	320	235
5.	Bullock Drawn Boom Sprayer	43,000	480	72.82	0.86	85	250	6.88	1136	38
6.	Thresher	85,000	480	554.9	9 qt/hr	62 Rs/qt	110 Rs./qt	72 qt/day	3456	25

EFC=effective field capacity

Source: Based on Field Visit and presentation by Farm Power & Machinery Dept., PDKV, Akola

Table 26 Operationalisation of the Custom Hiring Centre

Activity	Who will do	How
Demand generation for mechanisation	Agriculture Assistant / Cluster assistant, Krushi Mitra, Farmers, FIG, FPC	This will be done through the micro-planning process and will be captured by CHC owners.
Due diligence for CHC based on Demand	Project staff Krushi Mitra Lead Farmer / Farmer Groups / FPCs	Bankable proposal will be needed
Demonstration cum training	SAU KVK Vendors Lead farmers Project staff	The vendors with the project partners will prepare self-explanatory videos and brochures for operation and maintenance.

Guiding principles:

(i) The following parameters would be considered while selecting village for setting up of custom hiring centres:

(a) Extent of mechanisation

(b) Number of tractor population

(c) Number of small & marginal operational Holdings

(d) Crop Productivity and crop diversification

(ii) Each CHC will be set up on specific crop based, cost based and cluster based approach. Each custom hiring centre will have small crop specific machinery suitable for local requirement for mechanized farming under small and marginal holdings.

(iii) Assistance will be given to FPOs /FPCs/FIGs who submit a bankable proposal

COMPONENT B2

Strengthening emerging value-chains for climate-resilient commodities

4.6 COMPONENT B2: STRENGTHENING CLIMATE-RESILIENT VALUE-CHAINS

This component will support viable investments in the prioritised commodities and/or fruit crops value chain through product aggregation, handling, transformation and marketing (e.g. collection centres, grading and packaging units, cold storage facilities, ICT-based market information systems).

The FIG/FPOs/FPCs will offer a variety of services to its members. Effort would be made to cover almost all aspects of cultivation (from inputs, technical services to processing and marketing). The FPO will facilitate linkages between farmers, processors, traders and retailers to coordinate supply and demand; and to access key business development services such as market information and intelligence, input supplies, and transport services. Based on the emerging needs, the FPO will provide one or more of the following services:

Input Supply Services: The FPO will help in facilitating access to low cost and quality inputs to member farmers because of economies of scale. It will help in coordinating the ensuring the timely supply of inputs, i.e. fertilizers, pesticides, seeds and farm equipment and machineries.

Technical Services: The FPO will promote best package of practices for climate resilient agriculture, maintain marketing information system, diversifying and raising levels of knowledge and skills in agricultural production and post-harvest processing that adds value to products.

Procurement Services: The FPO will coordinate the procurement of agriculture produce from its member farmers; will help in arranging storage, value addition and packaging.

Marketing Services: The FPO will help in direct marketing after procurement of agricultural produce from member farmers. This will enable members to save in terms of time, transaction costs, weighing losses, distress sales, price fluctuations, transportation, quality maintenance etc.

Financial Services: The farmer members will coordinate with financial institutions to facilitate access to credit during different seasons through FPO and the same will be deducted from their selling. It will help to make the farmers free from pre farming contract with different traders.

Networking Services: Making channels of information (e.g. about product specifications, market prices) and other business services accessible to rural producers; facilitating linkages with financial institutions, building linkages of producers, processors, traders and consumers, facilitating linkages with government programmes, etc.

The details of various climate control structures such as pack house, storage structures, ripening chambers are given in Annexure II.

COMPONENT B3

Improving the performance of the supply chain for climate-resilient seeds

4.7 COMPONENT B3: IMPROVING THE PERFORMANCE OF THE SUPPLY CHAIN FOR CLIMATE-RESILIENT SEEDS

Adequate supply of seeds with short duration, drought-, salinity- or heat-tolerant features, is a key priority for the project in its strategy to build climate resilience in the agriculture sector.

Production of Foundation and Certified seed of Climate Resilient Varieties

A climate resilient variety of major crops is one of the most important interventions intended to build resilience to changing climate and climate variabilities. Production of nucleus and Breeders seed is taken up by the respective breeders. Further breeders seed is used to produce foundation seed and foundation seed is used to produce certified seed. The emerging FPO/FPCs in the project area will be promoted for seed production besides Maharashtra State Seed Corporation (Mahabeej). The climate resilient varieties recommended by SAUs, ICRISAT, CICR, etc. are given below.

Table 16 Climate resilient seed varieties (major crops)

Crop	Climate Resilient Varieties recommended for State
Pigeon pea	BDN 711, BDN 708, Vipula, PKV- Tara, ICPH 8863 (Maroti), ICPL-87
Chickpea	JAKI-9218, BDNG-797, Vijay, Digvijay, Akash, Virat, Raj Vijay, Vishal
Soybean	JS-335, MAUS-158, MAUS-612, MAUS-71, PHULE AGRANI,JS-93-05, JS-95-60, NRC-86 (AHILYA-6), JS-20-34, DS-228
Cotton	NHS250, AKA-5, AKA-7, NS615, PA402, NHH-44 Bt., PKV HY-2 Bt., MAHABEEJ-123 Bt., Suraj
Sorghum	M-35-1, Phule Anuradha, Parbhani Shveta, Parbhani Moti, Phule Revathi, Phule Vasudha, PKV Kranti, Phule Schetra,CSH -9

Development of Seed Hubs

Seed Hubs shall be developed at cluster level. Seed Hubs shall cover the range of operations like seed production, seed processing, storage and certification. Support would be extended to Farmer Producer Companies (FPCs), Farmer Producer Organizer (FPO), Farmers Interest group (FIGs) for establishment of various components of seed hub, creation of seed processing unit, creation of storage unit and certification including branding.

Prevailing seed production and supply system has been presented in the figure below:

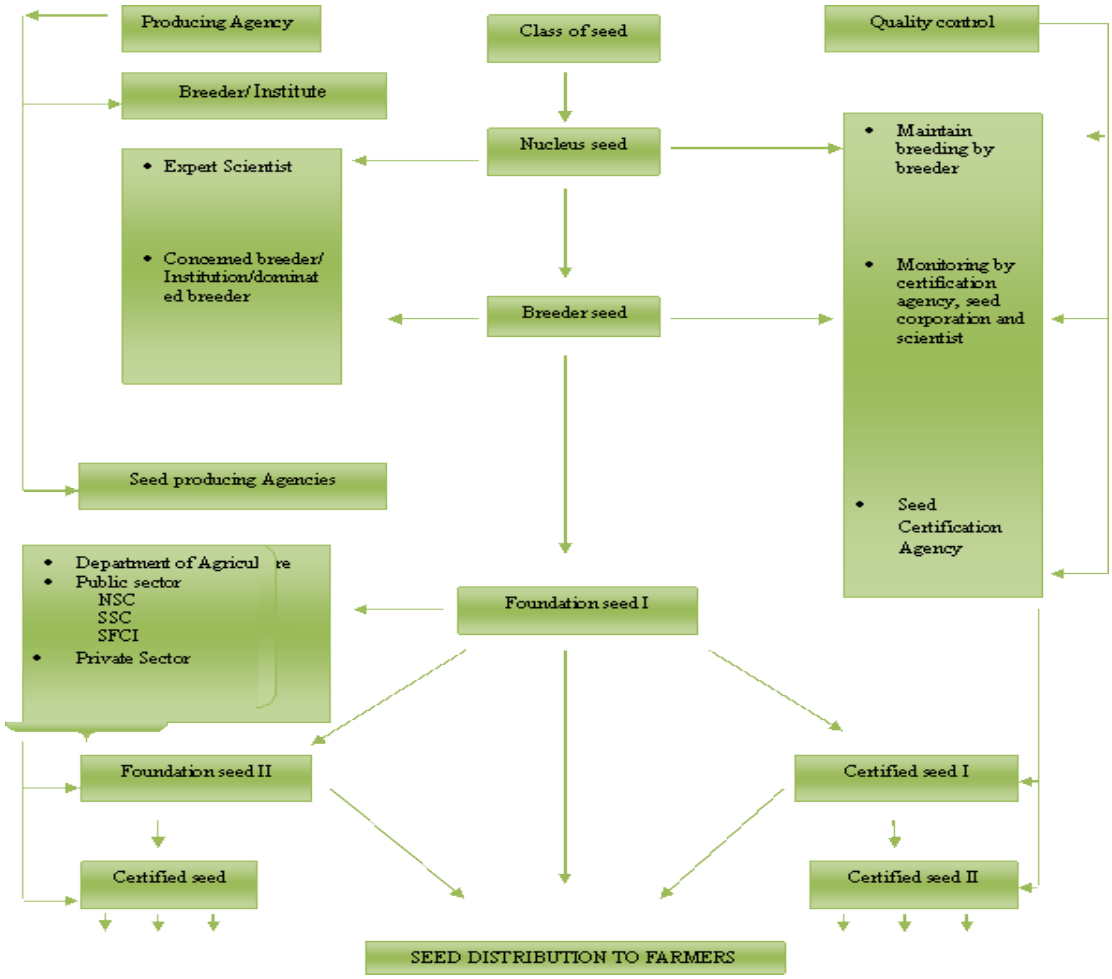


Figure 26 *Seed Supply Chain*

Table 17 Process flow for drought and salinity resistant variety production

Activity	Who will do	How	Remark
Identification of varieties	PMU, Department of Agriculture, ATMA and KVK	SAUs, ICRISAT, ICAR institutes, have recommended resilient varieties for project area	Database of CRV will be developed Taluk wise by the PMU
Seed/Variety Demand- Supply and gap analysis	Mahabeej and University Department of Agriculture	Mahabeej has a demand and supply forecast plan and would prepare a business plan to bridge the gap	A five year perspective plan for resilient seed production along with annual rolling plan shall be prepared by the project
Identification of seed grower farmer/ FIG/FPOs or FPCs	Cluster assistant ATMA NSC Mahabeej FPO/FPCs	During the cluster planning exercise willing farmers/ groups will be assisted to prepare the plan. Farmers will be imparted training regarding seed production technology. Registration with Maharashtra Seed Certification Agency (MSCA)	DPMU will prepare seed production & training plan in consultation with Mahabeej and FPO/FPCs Availability of Breeder & Foundation seed be ensured by DPMU with the help of SAU, NSC and Mahabeej.
Supervision of seed production process	State seed Certification agency NSC Mahabeej FPC/ FPO	The agencies will develop the capacities of the farmers for maintaining the quality.	MSCA, NSC, Mahabeej will provide chart, tools for the quality control and production process and educate the cadres.
Certification of seed	MSCA	Seed Certification Act 1966 and Seed Certification Rules 1968 will be strictly followed. Seed production plots will be inspected by MSCA.	Certified seed will be labelled.

Table 18 Process for creation of additional seed hubs

Activity	Who will do	How	Remark
Identification of seed hubs	DPMU ATMA KVK	Potential seed business FIG/FPO/ FPC will be identified. Business plans will be prepared by FIG/FPO/ FPCs Business plans will be appraised by commercial banks	Plan for one or more components of seed hub will be prepared as per the demand of FIG/ FPO/ FPC
Production target 3 year rolling	DPMU ATMA, SAUs Mahabeej	Assessment of demand of certified seed from clusters will be done by VCRMC, Agriculture Assistant & Cluster Assistant	
Storage and processing infrastructure	DPMU ATMA FIG/FPO/FPC	Seed certification agency / Department of Agriculture will technically validate the infrastructure and processing requirement with specification	
Sale of seeds	FIG/ FPO/FPC	The FIG/ FPO/ FPCs will be authorised to sell the certified seed through a licence as provided under Seed Act, 1968 & Seed Rules, 1968.	Quality assurance of seed will be done by Agriculture Department.

COMPONENT C

Institutional Development, Knowledge and Policies for a Climate-resilient Agriculture

4.8 COMPONENT C: INSTITUTIONAL DEVELOPMENT, KNOWLEDGE AND POLICIES FOR A CLIMATE-RESILIENT AGRICULTURE

4.8.1 Introduction

The project of this nature is complex and would require partnerships with various specialised agencies and networks. Simultaneously, a process of institutional development and transfer of technology and processes to the community based institutions will also be an important component of the project. A capacity development programme is defined as a set of activities which strengthen the knowledge, abilities, skills and behaviour of individuals and improve institutional structures and processes to efficiently meet the objectives of the project in a sustainable way.

Since the project revolves around the initiative to enhance on climate resilience, the sequencing of capacity building in this project will focus on the awareness about the issues related to climate change as well as the capacities of the communities to cope with it. The capacity development framework will evolve around the following:

i. Dissemination of the project objective, concepts, and approach.
ii. Development of knowledge, tools, models, policies that are workable on ground and scalable for resilience
iii. Empowerment of stakeholders, enabling learning and attitudinal change and creating ownership of various interventions proposed under this project, entrepreneurship and risk taking ability.

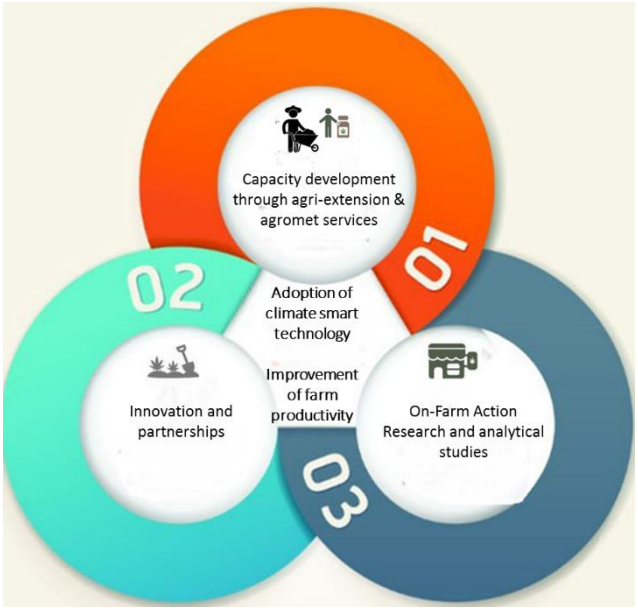


Figure २७ Key sub-components under component C

4.8.2 Objective

The objective of this component is to ensure adoption of the approach proposed for building climate resilience through a longer term adaptive management of agriculture, soil and water resources. The project envisages large scale capacity development programmes for the small farmers and other stakeholders in the drought and salinity vulnerable regions in the project area. It is expected that improvement in the farmers' productivity could be augmented by suitable capacity improvement of the stakeholders most

particularly farmers under POCRA intervention. This component bears adequate potentiality to have sustainable impacts on farm productivity and crop management. In addition, action research and analytical studies will enhance the knowledge base and there will be significant thrust on innovation especially on resilient technologies in the farm sector.

4.8.3 Activities

This component will have three main activities: (i) sustainability and institutional capacity development for various institutions in the project (ii) establishing a Climate Innovation Centre, and (iii) knowledge and policy: promoting an evidence-based policy dialogue on climate resilience and sharing various knowledge products developed during the project implementation with the stakeholders.

Apart from training of the farmers, the project also aims at the capacity development of the project management unit and organisations directly associated with the capacity development of the farmers. This is proposed to be done through training and exposure visits. Capacity development of the farmers will include skill development encompassing a wider variety of thrust areas like natural resources management, farm mechanization, development of agricultural systems in the context of climate change and adaptation. Partnership with various institutions associated with the project to address the issue of climate change will be an added dimension of capacity development.

Under the project the capacity development framework shall be as follows:

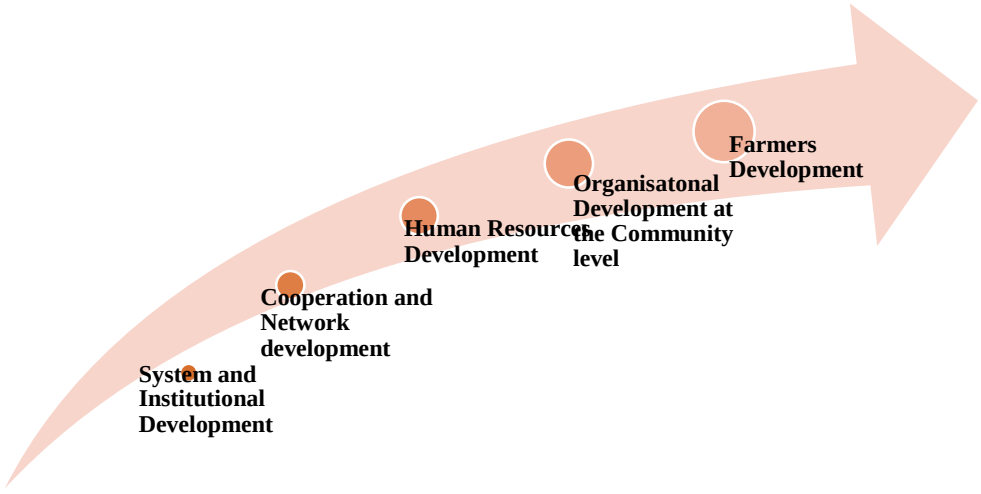


Figure 24 Capacity development framework

- **System / Institutional Development:** The project will focus on establishment and capacity development of VCRMC which would play a pivotal role as the main community institution in the project planning and implementation. It will also build capacity of the PMU at the state level and units at the taluka and district level for bringing in the change in their approach to address the issue of climate resilience through all interventions.
- **Cooperation / Network Development**: The project at different phases of its implementation will seek the support from a number of organisations through necessary collaborations. The basic purpose behind network development is for developing knowledge, tools, models, policies that facilitate the workability and scalability of the project. This will be network of research institution around specific themes.
- **Human Resources Development**: Keeping in view the specific goals of the project, a new cadre of project staff would be recruited and they would be groomed through proper training support on all the aspects of the project, including climate resilience, planning process, activity implementation, and reporting, procurement, financial, and safeguards requirements.
- **Organisation Development at the community level**: The project is aimed at capacitating certain community based organisations like Women Self Help Groups (SHGs), farmers Interest Groups(FIGs), and farmer Producer Companies (FPCs)
- **Farmer Development:** Ultimately the farmers are to be sufficiently trained under the project on various interventions that address climate stress and bring resilience by doing certain things differently.

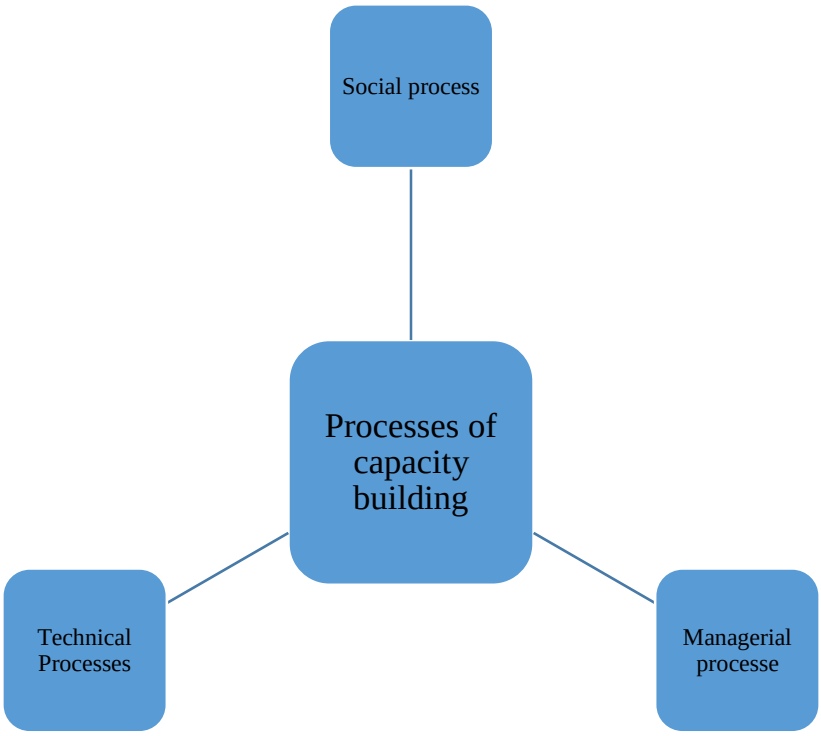


Figure 29 capacity development process

Most of these activities will be carried out by partners, resource agencies and ATMA. PoCRA will make conscious attempt to identify a cadre of master trainers and extensions specialists to get oriented with resilience aspects and technical issues/challenges in the project. While some of the regular activities in agricultural extension and research are already part of earlier components with cost inbuilt therein. Specialised training and research initiatives as required for demystifying climate resilience actions (i.e. ex -ante assessment of GHG as well as extent of carbon sequestration, climate resilient variety/technology adoption, etc.) in the field will be covered in this component.

ATMA will have the responsibility of Training Need Assessment (TNA), Skill Gaps Analysis (SGA) on the basis of feedbacks gathered during micro planning exercise. The type of training programmes to be undertaken, type of knowledge partners (resources agencies) to be involved and all sorts of training arrangements would be decided in consultation with state level and regional level state government supported training providing agencies i.e. Vasant Rao Naik State Agricultural Extension Management Training Institute (VANAMATI) and Regional Agricultural Extension Management Training Institute (RAMETI) respectively.

To mainstream the capacity development programmes in the project area, ATMA would prepare a training calendar in consultation with VANAMATI and RAMETI. The training will be provided in a phased manner. KVKs will be next level of interface capitalizing their technical expertise as well as their understanding of local issues. KVKs will have a major extension-cum-training programme through FFS. Project Director, ATMA will be responsible for extension and capacity development programmes.

To facilitate the micro planning exercise in the project villages, ATMA functionaries including technical consultants would be provided with Trainers' Training on how to conduct micro planning in alignment with project objectives. They, in turn, will train cluster resource persons and Krushi Mitras operating at the village level. Ultimately, the Krushi mitras are expected to be instrumental in anchoring the entire micro planning exercise at the village level.

One of the key objectives of the project is to develop a series of learning materials for smallholder farmers with communication message about how to build a more effective climate resilient agricultural system. These learning materials would focus on increasing awareness level of climate change and climate change adaptation requirements. These materials would set the foundation of the entire capacity development process. Yashwantrao Chavan Academy of Development Administration (YASHADA) would be considered as knowledge partner in addition to VANAMATI, and RAMETI.
The project will have a comprehensive communication strategy and will use (a) mass media, (b) social media (c) audio-visual material on good practices, case studies and thematic knowledge products.

Activity	**Sub Activity**	**Who will do**	**Output**	**Indicator**
Update SREPs	SREPs for each district will be updated and aligned with the project approach	ATMA Project staff	Updated SREPs	Number of SREPs updated
Agro-met advisory centres	Real time agro-met advisory services to	SAU / KVK Agriculture Department	Setting up the Centre with	Number of farmers accessing the agro-met advisory service

	farmers in the project area		partner organizations	
Preparation of contingency plans	Cluster level contingency plan to be prepared	SAU KVK	Cluster level contingency plans	Number of plans prepared
Analytical studies	The studies would be focussed on climate resilience in the project area	SAUs IIT IISC and other knowledge partners	Thematic analytical studies	Number of studies completed; Key findings in a synthesis report widely shared
Maharashtra climate innovation centre	Assess and promote start up incubators in agri-services, agricultural technology	PoCRA PMU & other Private partners Research Institutions	One climate innovation centre established	one centre
Innovative technologies- demonstration/ testing/ consolidation	Innovative technologies to be demonstrated in the farmer field	CIC	Innovative technologies to be demonstrated	No. of technology demonstrated in farmer fields and results documented
Strategic partnerships with other institutions	Partnership terms agreed and timelines are aligned with project	PMU	Agreements indicating deliverables, timelines,	Number of MOU/agreement signed

			costs involved, and resources to be deployed	
Capacity building	PMU officials - International Training/ workshops/ seminars	YASHDA RAEMTI VANMATI SAU Project staff		Number of training man days
	PMU officials- Within country training/ workshops/ seminars			Number of training man days
	Div./ District/ Subdivision officers training			Number of training man days
	Taluka and below project officers/ assistants training			Number of training man days
	Accounts personnel			Number of training man days
	Accounts officials			Number of training man days
	Other stakeholders			Number of training man days
Training of Farmer Friends &	To be covered under various capacity building initiatives such technology	ATMA SAU/KVK Line department personnel at		Number of farmers covered (training days) No. of programmes

VCRMC members	demonstration, skill development etc.	Block level linked with POCRA Programme		
Exposure visits	To locations (intra and interstate and international) for learning best practices	RAMETI and other resource agencies		Number of days

A tentative convergent framework for various modules has been given in the table below. This can be revised during the project implementation after the training need analysis is conducted.

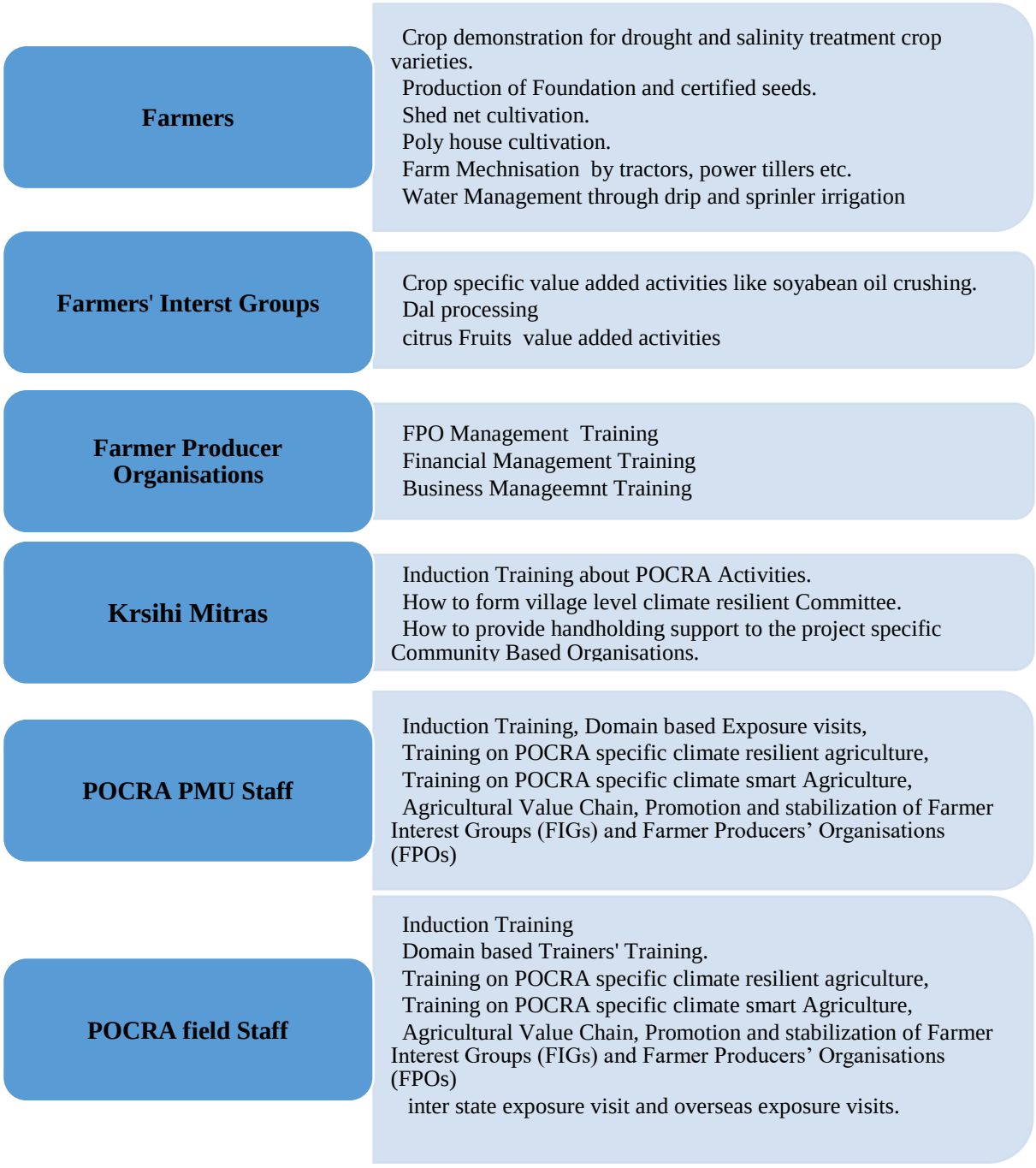


Figure 30 Possible training modules

S. No.	Activity	Sub Activity	Stakeholders	Who will do	Phasing
1	System and Institutional Development	Induction Training Programme	All Freshly recruited project staff above cluster level	SAUs, Yashada, VANAMATI, KVK, and need based sector specialized Organizations	Within 1 month of joining
			Cluster assistant	RAMETI, KVK and need based sector specialized Organizations	Within 3 months of joining
			Krushi Mitras	KVKs	Within 3 months of joining
		Refresher Programme	Senior Management-PMU	SAUs, CRIDA, Yashada VANAMATI	Every year
			Mid/ Junior Management-PMU	SAUs, VANAMATI	Every year
			Project specific Experts at PMU Level	VANAMATI, SAUs	Every year
			Project specific Experts at District ATMA level	SAUs, RAMETI	Every year
		Exposure Visit	Senior Management-PMU	To be decided	As per requirement
			Middle level and Junior - PMU	To be decided	As per requirement
		Enhancing capacity of line department officials	Line department personnel at Dist./ Subdivision/ Block level linked with PoCRA Programme	YASHADA/ VANAMATI/RAMETI	As per requirement
		Action Research	With knowledge partners	IIT- Mumbai, CRIDA, Gokhale Institute of economics and Politics	One action research to be completed each year
2	Cooperation and network development	Project Networking	Organizations and Institutions to be linked with POCRA activity through MOU routes	To be decided	
3	Organizational Development at community level	Training on FPO Management	Farmer Interest Groups, Farmer Producer Organizations, Farmer Producer Companies, Women Self Help Groups	SAUs, Resource agencies, Project staff	
		Training on Financial Management		Resource agencies, Project staff	
		Training on Business Management		Resource agencies	

		Training on Contingency Planning		SAUs, Project staff	
		Management of Custom Hiring Centres		SAUs, Project staff	
		Farmer Field Schools	Learning and documentation centre for generating continuous knowledge	KVKs	
		Climate Innovation Centre	A dedicated institution for developing climate resilient sustainable agricultural practices	GoM, Private Sector, Research Institutes, GoI institution	
5	Farmers' Development	Farmers' Training and Technology Demonstration	Farmers of the POCRA intervention area	KVK and SAUs	Each Batch consists of 50 members
		Exposure Visit to the farmers	Farmers of the POCRA intervention area	To be decided by PMU	
		IT Training to the farmers	Farmers of the POCRA intervention area	Project staff, Resource agencies	
		Livelihood Expansion	Landless households with special emphasis to women headed, ST, SC and other vulnerable households	Line Departments of the concerned project area.	

4.8.4 Approach

In compliance to the project objectives, adequate training is to be given to Commodity Specific Groups. Due to technical expertise available with KVK, it is proposed that KVKs are to undertake climate resilient technology demonstration programmes in FFS. Besides institutional arrangements are to be made for crop specific specialized training programmes for the farmers in the project area. A case in point is of State level Banana Research Institute, Jalgaon which may conduct banana cultivation training programme for the farmers. Citrus centre, Nagpur can be mobilized for training in Citrus crop

management. Based on the evolving needs, the partner agencies would be identified. A Joint Training Calendar would be prepared by the KVKs to mainstream the capacity development programmes in the project area.

Update of Strategic Research and Extension Plan (SREP):

Strategic Research and Extension Plan (SREP) is a comprehensive document prepared at the district level identifying research/ extension priorities for district, keeping in mind agro-ecological conditions and existing gaps in technology generation and dissemination in all agriculture and allied sector areas/ activities including in the area of Seeds, Mechanization, and Plant Protection. Existing SREPs will be updated to include the project approach and strategies in coordination with the line departments, Krushi Vigyan Kendras (KVKs), VCRMC, Private Sector, lead farmers and other stakeholders.

The updated SREPs will be aligned with the mini watershed plans developed under Component A.

Agro-met advisory

For weather advisory services, project activities will include(i) collecting, processing and managing agro-meteorological data, (ii) issuing agro advisories using the IT system and farmers' feedback, and (iii) enhancing local capacity for community-level pest and disease surveillance. To that effect, the project will work closely with the two partner universities and Indian Meteorological Department (IMD). MoU will be signed with the universities for this purpose. It is planned to develop suitable mobile apps to communicate with the farmers on agro meteorological information.

Real time contingency planning

Climate variability, varying rainfall trends during the monsoon season and long term climate change will impact cropping pattern, crop productivity and profitability of small holder farming systems. Climate variability includes; inter-annual variation in total rainfall and rainfall distribution within the cropping season, drought, delay in onset of monsoon, mid-crop season dry period, unseasonal rains, etc. There is a need to adopt a strategy of "Contingency Planning" to adapt to changing rainfall pattern during the cropping season. CRIDA has been experimenting with contingency planning in selected districts of India.

Contingency crop planning refers to implementing a plan for making alternative crop or cultivar choices in tune with the actual rainfall situation and soil in a given location. In rain-fed areas, as a general rule early sowing of crops with the onset of monsoon is the best-bet practice that gives higher realizable yield.

Major crops affected due to monsoon delays are those crops which have a narrow sowing window and therefore cannot be taken up if delay is beyond sowing window. Crops with wider sowing window can still be taken up till cut-off date without major yield loss and only the change warranted could be the choice of short duration cultivars.

Beyond the sowing window, choice of alternate crops or cultivars depends on the farming situation, soil, rainfall and cropping pattern in the location and extent of delay in the onset of monsoon. Breaks in the monsoon cause prolonged dry spells and are responsible for early, mid, and terminal droughts. These aberrant situations often lead to poor crop performance and or total crop failures.

While early season droughts have to be combated with operations like gap filling and re-sowing, mid and late season droughts have to be managed with appropriate contingency measures related to crop, soil nutrient management and moisture conservation measures. Drought also causes loss in livestock productivity due to shortage in fodder production. Appropriate location specific fodder production strategies are essential for reducing the adverse impact in livestock which is the major source of livelihood in dryland area.

"Any contingency measure, either technology related (land, soil, water, crop) or institutional and policy based, which is implemented based on real time weather pattern (including extreme events) in any crop growing season" is considered as Real Time Contingency Planning (RTCP).

The stakeholders in each cluster will be oriented with the real time contingency planning developed by CRIDA and SAUs. The training would be conducted by the KVK network of the partners SAUs. A draft contingency planning framework has been given in Annexure -VIII

Knowledge Products

The project shall arrange to avail the technical support from the public sector institutions like Central Research Institute for Dryland Agriculture, Vasundhara Watershed Development Agency, Maharashtra State Seeds Corporation (MAHABEEJ), State Agriculture Universities, Maharashtra State Marketing

Board, National Institute of Abiotic Stress Management, National Innovations on Climate Resilient Agriculture (NICRA), Central Soil Salinity Research Institute, Central institute of Agri Engineering, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India Meteorological Department, IIT Bombay, and Yashada for overall success of the project. The project will have strategic partnership with institutions to develop several knowledge products. This will include the following:

- Development of long term climate change model for the project area and its implications
- Various thematic studies on climate resilience
- Creation of tools to carry out resource and opportunity analysis for project clusters
- A risk matrix on project activities

The results of these partnerships would also contribute to other initiatives of the GoM.

Capacity Development

Capacity Building of farmers and project staff shall focus on the following:

i. *System and institutional development*
ii. *Cooperation and Network Development*
iii. *Human Resources Development*
iv. *Organizational Development at Community level*
v. *Technical Training*
vi. *Social Processes and Managerial Training*

Action Research and climate resilient technology demonstration

As a part of project activity, it is desirable to have a series of action research projects to be undertaken by strategic partners during the entire length of the project period. These action research projects are to provide strategic directions for the effective implementation of the project. Lessons learnt from these action researches would be carefully documented and widely publicised to enrich the existing knowledgebase. Besides some of the validation works could be completed on the basis of the results of action research projects pertaining to drought and salinity tolerant crop varieties. Some of the strategic action research projects would also be carried out through the knowledge partners to be identified under the project. It is viewed that results emanating from action research projects would guide the PMU to implement the project in right direction.

Exposure Visits

PoCRA will explore learning partnerships with national and international agencies. Under such exposure visits for the farmers and PIAs at different levels would be arranged within the district, within the state

and outside the state. The purpose of these visits would be to give exposure to the best practices in the climate resilient agriculture. The project will identify a partner like ICRISAT who specialise in identification and facilitation of visits to project sites to learn best practices.

4.8.5 Climate innovation centre

A CIC shall be established at state level for dissemination of innovative ideas, knowledge, technology, information, etc. This component will finance the planning, launch and start-up phase for a CIC till it operates in a self-sustained manner. The CIC will support local private sector capacity – with focus on entrepreneurs and SMEs – to commercialize and deploy emerging technologies and business models in growing climate sectors (e.g. climate-resilient agriculture, water, energy) to provide local solutions to climate change. The project is expected to promote innovations that can be scaled up.

Establishment of Innovation Centre: At the state level a CRC would be established under the auspices of a special purpose vehicle (SPV). The centre may provide various types of paid services to the companies, agri-entrepreneurs, FPCs, and other institutions who would like to avail of cutting edge technological solutions to improve farm productivity and create resilient value chain. The CIC would also provide policy input to the government.

The **key objective of** the climate innovation centre is to convert climate change related challenges in the state to a growth opportunity. The centre established at the state level will have the following components.

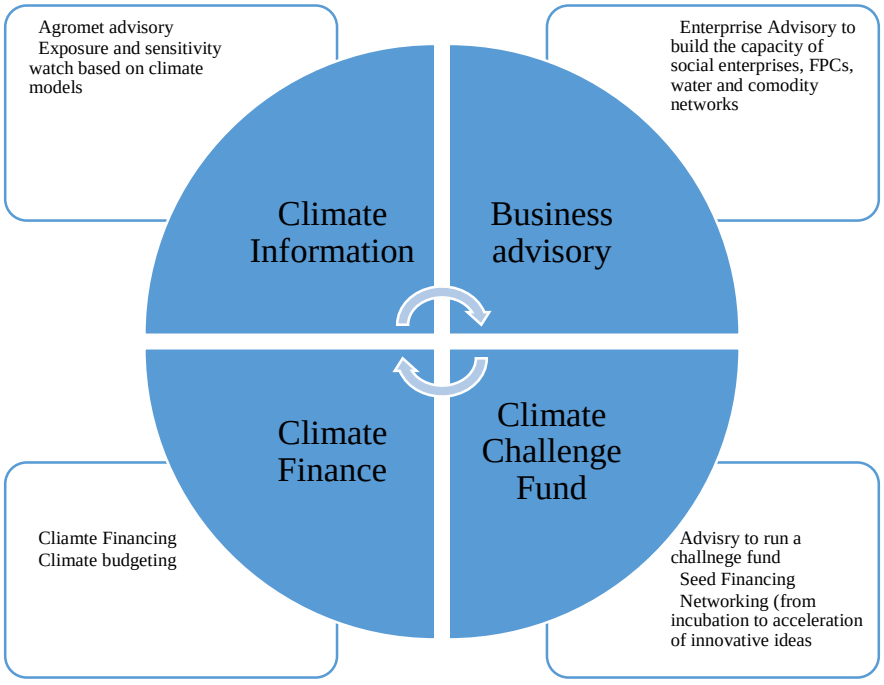


Figure 31 *Components of Climate Innovation Centre*

Rationale of CIC

a. A CIC within PoCRA could serve a vital purpose to enhance climate resilience in the state: The CIC's focus on supporting actors – primarily private sector entrepreneurs and SMEs – to commercialize and deploy climate technologies and business models could address barriers to scaling solutions that undermine the agricultural climate-resilience in the state.

b. The CIC would use its finite resources most effectively to support private sector to overcome standard barriers in taking proven technologies from the lab into the field on a commercial basis at scale.

c. The CIC would enhance and complement rather than duplicate existing entities.

d. The CIC would support a range of diverse stakeholders and deal with the highly dynamic nature of innovation. The institutional structure would ensure its ability to do so effectively.

e. The CIC's role as a conduit to linking local actors to international players and information on latest technologies being developed globally would be an effective role in accomplishing its goals.

f. In addition to directly enhancing local agricultural climate resilience, the CIC can also boost capacity of local private sector to create a sustainable means to continually provide farmers with the latest technologies. This could lead to increased investment and job creation.

4.8.6 ICT Strategy

The ICT strategy will help PoCRA to have a (a) decision support system, (b) tracking tools, (c) knowledge management system (d) MIS framework for the sector (e) input for policy and regulatory reform.

While this strategy will be pre-tested under program it should aim to be a platform for the department in the future to track various activities of the department.

Proposed ICT Systems to support POCRA Components

The project intends to adopt a Climate Risk Management (CRM) approach for smart systems development. As per the United Nations Framework Convention on Climate Change (2011): 'CRM refers to different aspects of the risk management process, including: (a) risk assessments for informed decision-making; (b) risk reduction: planning and preparation; and (c) risk sharing, pooling and transfer in the context of adaptation'.

Under the proposed CRM based systems development approach, the POCRA project would use climate, local conditions data, soil and farming data and socio- economic data / information in a multidisciplinary context to address the climate's impacts on development and resource management problems being experienced in the state of Maharashtra. The proposed CRM based ICT and new media systems would therefore plan to cover a broad range of potential actions, including early- response systems, strategic diversification, dynamic resource-allocation rules, financial instruments, infrastructure design and capacity building.

The proposed approach is of immediate relevance to small and marginal farmers, because it plans to focus on a 'coordinated response' for addressing climate risks with active engagement of all key stakeholders including farmers, agricultural support agencies, agriculture and rural services providers, rural and agricultural institutions.

An important requisite of the proposed approach will be to bring together two key objectives:

Support actions and activities to improve adaptive capacity and preparedness to cope with the current climate variability, and

To build the necessary resilience and preparedness to better respond and cope of with disaster / crisis situations due to climate change.

POCRA – Climate Risk Management System

A common integrated platform – POCRA CRM System is proposed that is able to collect data from multiple sources, seamlessly integrate and analyse the data / information and provide useful information to support informed decision-making, improve operational effectiveness of project activities and monitor and evaluate performance to facilitate quick corrective action, where required.

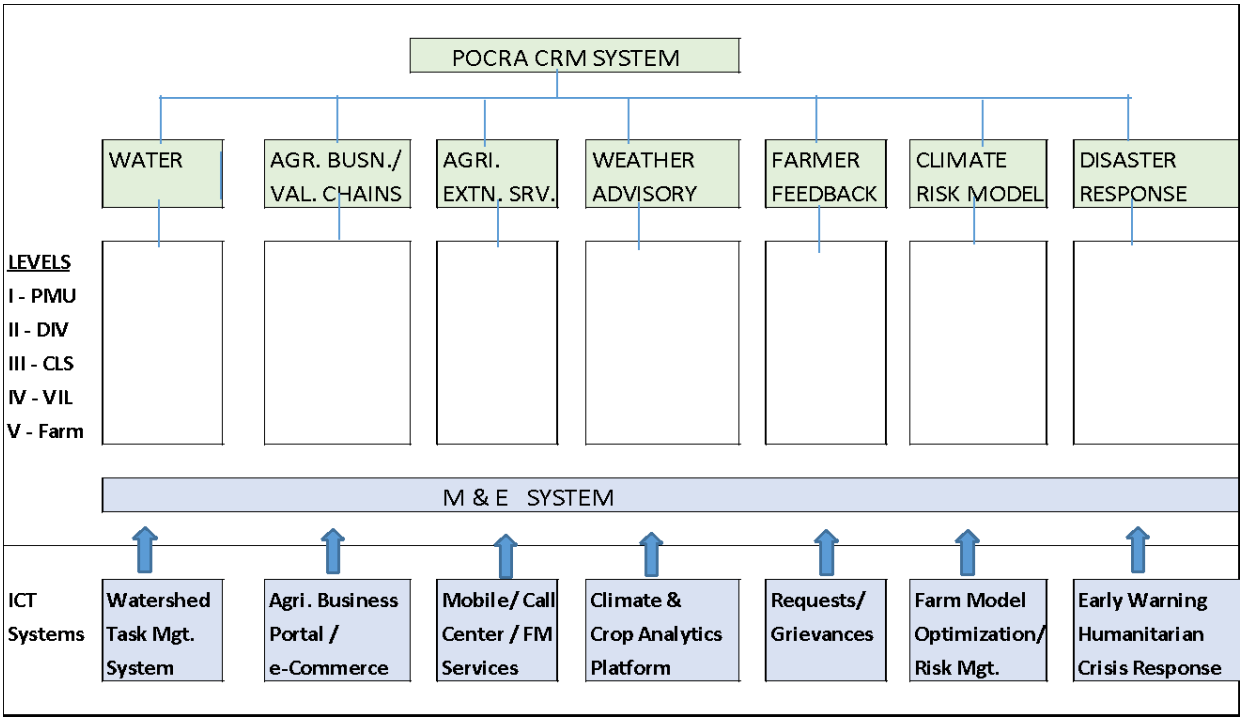


Figure 32 PoCRA Climate Risk Management System

The proposed ICT System platform would be required to support POCRA's objectives and a broad range of potential project actions and activities, and will therefore comprise of the following eight sub-systems:

- Watershed Mgt. System
- Agri Business & value Chain Mgt. system
- Agriculture Extension Services system for practices for sustainable production,
- Weather Advisory and Warning system
- Farmer Engagement & Feedback System (Multi-channel access for farmers)
- Climate Risk Modelling (Farm level Planning & Risk Mgt. Advice)
- Climate Disaster Management - Crisis and Humanitarian response,
- Monitoring & Evaluation System

All subsystems under the proposed platform will be designed and deployed to allow multichannel access (Web, Mobile, IVR, and Touchscreen Kiosk). The designed system will utilize SMAC (Social, Mobile, Analytic and Cloud) technologies coupled with IOT for real time collection, analysis of and dissemination of data and information to all the stakeholders (Suppliers as well as users) of the project.

Key milestones

Timeline (Months)	**0-9**	**10-18**	**19-21**	**22-24**
Phase	Diagnose	Design	Deliver	Sustain
Road-Map	KPI development, Stakeholder mapping, Best practices adoption, ICT platform, Change management, RFP with vendor identification	Development of user modules, Prototype, User acceptance testing	Go-Live, User workshops, training	Support stable system, Changes identification, Open items review

Information, Education, and Communication (IEC) strategy

The key objective of the IEC strategy shall be to familiarise all stakeholders about the project approach, activities, guidelines and outcomes. Effort would be made to maintain uniformity in messages and production of high quality, cost effective, and target specific IEC products based on the key messages and thereby ensuring better uptake of the project activities by the community. The strategy will be innovative and may take a little detour from the conventional mass media driven approach in message dissemination to focus on mid media and interpersonal media initiatives to ensure that the messages reach the target group in an effective and sustainable way. Advantages of social media websites will also be utilized and importance will be given on the branding of POCRA. The media advocacy plan would also focus on orientation of staff to achieve the desired objective. IEC strategy will also try and assess the communication need assessment it will have provision for engaging a professional agency to run a focused campaign in the project districts.

COMPONENT D

Project Implementation Management

4.9 PROJECT IMPLEMENTATION MANAGEMENT

The project implementation framework is based on tight convergence with government departments and with limited project staffing specifically not to create any parallel structure. To improve the efficiency of the project staff, the project relies heavily on IT driven MIS system. Project partners would also be integrated with the IT system to facilitate monitoring.

The overall project structure is given in the diagram below:

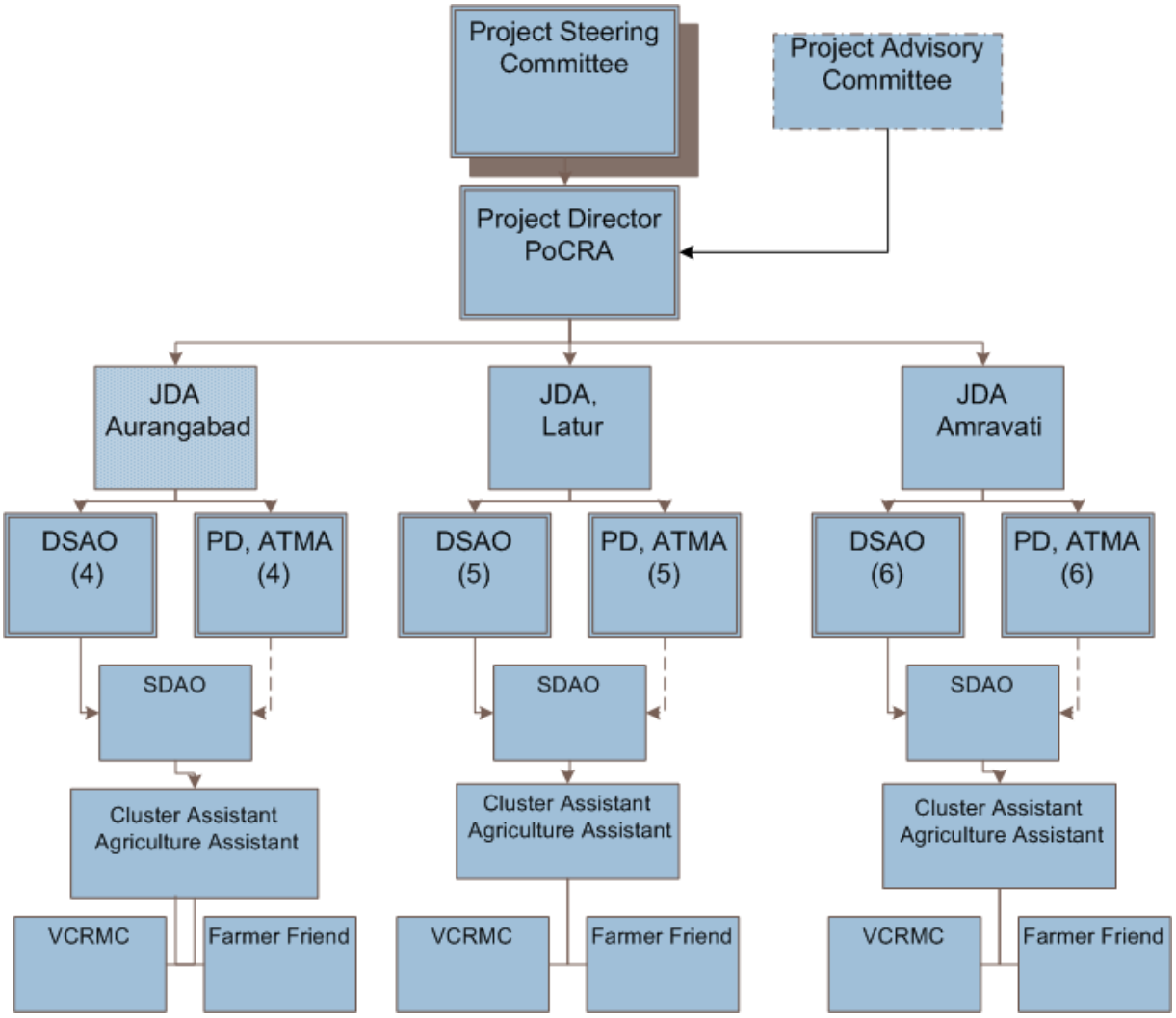


Figure 33 *Overall project implementation structure*

4.9.1 Project Governance

4.9.1.1 Project Steering Committee

A high level steering committee has been proposed under the chairmanship of the Chief Secretary. The proposed members of this committee and the responsibilities have been outlined below.

Table 19 Project Steering Committee

Composition	Role
Chief Secretary	Chairperson
Secretary, Agriculture Department	Member
Secretary, Water Conservation Department	Member
Secretary, Animal Husbandry Department	Member
Secretary, Marketing Department	Member
Secretary, Planning Department	Member
Secretary, Finance Department	Member
Vice Chancellors (PDKV and VNMKV)	Members
Commissioner, Agriculture	Member
Project Director, POCRA	Member Convener
Any other person	Invitee

The roles and responsibilities of the Project Steering Committee shall be as follows:

- Provide conceptual, strategic and policy guidance for the design and implementation of the project activities.
- Review Annual Work Plan and Budget, ensuring adequate budget provision for the activities
- Review the progress of Programme Implementation based on progress and monitoring reports, impact assessment studies and make recommendations
- Guide inter-departmental convergence and coordination
- Review and resolves the issues arising out of field implementation
- Undertake such tasks that may help the effective implementation of the project

4.9.1.2 Project Advisory Committee

A Project Technical Advisory Committee has been formulated under the chairmanship of the Principal Secretary (Agriculture) by Department of Agriculture, GoM as per GR dated June 13, 2017. The composition, roles & responsibilities are as follows:

Table 20 Project Advisory Committee

Sr. No.	Designation	Role
1	Principal Secretary(Agriculture)	Chairperson
2	Project Director , PoCRA	Member
3	Commissioner (Agriculture)	Member
4	Director of Research ,VNMKV , Parbhani	Member
5	Director of Research ,Dr. PDKV , Akola	Member
6	Director, CRIDA	Member
7	Director, MRSAC	Member
8	Deputy Director General, IMD	Member
9	Director , GSDA	Member
10	Director ,Maharashtra State Seeds Corporation Ltd(Mahabeej), Akola	Member
11	Director , Marketing	Member
12	Deputy Project Director , PoCRA	Member Secretary
13	Non-Government Members(2)	Member (By approval of Govt.)

14	**Invitee Member(s)**	**By Approval of Chairperson**

Roles & Responsibilities:

1) To give technical advice on the components and activities of approved Project Plan

2) To suggest proper solutions to the technical problems arising during the implementation of the project.

4.9.1.3 Project Management Unit

The state has already set up a state project management unit vide government resolution dt. 10/08/2016. The structure of the PMU has been given below:

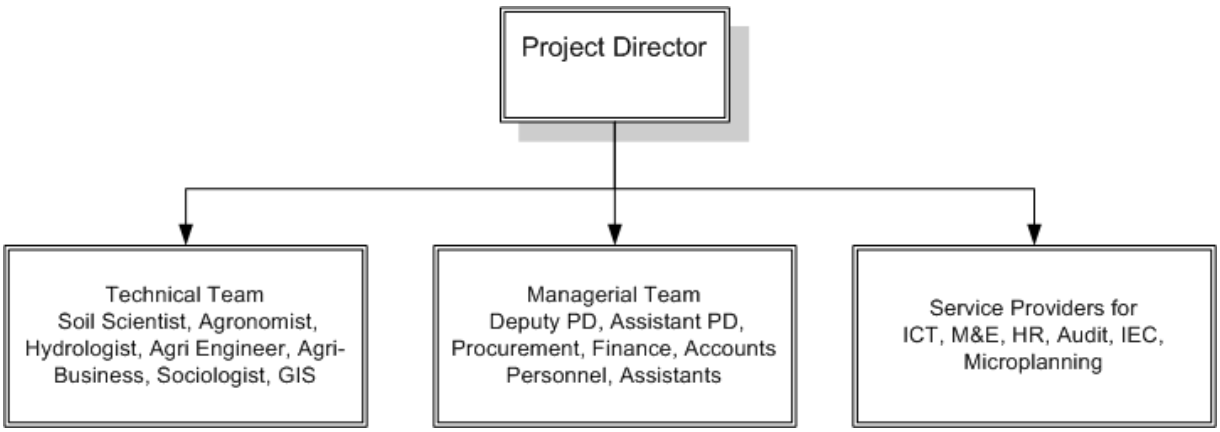


Figure 34 *Project Management Unit*

The PMU is headed by a Project Director who is responsible for overall implementation of the project activities.

Table 21 PMU positions

Position	Qualification	Role
Project Director	Senior Officer from Indian Administrative Service in the rank of Secretary to the state government	Overall leadership for the project

Deputy Project Director	Under Secretary Rank, on deputation	Administrative support
Assistant project Director	Desk Officer Rank, on deputation	Administrative support
Finance specialist	Deputy Director Rank officer from Maharashtra Finance and Accounts Service, on deputation	In charge of project accounts and finances, internal and external audit, fund flow
Procurement specialist	Fully conversant with the world bank procurement process	To manage centralize procurement function as per the guidelines and manuals; work with district level agencies to assist them in the decentralized procurement functions
Agronomist	Deputy Director Rank officer of Agriculture Department	To plan, coordinate with district and field implementation units on crop production and management practices.
Hydrologist / Geologist	Specialization in Hydrology	To conduct hydrological assessment of clusters
Soil Scientist	Deputy Director Rank officer of Agriculture Department	To plan and coordinate soil conservation measures, soil improvement, soil reclamation
Sociologist	Specialist with post graduate degree in Social Work preferably in Community / Rural Development and experience in social aspects of agriculture or rural development	To ensure social inclusion, to identify social inequity and genders issues and safeguard issues relating to vulnerable segments in the project. Prepare strategy and follow up for social inclusion
Agriculture Engineer	Deputy Director rank officer of Agriculture Department/ SAU / Specialist with Post graduate degree in Agricultural Engineering	To provide technical support, planning, coordination of watershed development, water use efficiency, farm mechanization, agro-processing, activities.
Agri-Business specialist	Specialist with experience in agribusiness promotion	To design agribusiness component, prepare guidelines, promote agribusiness activities, support & monitor preparation of agribusiness plans, promote producer groups/ companies.
GIS specialist	Specialist with experience in GIS / Geoinformatics and / or Remote Sensing	Geo-referencing & Fusion of remote sensing Data & Preparation of cluster & village wise maps, analyse remote sensing data, provide IT support to PMU

4.9.1.4 Division Level

There are three divisions in the project area, headquartered at Amravati, Latur and Aurangabad. In each of these divisions, Divisional Joint Directors will be designated as PoCRA nodal officers. The primary function of these offices will be to coordinate with the districts in their jurisdiction. These offices will also procure human resources (other than technical assistance consultants) for their respective areas. PoCRA will provide IT/MIS support to their office and requisite guidance from the state PMU. The structure for this office is given below:

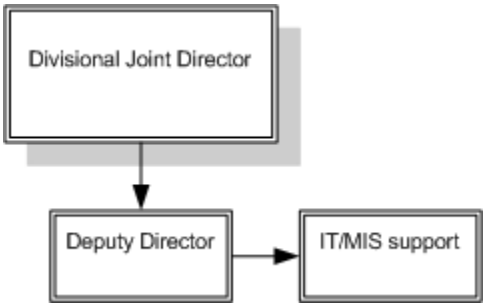


Figure 35 *Interface structure for PoCRA at Division Level*

4.9.1.5 District Level Structure

The role of the district level unit has to be that of a facilitator, collaborator, supervision, and bringing convergence. The natural coordination for project activities can be provided by the district collector who also chairs the district ATMA, and Jal-Yukt Shivar initiative. Collector will chair the district level steering committee for PoCRA. The district level structure for the project has been given below:

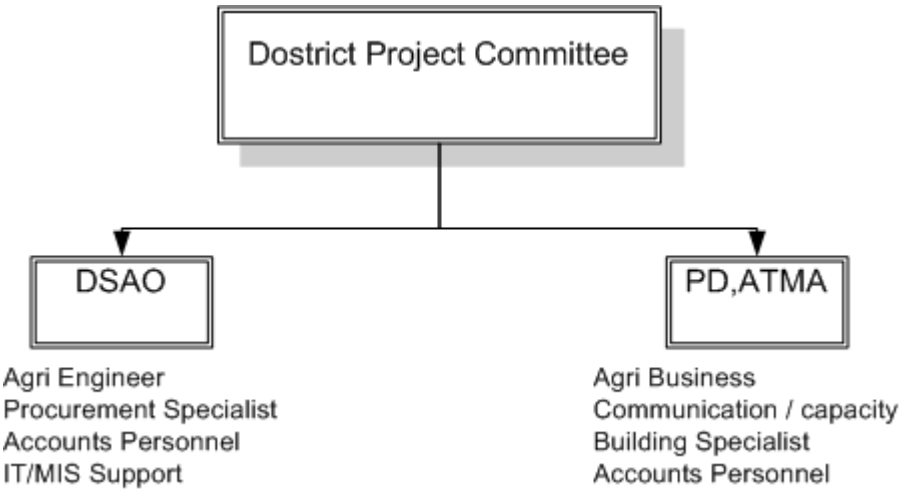


Figure 36 District Level Interface structure

4.9.1.6 Subdivision level structure

The districts are further divided into subdivisions. One Sub-Divisional Agriculture Officer (SDAO) is normally in-charge of about 3-5 talukas in a district. The project area is spread over 36 subdivisions. SDAO would also be the drawing and disbursing officer. The project will provide accounts personnel to support proper utilization of funds at the level of SDAO as well as VCRMC.

The subdivision level implementation structure has been given in the diagram below:

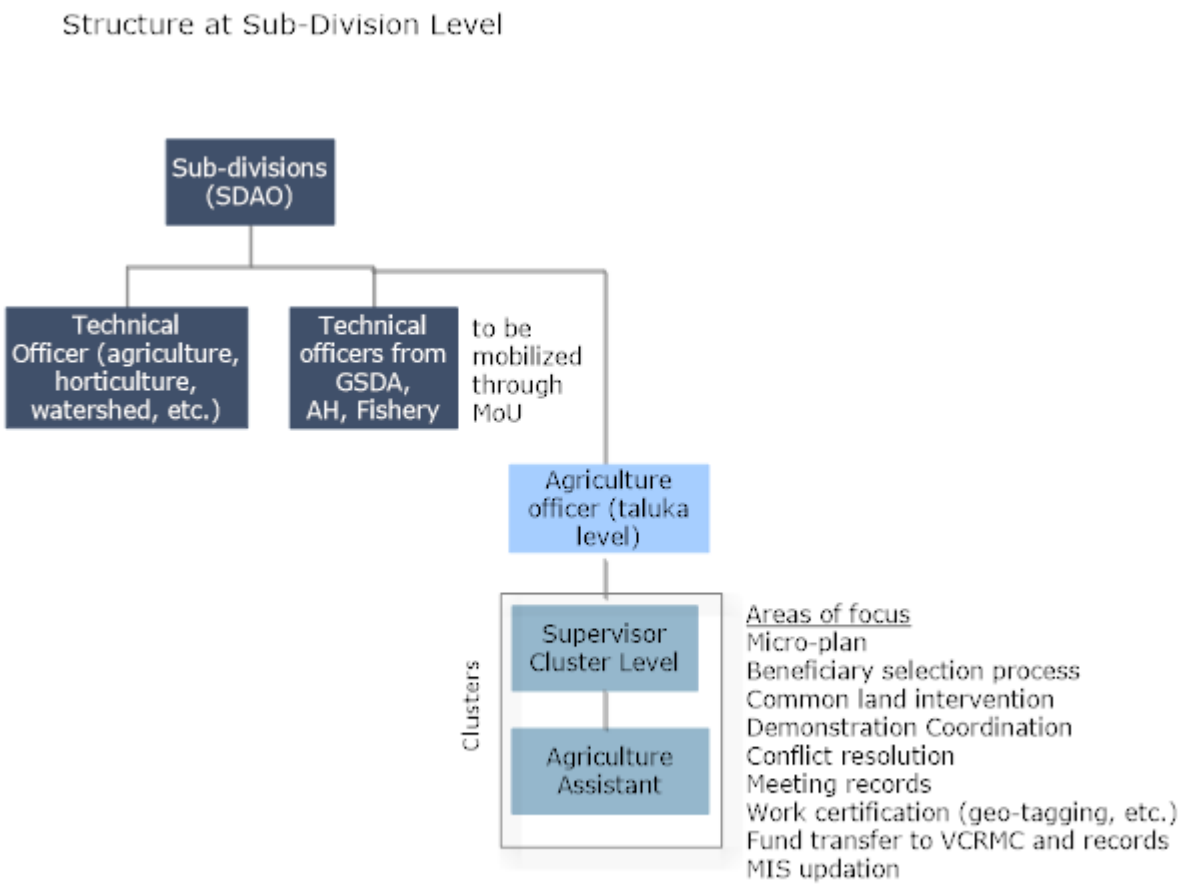


Figure 37 *Figure 31 Sub-division Level Implementation Structure including Cluster*

4.9.1.7 Village level structure

The village level structures are given below:

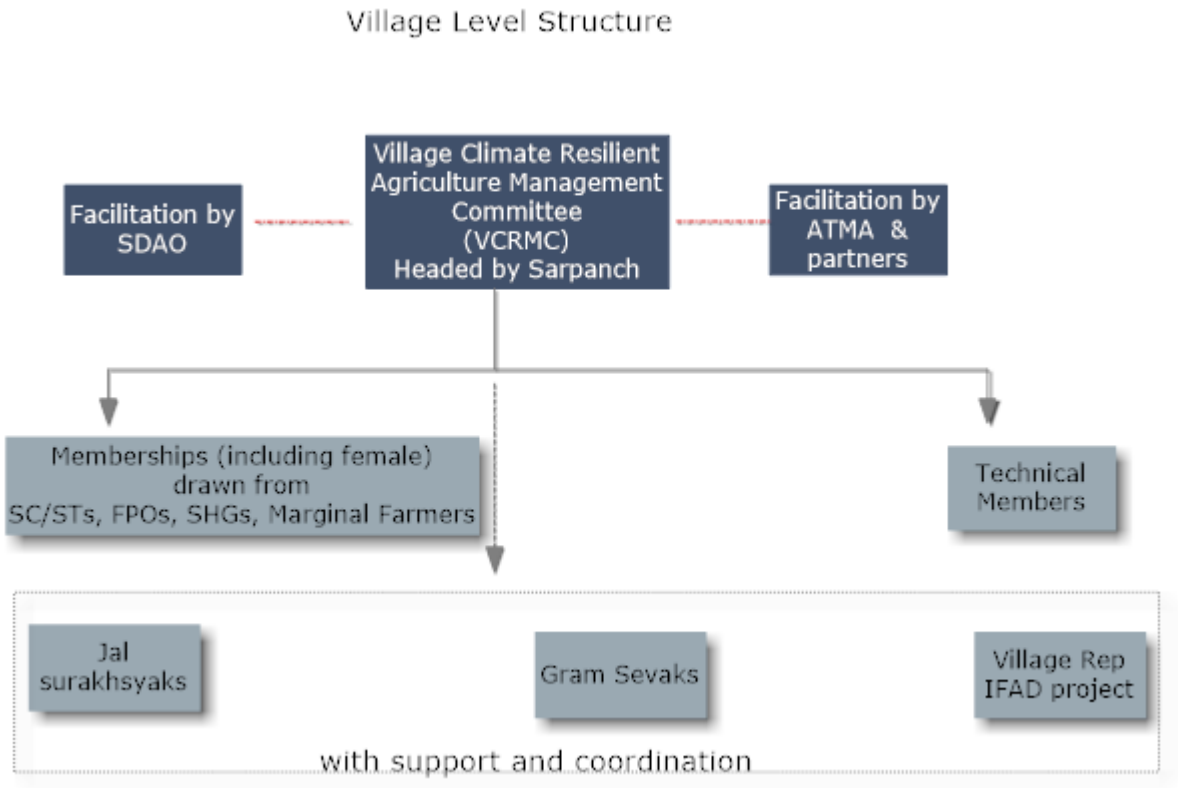


Figure 38 *Figure 32 Field Level Implementation Structure: Cluster and Above*

As evident from the diagram above, many field level committees have already been formed under different programmes. The project will work with such institutions to gain from their expertise and strength. The composition and functions of the VCRMC are as below:

Composition of Village Climate Resilient Agriculture Management Committee (VCRMC)

1. Chairman: Head of Gram panchayat (Sarpanch)
2. Members (10)
    a. Farmers' Friend (1)
    b. Progressive Farmer - Male (General-1, Scheduled Caste/ Schedule- 2)
    c. Progressive Farmer - Female (General-1, Scheduled Caste/ Schedule- 1)

d. Farmers Producer Organization/ Company - 1
e. Women Farmers Self Help Group (SHG) - 1
f. Farmer doing allied activity – 1

3. Technical Expert (Agriculture Assistant) - Member
4. Cluster Assistant - Convenor

Roles & Responsibilities of VCRMC

1. Preparation of participatory village micro-plans and get approval of Gram Sabha
2. Selection of beneficiaries for individual benefit activities
3. Ensuring beneficiary contribution as well as assistance from commercial banks, wherever necessary
4. Planning and execution of community works as per approved annual action plan
5. Maintenance of assets created through project assistance on community land including books of accounts. This will be by a trained community book-keeper hired by the VCRMC for the purpose to be met out of the expenditure estimated for the works/services.
6. Preparation of contingency plans with the help of technical experts and ensuring its application during contingency situation.

4.9.2 Role of project units at various levels

The details of leadership team role have been given below:

4.9.2.1 PMU

- Overall leadership, control, monitoring, and supervision of the project activities and staff.
- Ensuring implementation of Govt. orders and to make fund available to the field units/ functionaries
- Ensuring timely submission of reports to GoM and World Bank
- Ensuring deployment of field staff, resource agencies, service providers and other functionaries
- Coordination with line departments at state level
- Ensuring consolidation of the annual work plan and budget of various units for submission to the state for sanction of the Budget.
- Ensuring approval of annual work plan and budget by Project Steering Committee/ Governing Body and Executive Body

- To receive the funds from additional sources for integration
- Ensuring timely distribution of the funds to various field units and service providers as per the physical and financial targets and other deliverables
- To submit Consolidated Statement of Expenditure to the World Bank for reimbursement of Claims.
- To monitor the activities and progress of works in project.
- To provide necessary guidance and coordination and ensure proper implementation of the Project.
- Conflict Resolution

4.9.2.2 Office of the DSAO

- DSAO will be the administrative head at the district level and responsible for smooth implementation of the project in the district.
- DSAO will be responsible for Implementation of annual work plan, regular monitoring of the project activities, and to make fund available to the field functionaries
- Coordinate with line departments at cluster, block, and district level and office of ATMA
- To provide technical guidance regarding technical matters
- Ensure formulation of village micro-plan, review and appraisal of Cluster Development Plan, preparation of Annual Action Plan
- Consolidate the Annual Action plans of all the GPs under them to make consolidated budget for GPs.
- To add their own administrative budget in the consolidated budget of GPs for further submission to Project Director.
- To receive the budget envelop from Project Director.
- To allocate budget to various GPs and execute Financial Agreements / MoUs with GPs or agencies, if any.
- To consolidate expense statement
- Timely submission of all reports to higher officers and monitor the progress
- Field appraisal and to suggest alternatives in action plan.
- Provide guidance for effective implementation of Annual Action Plan.
- Assist SDAO office in procurement of goods, works, and services, wherever required.
- To resolve conflicts and grievances

4.9.2.3 Office of PD, ATMA

A) PD ATMA-

a. Liaison with SNO and SAMETI at State level and coordination between line departments including KVK, PRI, Private Sector and Planning Units at district level as far as training & technology dissemination is concerned.

b. Effective implementation & coordination of different project component

e. g. Training need assessment & Preparation of yearly training calendar for training of Farmers & field staff, farmers field school & strengthening of FPOs, FIGs, CIGs etc.

c. Use of audio visual aids for awareness, publicity & effective program implantation

d. Review of the project progress

e. To receive the budget envelop from DSAO

f. To consolidate expense statement

g. Timely submission of all reports to higher officers and monitoring the progress

h. Field appraisal and to suggest alternatives in action plan.

i. Provide guidance for effective implementation of Annual Action Plan.

j. To resolve conflicts and grievances

4.9.2.4 Office of SDAO

a. SDAO will be the administrative head at the subdivision level and responsible for smooth implementation of the project in the sub-division.

b. SDAO will be responsible for Implementation of annual work plan, regular monitoring of the project activities, and to make fund available to the field functionaries

c. Coordinate with line departments at cluster & block level and office of ATMA

d. To provide technical guidance regarding technical matters

e. Ensure formulation of village micro-plan, review and appraisal of Cluster Development Plan, preparation of Annual Action Plan with in his jurisdiction.

f. Consolidate the Annual Action plans of all the GPs under them to make consolidated budget for GPs.

g. To add their own administrative budget in the consolidated budget of GPs for further submission

h. To receive the budget envelop from DSAO.

i. To allocate budget to various GPs and execute Financial Agreements / MoUs with GPs or agencies, if any.

j. To consolidate expense statement

k. Timely submission of all reports to higher officers and monitor the progress

l. Field appraisal and to suggest alternatives in action plan.

m. Provide guidance for effective implementation of Annual Action Plan.

n. Assist Cluster assistant in procurement of goods, works, and services, wherever required.

o. To resolve conflicts and grievances

4.9.2.5 Office of the Cluster Assistant

- Facilitate the process of preparing Cluster Development Plan.
- Focal interface for all project related activities with community
- Execute and facilitate the implementation of the project activities
- Supervise and conduct inspections for project activities including maintaining records of social audit
- Extension work
- Coordinate with farmer friends for mobilization and extension support

4.9.2.6 Agriculture Assistant

4.9.3 Staffing structure

The staffing structure of various units of project is given in the annexure-IX

4.9.4 Village Level Institutions, their Roles & Responsibilities

The project will take the assistance of strong and robust community level institutions in the planning, implementation, supervision and sustainability of the project activities.

Table 22 Village level institutions: roles and responsibilities

Sl No	Institution	Composition/ Qualification	Roles and Responsibilities	Accountable To
1.	Gram Sabha	All voters of the village	To discuss & approve all major decisions related to Village Development Approval of village micro plan, annual plan, and list of beneficiaries Ensure inclusion of disadvantaged groups such as women, poor, SC/ST, landless Formation and monitoring the working of VCRMC Conduct social audit of the project activities at periodic intervals	Village Community
2.	Gram Panchayat (GP)	Sarpanch & elected ward members	Sign all necessary and appropriate agreements related to the project Convene Gram Sabha meetings Assist project staff and agencies in mobilization of village communities Initiate and complete the village development plan Open project bank account & judiciously manage project funds and expenditure Ensure complete transparency & accountability by all GP-level institutions & individuals involved in the project	Gram Sabha and Project

3.	Village climate resilient agriculture management committee (VCRMC)	A subcommittee of GP headed by the Gram Sarpanch, constituted under the provisions of The Bombay Village Panchayat Act, 1959.	Assist resource agencies in mobilization of village communities Lead the process of planning, preparation & implementation of village development plan Maintain the project account Help cluster coordination committee for implementation of common works and activities Submit periodical reports Comply with the audit requirements Recommend the eligible and deserving beneficiaries as per the project guidelines Prioritization and sequencing of activities	Gram Panchayat and project
4.	Cluster coordination committee	Cluster coordination committee will draw two members from each of the VCRMC in the cluster. Half of the members would be the women	Lead the process of preparing Cluster Development Plan Ensure sequencing of the watershed activities Plan for convergence regarding issues concerning more than one village	GPs and POCRA
5.	Krushi Mitra	A community resource person with qualification of matriculation and above with grassroots experience in agriculture and experience in agri business, etc.	Facilitates the process of community interface with social mobiliser and cluster executive in micro-planning Works with lead farmers and farmer groups on front line demonstration and on farm demonstration	ATMA

			Works with VCRMC on keeping records of minutes	

4.9.5 Inter-departmental convergence

There are two levels of departmental convergence. The first is top-down and the second is bottom up. The high level project steering committee provides strong convergence mandate for this project in the sense that the project is not in isolation but an additional catalytic investment for the drought mitigation initiative of the GoM. The state has prepared irrigation plans, agri-business plan, watershed development plan, crop-plan, and contingency plans for all the districts. In addition, specific crop / varietal advisories are available through the university extension machinery. Now the bottom up planning process from cluster upwards through micro-planning and facilitation by ATMA has to be integrated so that there is no duplication of resources and the allocation is optimal and efficient. The twin goals are water use efficiency and higher value share to small holder farmers. All opportunities around these objectives are to be tapped and constraints addressed. For all relevant agencies viz. agriculture, water conservation, rural development, MRSAC, GSDA, marketing, animal husbandry, social justice, tribal development, women and child development, and any other departments that have strong bottom up approach, this project would serve as an ideal platform.

4.9.6 Strategic Partnerships

The project will have strategic partnerships around the thematic areas with organisations of national and international repute. An indicative list has been given in the table below:

Table 23 Strategic Partnerships

Thematic Area	**Partner**	**Remark**
Contingency Planning (district and below)	CRIDA, SAUs	For integrating climate risk management and variability in the planning process
Weather Information and agro advisories	IMD, SAUs	Weather data monitoring and forecast, generation of agro-advisories
Water Management	IIT Bombay, GSDA, SAUs	Hydrological modelling, water balance
Soil profiling	NBSSUP, Nagpur	Soil health
Extension services	SAUs, KVKs	For crop management, varietal selection, agronomic practices
Watershed	Vasundhara Units	Watershed Alignment in clusters

Geo-spatial planning	MRSAC, Vasundhara, IIT Bombay	Cluster Planning
Resilient seed	Mahabeej, SAUs	Seed production and processing
Market Intelligence	MSAMB	Market information
Credit	NABARD, new age commercial banks, cooperative banks, payment banks, post bank pilot	For farm and no-farm credit coordination, Jan Dhan account saturation. Financing of FPCs
Commodity Platform and Value Chain	NAFED, SFAC, MAHAFPC, MSWC, Water Resource Group	Strengthening of value chain
Fruit and Vegetables	National Research Centre for Citrus	technological backstopping for Citrus crops
	National Horticultural Board	Convergence for infrastructure development for high value vegetables & fruit crops
Capacity Building	Yashada, Vanamati, Rameti	For microplanning, induction, and refresher training
Saline land management	CSSRI	For technical assistance for management of saline & sodic soils in project area.
Skill development	Skill development mission, UNDP, MAVIM	For assistance in social inclusion strategy

5 MONITORING AND EVALUATION

The project aims to mainstream climate resilience in the farming community through a bottom up approach. A robust monitoring framework and project management information system (MIS) would capture all the important outputs and outcomes. In addition, it will also provide PMU with real time information of physical progress (outputs) and financial milestone vis-à-vis outcome indicators.

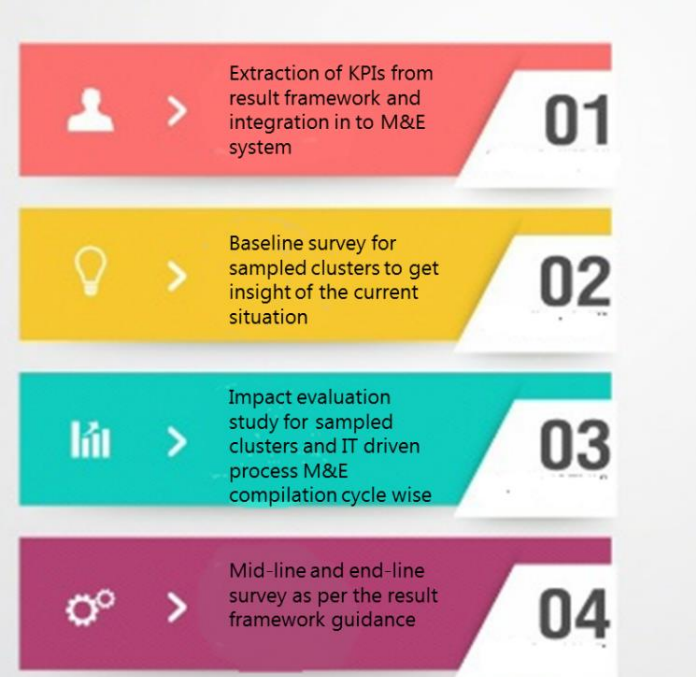


Figure 39 Key sub-components under M&E system

The key building blocks of the M&E system will comprise of: (a) the results framework for the project including Key Performance Indicators (KPIs); (b) a baseline survey for sampled clusters; (c) impact evaluation studies for each Cluster Development Plan (CDP); and (d) midline and endline surveys.

The PMU will have the responsibility for planning and coordinating M&E activities for the entire project. It will have an experienced M&E consultant in the PMU to coordinate with field units and outsourced service provider responsible for M&E. The M&E process in the project will be managed in the following manner:

- A baseline study of relevant indicators shall be conducted by the PMU through an M&E service provider who has adequate experience in climate change adaptation planning and monitoring and impact assessment.
- Line departments associated with the project and strategic partners will report the progress (physical and financial as well the processes agreed under MoU) to PMU every month to be consolidated in each quarter through project MIS.
- The team of technical specialists and finance and procurement specialists in PMU with M&E coordinator will be responsible for the quarterly consolidation and reporting.
- The M&E consultant based within the PMU will concurrently monitor and evaluate the identified indicators.

5.1 RESULT MANAGEMENT FRAMEWORK AND INDICATORS

Considering the scope of the project intervention, it is envisaged that there will be large scale generation of data on a recurring basis during the entire length of the project period. This data is expected to provide support to analysis, research, and mid-course correction of the project and most specifically, concurrent monitoring and evaluation for the entire length of the project period. Positive learnings generated from the project would need to be imbibed and changes will be made in operational procedures, as and when required. There would also be a need of spreading good practices beyond the boundaries of the targeted intervention area to ensure cross-learning. Monitoring and Evaluation System aids in assessing the performance of the project against the pre-determined project indicators. The system, in addition, will help PMU and policy makers in assessing the trends in important parameters arising out of the project. Imaginative use of M&E framework can help in understanding some of the core issues in a public sector development programme like: the functioning of new community level organisations such as Farmers' Interest Groups (FIGs) and their associations in the form of Farmer Producer Organisations (FPOs), governance issues, empowerment of the people, inclusiveness, democratic principles, principles of equity, etc. In view of these, there is an imperative need for a systematic assessment and understanding of the key project indicators at project conceptualisation / starting phase, implementation phase, project completion, and post project completion phase.

M&E system would help in improving the accountability and transparency, meeting timeframes and project milestones, maintaining quality of goods/works/services, and meeting the targets that contribute to Project Development Objective (PDO) level indicators.

For developing a preliminary result framework, a workshop was conducted in Pune. Subsequently two rounds of interactions were undertaken with the World Bank task team and PMU.

5.1.1 Objectives

Keeping the above in view, objectives of the Monitoring, Learning & Evaluation Component include the following.

- To integrate activities, outputs and outcomes
- To understand the effects of development interventions and the progress in comparison to the baseline situation
- To set up a system for baseline data collection, analysis, evaluation and generation of reports and monitoring through measurable indicators during the course of project and also ex-ante and ex-post
- To set up standardized learning and evaluation process for stakeholders and dissemination of learning from the development process for use by the stakeholders as well as wider community.
- To conduct implementation audit, monitoring, tracking, impact and outcome analysis and building the capacity of implementation partners

5.1.2 Approach

To achieve the above mentioned objectives the key approach is to have an internal and external Monitoring and Evaluation system, a participatory monitoring, learning and evaluation process, an MIS and GIS product designed to store, track, analyse and present data and information.

The main focus of the project MLE system will be on

- Results-based management (timely monitoring, analysis and feedback on project activities)
- Evaluation (of project outputs, outcomes and impacts, using appropriate baseline and controls)
- Self/participatory monitoring and learning on a concurrent basis
- Periodic Benefits tracking on sample basis to understand status and changes in various activities and project processes

The system will also be used for

- Planning and Defining Course of Action
- Learning for all Stakeholders
- Empowerment and Capacity Building of the community based institutions

The introduction of the external MLE agency will help the Project Management Unit (PMU) to gain an external perspective of the work being carried out under the project. The MIS and GIS will provide a quick and easy understanding of data and information not just at the project management level but also

at other levels involving direct and indirect stakeholders as it would be web enabled. Additionally, the IT-MIS system will promote transparency and accountability in procurement and financial system. It is planned to design a multi-channel IT system, which would also include a mobile application to collect and aggregate information at various levels.

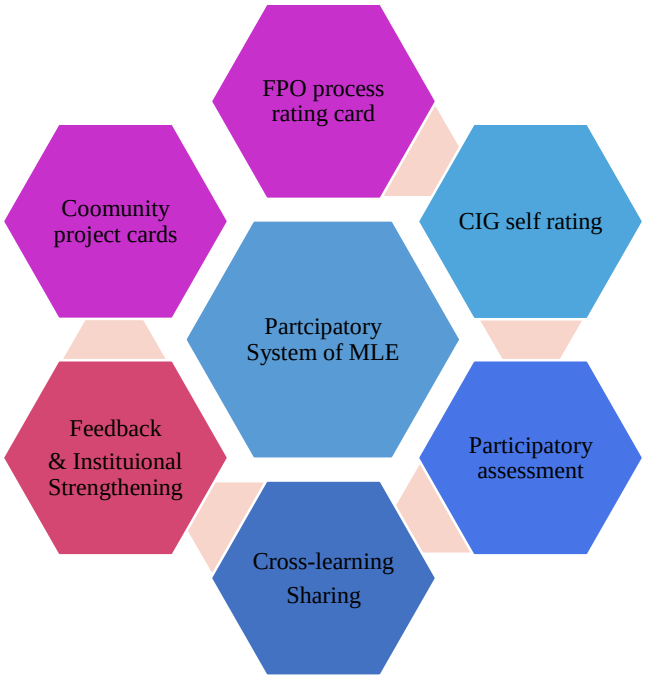


Figure 40 *Participatory M&E system*

5.1.3 Component-wise details of the M&E System

(a) MIS: The MIS will be an important tool for project management. It will cover primarily the input and output monitoring. Standard reports on inputs against the annual action plans will be produced and used by the project teams to assess the progress on inputs. MIS will also be integrated into a portal with various sub-systems, outreach documentations, special orders/guidelines issued from time to time.

(b) **Third Party or External Monitoring:** The external monitoring would be by a third party agency. It is planned that external monitoring of the project would be undertaken at three different times periods of the project i.e. a baseline study would be undertaken at the initial phase

of the project. A midline study would be done after the completion of first phase implementation of the project. Ultimately an end line study would be undertaken at a time when the second phase implementation gets completed and project consolidation phase started.

Baseline Survey: A baseline survey will be undertaken by the project to understand the pre-project situation on key parameters covering socio-economic dimensions as well as the environmental aspects. The baseline survey will not only cover the project areas but also relevant "control sites" which will be used to assess the (incremental) impact of project interventions vis-à-vis generic growth influences over time. The M&E resource person will provide support in finalizing the coverage and sampling strategy of project clusters, villages, farmer interest groups/social groups, and keeping in mind issues of statistical validity and operational feasibility. The baseline survey will be completed and a draft report prepared before the end of the fourth month after effectiveness of the project.

Concurrent Monitoring: Field level implementation would be independently monitored by identified external MLE agency. This will be done by selecting representative clusters within each major area for intensive periodical visits. These reviews will focus on understanding the critical processes as well as the progress of performance indicators. Field visits will also include random verification of the information of progress reports as well as understanding the sequencing of events. The progress reports data prepared by M&E agency with a half yearly cycle (including sample and control areas) will be used to understand overall progress.

Six-monthly progress reports would be prepared covering the following-

- up-to-date physical and financial expenditure data compared to annual and end project targets
- updated Key Performance Indicators (KPI) compared to annual and end-project targets
- successes and problems encountered during the reporting period with suggested remedial actions
- Socio-economic and environmental impacts of the project

Joint reviews of the project will be undertaken on a six monthly basis wherein a number of stakeholders will participate to discuss progress and achievement of results compared to the plan. The joint review teams will use quantitative input / output data from the MIS database, supported by analysis, as well as processing monitoring and other information.

Impact Assessment: Two full-scale impact evaluation studies will be undertaken at midpoint (Mid-Term Assessment Report) and at completion (Final Assessment Report) of project implementation. The studies would include comparative analysis of performance in project areas with those of selected "control sites" in non-project areas.

Mid Term Assessment: The study would include an impact assessment of the project to date, but also focus on implementation processes and recommend adjustments in the project design and/or implementation arrangements to overcome identified bottlenecks. The Assessment Report would be a comprehensive overall impact assessment including quantitative and qualitative assessment of progress against project development objectives. The assessment will include socio-economic and environmental impacts of the project. This will also include GHG assessment for the project.

Final Assessment: The Final Assessment will be taken up towards end of the project. It will focus on understanding the outcomes of project interventions and effect of the same on the target population and compare these with the baseline situation to assess the effectiveness of the project in terms of physical infrastructure development, socio economic changes environmental impacts as well as institutional strengthening (of FPOs/FPCs, CHCs, etc.) Both the impact assessments will update the financial and economic analysis of project returns undertaken at the start of the project. These assessments will also undertake analysis of issues relating to sustainability of project outcomes and impacts. This will also include GHG assessment at the end of the project.

Social and Environmental Management Audits: The M&E agency will undertake two audits during the project period to assess the implementation of Environment and Social Management Framework (ESMF) of the project. These audits will focus on understanding the implementation and outcomes of the social and environmental management measures proposed in various stages of project cycle and also changes that have occurred in the project villages with respect to key concerns identified by the ESMF. Two audits will be undertaken – one in the mid-term of the project and second at the end of project period. IPNM as required under component A2 will be part of this audit.

5.2 RESULT MANAGEMENT FRAMEWORK AND INDICATORS

Proposed indicators at various levels are given below. A table indicating year-wise proposed achievements against each indicator is enclosed at Annexure -X

Table 24 Key Indicators for monitoring

PDO Level Indicators
1. Climate resilient agriculture: Farmers adopting improved agricultural technology
Farmers adopting improved agricultural technologies promoted (CRA) (% targeted farmers) (% share of female)
2. Climate resilient agriculture: Improved water-use efficiency at farm level
Area provided with new/improved irrigation or drainage services (in ha)
3. Climate resilient agriculture: GHG Accounting
Net GHG emissions (in tCO_2eq/ha)
4. Profitability: Annual farm income
Farm income comparator (as ratio with/ without farm income)
5. Direct project beneficiaries
Number of farmers reached with agricultural assets or services (% of female)
Intermediate Outcome Indicators - Component A: Promoting Climate-resilient Agricultural Systems
6. Climate resilient agriculture: improved yield uniformity and stability
Spatial and temporal yield variability for crop A (std. deviation of avg. yield in kg/ha)
Spatial and temporal yield variability for crop B (std. deviation of avg. yield in kg/ha)
7. Climate resilient agriculture: Improved availability of water for agriculture
Surface water storage capacity from new farm ponds (in 1,000 m^3)
8. Climate resilient agriculture: Enhanced soil health at farm level
Area with GAPs for improved management of saline and sodic soils (in ha)

Intermediate Outcome Indicators - Component B: Climate-smart Post-Harvest Management and Value-chain Promotion
9. Seeds supply: Promotion of climate resilient crop varieties
Share of arable land under cultivation with improved seed varieties (in %)
10. Farmer Producer Companies: Strengthened and financially sustainable FPCs
Number of project-supported FPCs with growth in annual profit
Intermediate Outcome Indicators - Component C: Institutional Development, Service Delivery and Knowledge for Climate-resilient Agriculture
11. Research and Extension: Mainstreaming climate-resilience in agricultural research and technical advisory services
Number of updated district SREPs centered around climate resilience (x out of 15)
12. Climate Innovation Centre: Private sector participation
Number of clients (FPCs, SMEs, …) receiving services from the CIC
Cross-cutting Indicators
13. Beneficiary Participation and Civic Engagement
Number of approved participatory mini watershed plans implemented / under implementation

5.3 FEEDBACK AND LEARNING MECHANISM

Apart from the responsibilities assigned to the M&E agency, the PMU will constitute an internal team who will undertake the field visits on a periodic basis. The PMU team will consist of the subject matter specialist. Supplementation of the work of M&E agencies with these internal monitoring teams will facilitate integration and comprehensive review of project activities at the cluster and district level. This review will help the PMU as well as the district level officials in getting a 360^0 feedback which will also create the opportunities for learning of project functionaries.

6 COMPLIANCE PROCEDURES

6.1 FINANCIAL MANAGEMENT FRAMEWORK

6.1.1 Introduction

A sound Financial Management system is critical for the efficient and effective decision-making for the implementation of the project. This includes proper planning, budgeting, accounting, financial reporting, internal control, auditing and physical performance of the project with the aim of managing the project resources properly for achieving the project objectives. Since the financial transactions of PoCRA will be done at different levels viz. the State, PMU, DPMU and the cluster level, it is imperative that the financial management framework captures the details of all transaction at every level and reflects them through proper accounting system.

6.1.2 Objective

The objective of financial management system of PoCRA is to ensure effective management and utilisation of project resources for achieving the project objectives. The primary objective of sound financial management is

- to ensure smooth flow of funds to the different project implementing level/agencies, so that there is no delay in implementation of project activities.
- all financial transactions are as per the rules and procedures and in line with the norms of the project,
- all such transactions are duly accounted for in the prescribed formats and
- all payments due to be made to any service providers are done in efficient, speedy and transparent manner.

Since the implementation is at different levels, it is important that there is a coherence and standardisation in project budgeting, accounting, financial reporting and audit, etc. aligned with the norms of the World Bank. An important objective of this document and the Financial Management Manual is to guide all the project implementing authorities and participants in general and the finance persons in particular, in the financial issues in the project. The financial management of PoCRA aims at producing real time, relevant and reliable financial information that would allow the project executives to plan and implement the project, monitor compliance with agreed procedures, and guide the project progress towards the set objectives.

6.1.3 Fund Flow

The State Government prepares its own budget, which comprises a receipts section and an expenditure section. All incoming receipts of loans and grants through the central government (called additional central assistance) are included in the receipts budget. Estimated expenditure on all externally aided projects (comprising both the share of the state government and the external agencies) is included in the expenditure budget. The flow of funds in this project shall be at GOI level, at State level, at PMU level, at District level and at Sub-divisional level.

6.1.3.1 GOI level

The World Bank shall transfer funds into a Special Account opened for the PoCRA project with the Reserve Bank of India. This account will be operated by the Controller of Aid, Accounts and Audit (CAAA), Department of Economics Affairs (MoF), GoI. The Department of Economic Affairs (DEA) in Ministry of Finance acts as the administrative authority in respect of all fund flows originated under an externally aided program (EAP). Under the proposed arrangements there shall be back to back transfer of funds from GOI to the State Government on receipt of funds from the World Bank.

6.1.3.2 State Level

Government of India will transfer funds to the Loan Account of Government of Maharashtra. Government of Maharashtra will pass on the funds (Bank finance and own contribution) to project implementing agencies through budgetary grants. The Finance Department shall allocate budget to Department of Agriculture.

6.1.3.3 Fund Flow to PMU PoCRA

The Department of Agriculture will further allocate the budgetary grants through BDS to Controlling Officer in PMU. The budget allocation for Project Director PoCRA will specify the funds provided for activities to be carried out at PMU Level. The DDO in the office of PMU will incur expenditure through Pay and Account Office (PAO) for following purposes:

1. Project Management expenses
2. Project Component expenses

6.1.3.4 Fund Flow at District level

6.1.3.4.1 Fund flow to DSAO

The Controlling Officer in PMU will further allocate the budgetary grants through BDS to the District Superintending Agriculture Officer (DSAO). The DDO in the office of DSAO will incur following expenditure through treasury for following purposes:

1. Project Management expenses
2. Project Component expenses

6.1.3.4.2 Fund Flow to ATMA

The funds sanctioned to ATMA shall be released on BDS to DSAO. The DSAO will draw funds from district treasury and deposit in a separate account of Project Director ATMA. The Project Director ATMA will make payments from the funds deposited in his account for following expenditure:

1. Project Management expenses
2. Project Component expenses

6.1.3.5 Fund Flow at Sub-Divisional level

The DSAO will further allocate the budgetary grants through BDS to the Sub-Divisional Agriculture Officer (SDAO). The DDO in the office of SDAO will incur following expenditure through treasury:

1. Project Management expenses
2. Project Component expenses

The actual fund flow for the project & units under the project is depicted in detail in the finance manual.

6.1.3.6 Fund Flow at Cluster/Village Level

The Funds sanctioned to VCRMC for meeting project related expenses shall be released by Sub-Divisional Agriculture Officer through core banking system. The SDAO will draw funds from treasury and deposit in a bank account of VCRMC. The VCRMC will make payments from the funds deposited in bank account against the project expenses.

The funds for project implementation will be channelled to the project implementation agencies as per the flow as envisaged in Figure below.

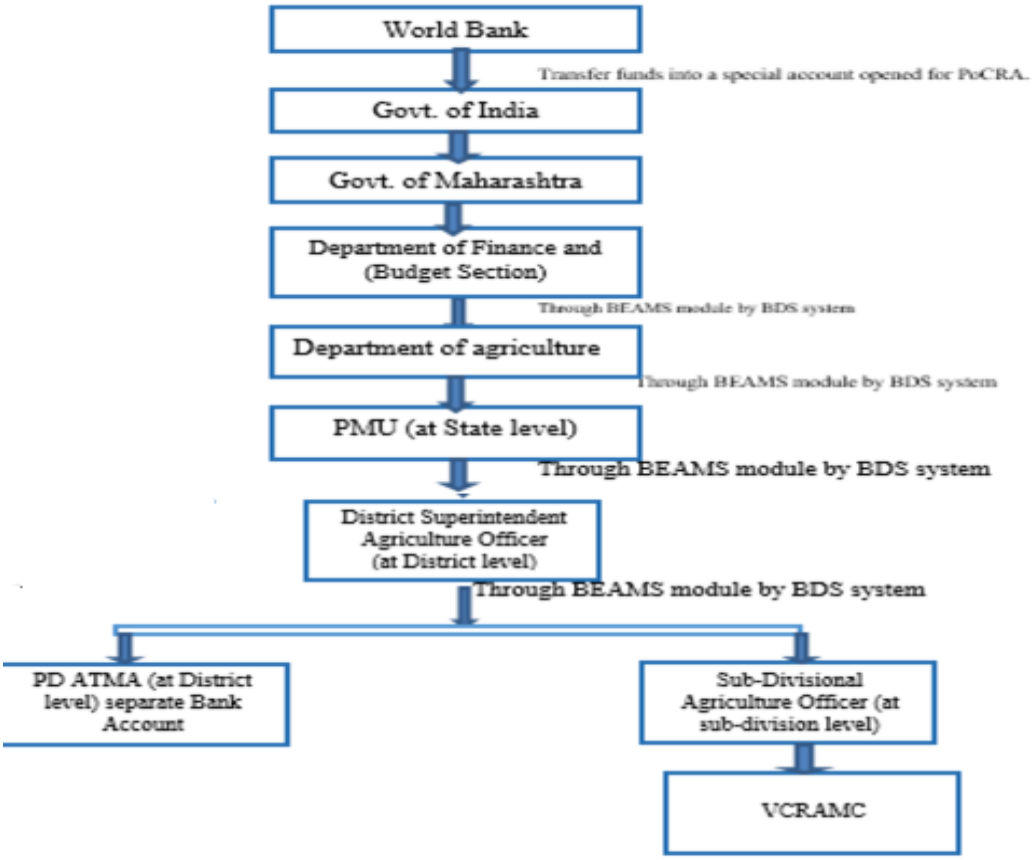


Figure 34 Fund Flow Mechanism

The Annual Work Plan of the project will be approved by the Steering Committee.

Audit: There shall be external & internal audit arrangement for the project. Utilisation Certificates will be verified by the internal audit system.

6.2 DIRECT BENEFIT TRANSFER MECHANISM

6.2.1 Objective

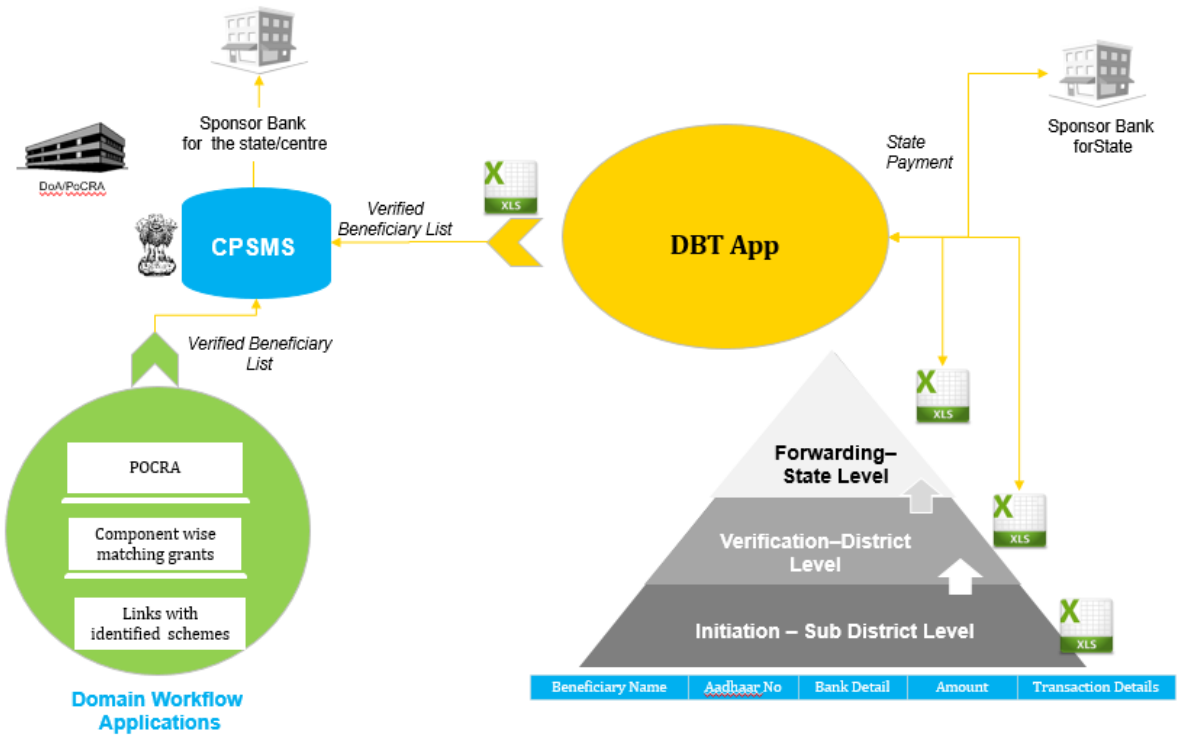
Direct benefit transfer scheme aims to improve the efficiency of various schemes and programmes.

Government of India has advised States to adopt this method for transfer of various subsidies and grants under different schemes. So far DBT has been rolled out for as many as 20 schemes in 43 pilot districts since 2013. The three most promising pilot schemes of DBT are PAHAL (modified DBTL for LPG Subsidy), Public Distribution System (PDS) and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). Maharashtra is one of the pioneers in adopting DBT under various schemes. PoCRA will adopt the same process for transferring project related matching grants to beneficiaries adopting the DBT framework. This will be built into the project MIS.

6.2.2 Approach

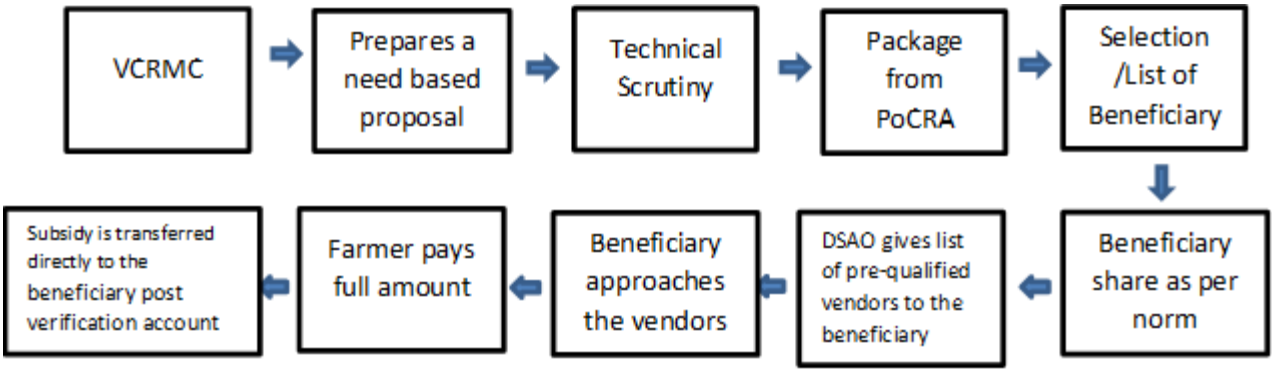
Since the state is following the DBT process, the project will follow this workflow as given below to integrate with the state DBT cell. Project MIS will also have an interface to the DBT App.

Figure 35 DBT workflow integration with PoCRA



6.2.3 Guidelines

The following workflow from VCRMC upwards will be followed for seamless integration:



Step 1: POCRA beneficiary list is generated from clusters as per the project components from the clusters

Step 2: Beneficiary database to be digitised as per the format below by the trained cluster assistant as per the format below:

Step 3 Aadhar ID has to be seeded with the beneficiary database with the support of district NIC unit and to be coordinated by DSAO. Whoever, does not have AADHAR card has to be enrolled by enrolled agency.

Step 4: The bank account of the beneficiary has to be linked with Aadhar. Whoever does not have bank account, new account to be opened with Aadhar along with bank specific KYC.

Step 5: The Department/Ministry/Implementing Agency(PoCRA) will furnish to the Sponsor Bank a list of beneficiaries for issue of Payment Advice, based on the Aadhar number, Scheme reference number and the amounts to be paid.

Step 6: For all those beneficiaries whose Aadhar number have been seeded into the beneficiary database by the Department/Ministry/Implementing Agency (PoCRA) as well as in the bank's Core Banking Solution (CBS), Payment Advice may be made only using Aadhar through the Aadhar Payment Bridge (APB).

Step 7: Payment Advice would be sent to the Sponsor Bank in an electronic form, in XML/ Excel sheet duly authenticated containing a Unique Transaction Reference Number, beneficiary Aadhar number and amount.

Step 8: The bank, after execution of the Payment Advice will send the confirmation, or, in case of failed transactions, the details thereof, to the concerned Department / Ministry/Implementing Agency.

6.3 PROCUREMENT

6.3.1 Procurement Arrangement

The Project shall adhere to World Bank's New Procurement Framework comprised of policies and World Bank Procurement Regulations for IPF Borrowers" (July 2016) ("Procurement Regulations").

Accordingly, a separate Procurement Manual is prepared for the project describing Procurement Strategy, Procurement Approach, methods of procurement and procedures of procurement of Goods, Works, Non Consulting services and consulting services.

This is, by principle, to be a reference document for undertaking any type of procurement as might be necessitated under POCRA. The procurement manual defines the constitution and scope of Procurement Cell under the aegis of PMU, POCRA. It also chalks out about procurement plan and risk mitigation plan.

The rights and obligations of POCRA, Government of Maharashtra (the Borrower) and the providers of Goods, Works, Non-consulting Services and Consulting Services for IPF operations are governed by the relevant request for bids/request for proposals document and by the contracts signed by POCRA and the providers of Goods, Works, Non-consulting Services, and Consulting Services, and not by procurement regulations or the legal agreement. No party other than the parties to the legal agreement shall derive any rights from, or have any claim to financing proceeds.

6.3.2 Procurement Implementation Arrangement

PoCRA is primarily a Community demand driven project. The project proposes to develop and implement 790 mini-watershed plans in 5000 villages.

The planning process for the project starts at the village level and Mini-watershed based planning in clusters of villages in the project area will play an important role.

A village level micro plan will be developed in participatory manner and further consolidated into Cluster plan. The micro plan will cover

1. Cluster Profile- Socio Economic, Geo-physical, Agriculture, Livestock
2. Constraint Analysis- Water status, Soil health, Crop production, Marketing, Social, Gender

3. Causal analysis of crop wise yield gaps
4. Causal analysis of commodity value chain gaps
5. Opportunity mapping- resources & opportunities
6. Scope for major interventions like Water conservation & water harvesting structures, Soil & salinity management, Micro-irrigation, Plantation, Production technology, Mechanization, Agribusiness infrastructure, FPO/ FPC strengthening etc.
7. Training and Skill need analysis of farmers
8. Special needs of small holders, SC/ST farmers and Women farmers.

Based on the outcome of participatory micro plan, a detailed cluster development plan (CDP) will be developed. CDP will be the basic unit of planning for this project and it will give account of activities under Components A, B & C to be implemented in the cluster. Each CDP will be backed up by a technical sanction by the SDAO and Gram Sabha resolutions of the participating villages.

Therefore, the procurement requirements are substantial in quantity but are of small value.

6.3.3 PROCUREMENT CELLS

Procurement Cell at State Level in PMU

Procurement under project will be managed by the State Project Implementation Unit (PMU) headed by the Project Director (POCRA) who is overall in-charge of project implementation, procurement Specialist and adequate staff for overall Procurement Management under the project. The PMU will be the Project Nodal Agency responsible for guiding, monitoring and supervising the overall procurement implementation under the project. It would be responsible for all contracting and procurements in the project at state level and the PMU shall have the oversight and do the needful handholding and training as required for district and sub-district level procurement. It will also do the supervision of contracting and procurements at State/ district/ community level, across all components as advised by technical staff, consultants and specialized agencies contracted for this purpose.

In addition to overall responsibility of procurement activities, the Procurement Cells will:

a. Review the Procurement Plan for procurement to be conducted at the respective level and submit for Bank's clearance through STEP;
b. Ensure that consistent and correct methods of procurement as specified in the Financing Agreement and as per procedures outlined in this Manual are consistently followed by all the procurement entities of the Project;
c. Finalize technical specifications for goods/civil works and terms of references for consulting services respectively and preparation of bid documents;

d. Evaluation of quotations/ bids for goods & works and proposals for consultancies followed by preparation of evaluation reports;
e. Develop and maintain Procurement Management Information System through banks STEP portal and project MIS of all procurements done in the Project;
f. Maintain records of all procurement related complaints received and their disposal;
g. Collect, collate all procurement related information for review by Bank and its auditors;
h. Ensure that all procurement related records and documents required by the Bank Procurement Regulations are properly maintained, kept by the various procurement entities; with a system to retrieve the required document within a reasonable time.
i. Seek Bank No Objection for all Prior Review cases and wherever required as per the Bank's regulations or Procurement Plan.

PIU Level Procurement Cells at Regional / District /Sub-Division Level:

At the Regional/District/Sub-division Level the procurements under project will be managed by the PIUs led by the Regional Joint Directors of Agriculture / District Superintending Agricultural Officers/Sub-divisional Agricultural Officer of respective Region / District, who are overall in-charge of implementation of project activities under POCRA within the Region /District/Sub-division. The Procurement Cells under PIUs will be created at District level supported by designated Supervising Officers at the Regional / District /Sub-division level and designated procurement/finance management support staff.

6.3.4 PROCUREMENT PLAN

The PMU with involvement of District PIUs will prepare a procurement plan based on the projected activities in the Project Implementation Plan. The PMU will be the nodal agency with the responsibility of preparing the procurement plan and getting it cleared from Bank through the online STEP system. The Procurement Plan will include description of goods, works and non-consultant and consultant services to be procured (year-wise over the implementation period) along with their values which are consistent with technically and administratively approved cost estimates and milestones for all procurement activities. List of goods, works and services to be procured under the project year-wise, with estimated cost and method of procurement have been mentioned in the format specified by the Bank.

During preparation of the procurement plans, packaging shall be done appropriately indicating realistic dates. Items of similar nature, which can be supplied by same set of firms, should be packaged together

to achieve economies of scale. Aggregate value of total package will form the basis for determining the procurement method as well as the review requirement of the World Bank. For procurement of goods, works, equipment etc. suitable package shall be framed which shall be determined by below noted factors, namely

- Time limits, Geographical location (dispersal of works)

Following points should be borne while preparing the Procurement plan

(a) All procurement shall follow the agreed processes and procedures as specified in Bank Regulations and is elaborated in this manual.

(b) Bidding documents as agreed with Bank shall be used.

(c) Procurement plan shall be based on activities in the agreed cost tables. All procurements to be carried out on the basis of core principles i.e. Economy, Efficiency, transparency.

(d) The prepared 18 month plan shall be revised/updated at least once in 12 months and sent to bank for prior clearance through STEP. After the clearance the Procurement Plan will be published on the project website and Bank website.

6.3.5 STEP

STEP is a web-based system which is to be used for submission and publication of procurement plan, notices, documents etc. by the IFP Borrowers of the Bank and the Project Officials shall use STEP initially to create and later to revise Procurement Plans under Investment Project Financing (IPF), and to monitor performance, manage and store related documentation for all steps in a procurement activity. This will include both activities that are prior reviewed by the Bank and contracts subject to post review. STEP portal enables Bank Team to view activities at several levels of aggregation, including activity, project, and portfolio levels.

The major functions of STEP are procurement notices, procurement planning, tracking, correspondence system, checking supplier eligibility.

6.3.6 METHODS OF PROCUREMENT

The following are the methods of procurement of goods and works to be adopted in the Project:

- Request For Proposal

- Request For Bids
- Request For Quotations
- Direct Selection
- Framework Agreement
- Force Account

Following are the approved selection methods for the consulting services:

- Quality Cost Based Selection
- Fixed Budget Based Selection
- Least Cost Based Selection
- Quality Based Selection
- Consultants Qualification Based Selection
- Direct Selection

Procurement Manual provides detailed description of each methods of procurement mentioned above.

6.3.7 COMMUNITY PROCUREMENT

All the village level civil works are expected to be done by the village level community itself through VCRMC. Also Farmer Producer Group/Organization engaged in village/cluster level agri-business/agri-entrepreneurship are expected to procure necessary goods and works for establishing agri-enterprises by themselves.

Community participation in the works/ activities from planning to post implementation can help in smooth operation and maintenance and successful implementation of the projects.

The procurement Manual provides simple step by step instructions to the VCRMC on how they will go about procuring the various goods, works and services required for implementation of the project and includes simple forms and formats to be used during procurement procedures applicable in the project. This is intended to enhance the capacity of the VCRMC to undertake procurement to meet project needs.

6.4 ENVIRONMENT AND SOCIAL MANAGEMENT FRAMEWORK (ESMF)

6.4.1 Environmental management framework

The Environment Management Framework (EMF) is prepared taking into account the key concerns of different stakeholders and their suggestions on different project components. The framework also encompasses learning from various research studies and implementations at national and international level, including similar interventions in other places. While designing the framework, the project has taken a holistic view to deal with the concerns and ensures the outcomes of the project are realized in coherence to the environment. The project is intended to improve the local environmental conditions and ecosystem services. Focus on promotion of climate resilient agricultural practices will improve the natural resource management options in a more scientific manner along with conservation measures.

Following the classification of the World Bank on the project category, it can be concluded, after environmental screening, that the project falls in to "Category B", i.e., the project is likely to have moderate environmental impacts. The EMP reflects in detail about different mitigation measures that the project will take to improve the current environmental conditions that are most likely to benefit the community in general and farmers in particular.

Environmental Management Framework elaborated the potential negative and positive impacts of project activities on environment. This assessment based on the secondary data and stakeholder consultations. The summary has been given below. The details are available in the environmental assessment report separately.

Table 25 ***Degree of Environmental Impact of Selected Project Activities***

Broad Project Activities	**Impact Category**	**Implications of EMF**
Mini Watershed Planning	No Impact	As per Guidelines / Finalized Framework
Promotion of FPC		
Farmer Field School	Minimal to Low	Adoption of Recommended Practices / Best Practices / Technical Feasibility Dimensions
Sub-Surface Drainage in Saline-Sodic Land		
Farm Pond		
Construction of Water Harvesting Structures		
Drainage Line Treatment		
Micro Irrigation System		
1. Support to FIG/FPO/FPCs for product aggregation, handling, transformation & marketing	Low to Moderate	Case Specific Impact Assessment and Preparation of Site Specific Plan for Mitigation of Negative Impacts, if any.
2. Seed Production and Processing infrastructure		

Broadly it has been assessed that project will not have any major negative environmental impacts. Rather, it will be helpful for the environmental restoration. However, some of the anticipated impacts are listed below:

Table 26 Environmental Impact

Particulars of Components & Subcomponents	Environmental Impact (Yes / No)	Potential Environmental Impact
Promoting Climate-resilient Agricultural Systems		
Participatory development of mini watershed plans	No	
Climate smart agriculture and resilient farming systems		
Demonstration of climate resilient agronomic practices: Farmers Field Schools	No	
Enhancement in Carbon sequestration		
Afforestation in upper reaches	Yes (+ve Impact)	Check on topsoil erosion Check on siltation of water courses and waterbodies Check on speed of runoff water Improvement in infiltration of the water into the ground Improvement in groundwater level Improvement in carbon sequestration (depending on the species being planted) Improvement in biomass availability
Plantation of horticulture plants	Yes (+ve Impact)	Improved availability of biomass and organic content in the long run
Conservation agriculture	Yes (+ve Impact)	Improvement in soil moisture Improvement in soil carbon Improvement in benevolent soil microbes and fauna Lowering in consumption of synthetic fertilizers and pesticides

Improvement of saline and sodic soils		
Farm Field Schools (FFS)-Saline soils	No	
Subsurface drainage	Yes (+ve Impact)	Decrease in soil salinity
Application of soil amendments	Yes (+ve Impact)	Decrease in soil salinity Increase in application synthetic fertilizers
Catchment / Land Treatment		
Catchment treatment; Continuous Contour trenches	Yes (+ve Impact)	Decrease in topsoil erosion Decrease in speed of volume of runoff water Increase in water infiltration and thus volume of groundwater
Drainage line treatment		
Construction of Earthen Nala Bunds	Yes (+ve Impact)	Decrease in runoff water Increase in water infiltration and thus volume of groundwater Increase in volume of surface water Decrease in siltation of watercourses
Construction of Cement Nala Bunds	Yes (+ve Impact)	Decrease in runoff water Increase in water infiltration and thus volume of groundwater Increase in volume of surface water Decrease in siltation of watercourses
Improvement of water courses; Deepening of nalas	Yes (+ve Impact)	Increase in volume of surface water available
Construction of new water harvesting structures		
Construction of community farm ponds	Yes (Overall +ve Impact)	Increase in use of non-biodegradable material (if plastic sheet lining is used) Increase in volume of surface water

		Increase in water infiltration and thus volume of groundwater available
Construction of individual farm ponds	Yes (Overall +ve Impact)	Increase in use of non-biodegradable material (if plastic sheet lining is used) Increase in volume of surface water Increase in water infiltration and thus volume of groundwater available
Rejuvenation or desilting of existing water harvesting structures	Yes (+ve Impact)	Increase in volume of surface water Increase in water infiltration and thus volume of groundwater available
Construction of groundwater recharge structures; Recharging of open dug wells/ bore wells	Yes (+ve Impact)	Increase in water infiltration in the soil Increase in volume of groundwater
On-farm water security; Compartment bunding	Yes (+ve Impact)	Decrease in soil erosion
Micro irrigation systems		
Installation of drip irrigation systems	Yes (+ve Impact)	Increase in energy consumption (due to pumping of water) Decrease in water consumption Decrease in water wastage Improved water use efficiency / water productivity
Installation of sprinkler irrigation systems	Yes (+ve Impact)	Increase in energy consumption (due to pumping of water) Decrease in water consumption Decrease in water wastage
Strengthening Emerging Value-chains for Climate-resilient Commodities		
Support to FPCs for product aggregation, handling, transformation and marketing.	Yes (+ve impact)	Aggregation and bulk handling will reduce post-harvest wastage

The project by virtue of PDO and by design is a positive mitigation project and there is no major anticipated negative impact. However, if any project intervention if not implemented properly there may have some temporary and localised adverse impacts for which the mitigations measures are listed below:

Table 27 Expected Negative Impacts and Mitigation Measures

Project Activities	Anticipated Impacts	Potential Mitigation Measures
A2. On-farm climate-resilient technologies and agronomic practices		
A2.1 Demonstration of Climate Smart Agriculture	· Inappropriate use of fertilizer · Inappropriate use of fertilizer	· Encourage use of bio-fertilizers; bio-compost, vermicomposting, green manure, microbial inoculants, etc. · Adoption of INM / IPM to reduce chances of soil contamination and water pollution. · Promotion of bio-pesticides · Prohibition of banned pesticides · Plantation of pest controlling plants (in feasible / suitable cases). · Promotion of suitable cultural practices like deep ploughing, seed treatment, mixed cropping etc.
Catchment treatment	all efforts made under PoCRA aims at maintaining standard hydrological flow around drainage line in addition conjunctive use around catchment	This will be judiciously monitored
A2.4 Protected Cultivation Shed net house (GI/MS pipes);	By default protected cultivation should reduce adverse pest attack, however, if there is any incidence	· - Remove debris materials that might harbour or provide habitat

Project Activities	Anticipated Impacts	Potential Mitigation Measures
Shed net house – Bamboo; Poly house (open vent)	of pest / insect due to conducive environment may be higher	for pest multiplication on the site of the greenhouses · Avoid fumigation of soils by chemicals wherever possible · Sterilize soil by Soil solarisation · Maintenance / repair of faulty greenhouse structures which help in the entry of insect-pests · Always use insect-proof net screens · Shed Net / Poly House Structure can have double entry gates so as to minimize the risk of pest entry and staying back (if economically feasible) · Preparation of bed by building up rich flora of biological control agents for the management of soil borne pathogens especially nematodes. · Pest Monitoring measures using sticky traps · Introducing cultural control methods like resistant seed varieties, · Integrated Pest Management (IPM) strategies · Applying pesticides only when pest populations are large enough to cause economic losses (Above ETL)

Project Activities	Anticipated Impacts	Potential Mitigation Measures
		· Developing understanding of farmers on the impact of their activities on environment
Component B. Climate Smart Post-Harvest Management and Value Chain Promotion		
Support to FIG/FPO/FPCs for product aggregation, handling, transformation & marketing	General construction related safeguards	Standard EMP checklist developed as part of the project will meet the compliance requirement
B3. Improving the Performance of the Seed Supply Chain B3.2 Development of seed hub- infrastructure support	General construction related safeguards	Standard EMP checklist developed as part of the project will meet the compliance requirement

6.4.2 Social Management Framework

The stakeholder consultation has shown that the socio-economic diversity prevalent in the area and indicates the preponderance of people from different castes, gender, ethnicity and diverse livelihood practices with varying economic status. Such diversity necessitates specific interventions to improve the socio-economic status of the users especially for the landless, marginal land holders and the Scheduled Tribe. This also calls for taking into consideration specific legal and constitutional provisions while the project is being implemented and complying with the World Bank's (WB) relevant social safeguard policies related to indigenous people. Based on the activities identified the land acquisition is not foreseen and relevant safeguard policy may not require to be triggered.

The Social Management Framework (SMF) is also prepared taking into account the key concerns of different stakeholders and their suggestions on different project components.

6.4.2.1 Social Management Plan

While designing the framework, the project has taken a holistic view to deal with the concerns and ensure the outcomes of the project is realized in order to benefit the small holders and marginalized sections of the project locations.

Table 28 Social Management Plan

Activity	Sub-Activity	Key Challenges	Proposed Project Measures	Project Stage		Responsibility		
				Planning	Implementation	Primary	Secondary	Tertiary
COM A-A1								
Participatory Development of Mini Watershed Plans	Preparation of Cluster Level Plans	Identification of needs of MF, SF, and farmers belonging to ST and marginalized community and its inclusion in the plan	Assessment of needs by holding categories, social categories with special focus on women farmers. Planning by social and holding categories, taking the assessment findings into account, for each component of the project. Adoption of inclusion strategy in each activity during planning, based on the scope and feasibility.	√		External Agency Engaged for Facilitating Plan Preparation SDAO	DSAO	PMU
COM A-A2								
Demonstration of climate resilient agronomic practices(CRAP) dry land farming	Farm Field School (FFS) for Technology Dissemination	Demonstration in inaccessible tribal areas / scheduled areas; Coverage of less holding farmers, including women farmers and farmers from ST/SC communities. Adoption / Learning Replication	Coverage of inaccessible pockets / scheduled areas under demonstration / FFS; Coverage of tribal farmers, women farmers and other farmers having less land holding (based on their interest); Hand holding support and on-farm guidance to farmers.		√	SDAO VCRMC Cluster Committee Technical Agency (Association Based)	DSAO	PMU
Enhancement in Carbon Sequestration	Agroforestry- farm periphery/ small block	Coverage of available culturable waste and other lands of small holders, farmers from ST / SC community, women farmers and farmers having land under FRA	Assessment of area available for plantation of fruit trees, taking in to account farmers having less holding; Rejuvenation of degraded land through plantation in areas falling under scheduled area;		√	SDAO VCRMC Cluster Committee	DSAO	PMU

			Promotion / replication of BADI concept in feasible pockets, including scheduled areas; Promotion of agriculture-horticulture mixed model / integrated farming system in feasible cases where holding size is less; Local institutional / community arrangement for benefit sharing, wherever needed.					
Improvement of saline and sodic lands	Demonstration of Technology for Salinity Management Farm Field School (FFS) Farm Pond with Inlet & Outlet and Grass Cultivation; Water Pumps; Promotion of Sprinkler	Coverage of Small & Marginal Farmers, Women Farmers and farmers from ST/SC Community under different reclamation measures Association of Low holding category farmers in FFS; Access to Farm Ponds, Pumps and Sprinklers by Marginalised Sections;	Inclusion of SF/MF/WF and farmers from ST/SC in land treatment measures, capacity building and demonstrations; Coverage of SF / MF / WF and farmers from ST/SC community in FFS, based on their interest and locational feasibility; Capacity building (training, hand holding etc.) of farmers on technological options on saline sodic land management; Coverage of small holders, women farmers and farmers from ST/SC community as per the local planning outcome and Government norm.		√	SDAO VCRMC Cluster Committee	DSAO	PMU
Protected Cultivation	Shed Net House; Poly House; Poly Tunnels Planting Material	Accessibility of marginal and small holders to shed net, including tribal and women farmers	Coverage of small patch of land, as per technical specification, and designing the shed net / poly house accordingly for marginal and small land holders. Coverage of women farmers and households from ST/SC community, as per the village / cluster level plans, by which they can access the benefit; Provision of matching grant for marginal farmer, small farmers, women farmers		√	SDAO VCRMC Cluster Committee	DSAO	PMU

			and tribal farmers, adhering to the prescribed norms; Facilitate credit accessibility of marginal and small farmers, women farmers and farmers from ST/SC community through appropriate institutional arrangement and mechanism for greater access of benefit.					
Integrated Farming Systems	Promotion of Small Ruminants; Backyard Poultry; Sericulture; Apiculture; Inland fishery; Other agro-based Livelihood	Appropriate targeting and coverage; Economic feasibility of livelihood support activities and its sustenance	Identification of beneficiary households through participatory planning process (village / cluster level planning); Selection of target households and its finalization in the Gram Sabha, including in scheduled areas; Convergence with other departments, for services and wider coverage; Capacity building of the beneficiaries on management of specific livelihood intervention.		√	SDAO VCRMC Farmer Friend Line Dept. / Other Institutions / Societies of Govt.	DSAO	PMU
Soil Health Improvement	Vermi-compost and NADEP Units; Organic input production unit	Continuity of practice by farmers and its sustained adoption	Coverage of use of vermi-compost / NADEP unit in demonstrations (FFS) for farmer's learning and adoption; Capacity building of farmers on organic farming systems;		√	SDAO VCRMC Farmer Friend	DSAO	PMU
COM A-A3								
Catchment Treatment; Drainage Line Treatment	Continuous Contour trenches Model1 & Model 2; Construction of Loose Bolder Structures;	Coverage of land given to tribal farmers under FRA (if such land required for treatment);	Identification of treatment area during planning; Coverage of forest lands, allotted under FRA to tribal farmers / other forest dwellers under treatment;		√	SDAO VCRMC Cluster Committee	DSAO	PMU

	Earthen Nala Bunds; Cement Nala Bunds		In suitable cases, coverage of forest land given under FRA under community forest right under soil and water conservation and land treatment measures,					
Construction of new water harvesting structures	Construction of Community Farm ponds; Individual Farm Ponds (with/without lining); Open Dug Well	Less involvement of SF / MF / WF and farmers from ST/SC Communities due to poor investment capacity / non-availability of land for farm pond.	Inclusion of SF/MF/WF, based on their interest, including farmers from ST/SC communities, as identified in the village / cluster planning; Facilitate credit accessibility through appropriate institutional arrangement and mechanism; Provision of matching grant for marginal and small farmers in general and Farmers from ST/SC and women farmers in particular. In cases of SF / MF, where farm pond is not feasible due to less availability of land, construction of dug well can be taken up, as identified in the village / cluster level plan.		√	SDAO ATMA VCRMC Cluster Committee	DSAO	PMU
Micro irrigation systems	Drip and Sprinkler irrigation systems	Involvement of SF / MF / WF and farmers of low holding categories from ST / SC communities	Focusing on small patch of lands of farmers having less land holding (MF / SM), based on economic feasibility. Inclusion of SF/MF/WF, and farmers from ST/SC community as per the village / cluster level plan; Facilitate credit accessibility through appropriate institutional arrangement (like VCRMC) and mechanism; Matching grant support to marginal farmer, small farmers, women farmers and tribal farmers, adhering to the prescribed norms;		√	SDAO ATMA VCRMC Cluster Committee	DSAO	PMU

			Convergence with existing schemes for wider coverage; Facilitate convergence with schemes of Tribal Development Dept. for improved coverage of tribal farmers under micro irrigation.					
Protective Irrigation	Water pumps & carrying pipes	Coverage of SF / MF / WF and farmers of low holding categories from ST / SC communities	Inclusion of SF/MF/WF, and farmers from ST/SC community as per the local planning (village / cluster level plans); Facilitate credit accessibility through appropriate institutional arrangement (like VCRMC) and mechanism; Matching grant support (as per the norm) for marginal and small farmers in general and Farmers from ST/SC and women farmers in particular; Facilitate convergence with existing schemes for wider coverage; Facilitate convergence with schemes of Tribal Development Dept. for improved coverage of tribal farmers.		√	SDAO ATMA VCRMC Cluster Committee	DSAO	PMU
COMP B								
SUB. COM B.1								
Support to existing FPCs	Preparation of development plan of FIG/FPO/FPC Strengthening of existing FIG/FPO/ FPCs Developing market linkages	Inaccessible / poorly accessible pockets and Tribal Habitations may not have FPCs; Market linkage of agricultural commodities in interior pockets	Assessment of existing FPCs and identification of areas of improvement; Preparing detail plan and strategy for strengthening FPCs in inaccessible / poorly accessible pockets and scheduled areas; Capacity building of FPCs, based on identified areas of improvement through training / exposure / guidance / hand holding support;		√	Resource Agency SDAO FPC	DSAO	PMU

			Market assessment in general and in interior pockets in particular for different commodities (including value chain assessment) and developing market linkage strategy;					
Establishment of Custom Hiring Centres	Custom Hiring Centres	Availability of land for establishing CHC; Establishment of CHCs in less accessible / scheduled areas; Accessibility of MF, SF, tribal farming families and women farmers to the farm machinery;	Land available with FPCs will be utilized, after due scrutiny and verification; In scheduled areas, decision of Gram Sabha will be followed. Establishment of CHCs in such areas, based on the identified requirement during planning process and after due verification of the feasibility. Devising guiding principles / procedures of effective operation of CHCs for equal opportunity accessibility;		√	SDAO ATMA FPC	DSAO	PMU
		Women friendly farm machinery / equipment	Women farmer friendly farm equipment in the CHCs (developed by ICAR institution/s)		√	SDAO ATMA FPC	DSAO	PMU
SUB. COM B.2								
Support to FIG/FPO/FPCs for product aggregation, handling, transformation & marketing	Support to business plans appraised by financial institutions/ commercial banks	Inaccessible / poorly accessible pockets and tribal habitations may not have FPCs; Poor operating capital base of FPCs restraining from taking up business ventures.	Involvement / engagement of nearby FPCs for product aggregation and marketing in areas where no FPC is there and scale of production is having potential for remunerative market linkage; Assessment of capacity and functioning of FPCs and preparing capacity building plan on identified aspects; Strengthening FPCs in inaccessible / poorly accessible pockets and scheduled areas through training, hand holding and exposure;		√	SDAO FPC	DSAO	PMU

			Technical support to FPCs for the preparation of bankable business plan.					
SUB. COM B.3								
Production of foundation & certified seed of climate resilient varieties	Production of Climate Resilient Seed Varieties	Involvement of SF / MF in Seed multiplication; Inclusion of interior tribal areas / villages due to conveyance / monitoring issues;	Identification of farmers of different social and land holding categories during village / cluster planning process; Initiative to involve SF / MF through consultation / discussion and with intermediation of VCRMC; FPOs / FPCs of the locality to be oriented accordingly if they are involved in the process; Devising strategies for areas where transaction cost of seed supply expected to be higher due to poor conveyance facility and localized replication would be beneficial for the farmers; Coverage of tribal habitations in scheduled areas for seed multiplication in view of the operational feasibility;		√	MAHABEEJ / Private Seed Companies SDAO FPC SAU	DSAO	PMU
Development of seed hub-infrastructure support	Seed Processing Equipment; Seed processing shed/ drying yard; Seed storage/ godown; Training of seed producer farmers; Strengthening of seed quality testing facility.	Establishment of Seed Processing and Storage Infrastructure in interior / scheduled areas; Availability of land for establishment of infrastructure	Identification of areas where transaction cost of seed supply is be higher due to poor conveyance facility; Assessment of feasibility of establishing such infrastructure in interior / scheduled areas; Coverage of less accessible clusters / interior clusters to have seed processing and storage infrastructure, based on the identified needs in the planning process; Training / exposure of FPCs for management of infrastructural facilities		√	MAHABEEJ / Private Seed Companies SDAO FPC SAU	DSAO	PMU

			Use of land available with FPCs for infrastructure					
COM C								
Capacity Building	TNA, Training Design and Module Preparation; Training of Project Officials / experts, Farmer's Friend, VCRMC, Farmers Exposure Visits	Participation of women farmers and farmers from ST/SC community, especially in heterogeneous community; Identification of training needs by farmer category and designing the module to meet their requirements; Uniform capacity building plan may not help to all the primary stakeholders at the community level	Capacity building need assessment of women farmers and farmers from ST/SC community along with other farmers in general; Designing training module keeping the needs of farmers of different holding categories, their educational level etc.; Ensuring their involvement in capacity building measures like training / exposure as per the identified needs; Organising trainings at local level to ensure participation of women farmers; In case of requirement, organising exclusive training of women farmers, based on their number, at cluster level; Preparing training session plan taking women engagement in to account and based on their identified needs;		√	SDAO ATMA External Agency Engaged for Capacity Building	DSAO	PMU

6.4.2.2 Tribal Peoples Planning Framework (TPPF)

The project will have exclusive strategic focus for greater inclusion and proportionate representation of tribal in non-scheduled areas and their active association in project interventions in scheduled / tribal dominated areas. The strategy proposed for inclusion of tribal communities is discussed below.

Table 29 Project Approach and Strategy for Tribal Development

Project Stages	**Project Approach and Strategy**	**Expected Outcome**
Preparatory Phase	Discussion with tribal families / farmers of the project area in general and exclusively in scheduled areas on project component and activities; Identifying key issues in the way of their greater involvement and benefitting from the project intervention; Preparing a priority list of actions, based on the identified issues and interest of tribal farmers / families of the project area. Preparing cluster specific plan of action for better inclusion of tribal in different activities that are feasible for their greater participation.	Key intervention areas are identified and guidelines prepared for improved participation of tribal in general and tribal farmers, in particular. List of actions finalized for implementation to ensure greater involvement and participation of tribal by activities
Implementation Phase	Implementing priority actions that are finalized during preparatory phase; Initiatives for convergence with tribal development schemes of Government at the village / cluster level; Priority action in inaccessible scheduled areas (project clusters) for establishment of infrastructures that are planned under the project, based on feasibility; Equal opportunity to dispersed tribal (living in a mixed community) for accessing project benefits, as per the plan for beneficiary coverage; Ensuring greater participation of tribal community in activities / sub-activities taken up under each component / sub-components of the project; Taking measures, adhering to the scope of the project, to build the capacity of tribal farmers in agricultural technologies, marketing, institution management etc., as per the project requirements; Taking measures that are legally binding under PESA; Monitoring of actions taken under the project for inclusion of tribal by project component / sub-components and initiating corrective measures accordingly; Documenting success and learning from different initiatives undertaken by the project that ensures greater participation of tribal.	Participation of tribal / tribal farmers in different activities implemented under the project; Project supported infrastructure and services in less accessible scheduled areas / tribal dominated areas; Inclusion of tribes and their active involvement ensured with better operational and management capabilities; Adoption of improved farming technologies by the tribal farmers and hence better yield from the available land.

Table 30 Tribal People's Planning Framework

Activity	Sub-Activity	Key Challenges	Project Approach and Strategy
Improvement of Seed Supply Chain	Mapping Farmer's Preferences / Needs	Capturing needs of tribal farmers in a mixed population where ST concentration is less	Initiative to identify needs of tribal farmers by land holding pattern. Listing seed preference by tribal / non-tribal category
	Identification of seed farmer group/FPOs or FPCs	Involvement of tribal farmers in multiplication & Replacement of seeds	Giving priority to the interest of tribal, involving them in seed multiplication activity taking in to account the land holding pattern. Existing FPOs / FPCs in the scheduled area to be oriented accordingly. Scheduled areas where no FPO/FPC of tribal is there, project will take promotion measures
	Identification of Seed Hub/s	Interior tribal villages near forest may be covered inadequately due to inaccessibility	Project will give equal emphasis on interior tribal areas / villages near forest for development of seed hubs, involving tribal farmers.
	Engagement of FPCs for Seed Multiplication, Processing and Marketing	Tribal habitations may not have FPCs which may restrict their association in seed multiplication process	Interior forest areas and tribal areas where no farmer's association / FPCs are there, project will take special measures to promote FPCs in such areas involving tribal
	Seed Processing and Storage Infrastructure	Establishing seed processing and storage structures in less accessible forest areas, tribal areas.	Project will give due emphasis to clusters near to forest areas / interior clusters to have seed storage and processing structures.
Promotion of farm mechanization	Establishment of Custom Hiring Centre (CHC)	Less demand for mechanization may shift focus to other areas for establishing CHC. In case of unavailability of land for CHC in tribal area; focus may shift.	Equal focus on scheduled areas for the establishment of CHCs. No involuntary land acquisition in tribal areas for establishing CHC. Available Govt. Land or CPR will be utilized or taking land on lease basis.

Promotion of Protected Cultivation	Shed-net / Poly House	Accessibility of STs to shed net / poly house, and their inclusion in a community with less STs	Emphasis for coverage of tribal farmers through awareness and motivational inputs. Provision of subsidy to tribal farmers as per Govt. norms. Proportionate inclusion of STs during selection & enrolment
Saline land Reclamation	FLDs of Climate resilient technologies, gypsum, BBF, Green manuring, contour cultivation & trainings	Coverage of STs under FLDs for learning under demonstration (in case individual plot specific demonstration)	Operational guidelines for inclusion of tribal families under FLDs Measures for FLDs in tribal dominated areas. Proportionate coverage of tribal families under FLD, in case individual FLDs.
	Shallow tube wells in river course (specific for saline area)	Involvement of STs and their enrolment in availing shallow tube well	Operational guidelines for inclusion of tribal families on proportionate basis, based on their interest
Creation of water source, groundwater recharge along with water lifting and emitting systems	Farm ponds	Involvement of STs and their enrolment in availing farm ponds.	Proportionate coverage of tribal families under individual farm pond based on their interest.
	Well and bore well, artificial recharging	Involvement of STs in availing artificial recharging facility	Proportionate coverage of tribal families having recharge wells based on their interest.
Water use Efficiency improvement	Promotion of Drip and Sprinkler irrigation system	Coverage of STs	Proportionate coverage of tribal families under drip / sprinkler irrigation system. Demonstration and training on use of irrigation system

Post-harvest infrastructure creation	Establishment of aggregation centre with Grading and packing facility and processing units	Establishment of units in Interior / inaccessible tribal villages.	Required measures for establishment of centre in scheduled areas, tribal locations. Financial allocation for establishing processing units in inaccessible tribal pockets, based on business feasibility.
	Establishment of Godowns /warehouse	Establishment of units in Interior / inaccessible tribal villages.	Construction of required no. of warehouse in inaccessible tribal locations, taking in to account the quantum of production
Strengthening of Commodity specific FPOs / FPC	Promotion of FPC	Inaccessible / poorly accessible pockets may not have FPOs / FPCs	Project will take exclusive measure to promote FPCs in inaccessible tribal areas Capacity building of tribal members on FPC management
Promotion of Community / Cluster Institutions	Formation of Climate resilient committee (Cluster)	Participation / membership of tribal members in the committee	Proportionate representation of tribal members in the Climate Resilient Cluster Committees

6.4.2.3 Gender Action Plan (GAP)

The project will take feasible and implementable actions, taking the duration of the project in to account, that will support greater participation of women in different activities of the project. The project will focus on women specific issues across different project components that would help women for a better participation and decision making along with benefitting from the project interventions. The project approach, therefore, would be more inclusive in nature and having positive bias towards women. The project will use the operational definition of women farmers (Operational Definition refers to women farmer holding land and having substantial engagement in farming and related decision making) in its intervention plan by which they will not be left out. In all the project activities, across the components, such strategies will be taken that help the women to participate and access project benefits. Along with this, project will take measures to improve schematic access of women farmers to existing schemes of the Government that are relevant for them. The project level gender development strategy is presented below.

Table 31 Approach and Strategy for Greater Balance and Participation of Women in the Project

Project Stages	**Project Approach and Strategy**	**Expected Outcome**
Preparatory Phase	Discussion with women of the project area in general with exclusive emphasis on women farmers by project component and activities. Focus group discussion (FGD) with women during the microplanning exercise. Preparing a priority list of actions, based on the identified issues and interest of women. Preparing cluster specific plan of action for better inclusion of women in different activities that are feasible for their greater participation.	Key intervention areas are identified and guiding note prepared for improved participation of women in general and women farmers, in particular. List of actions finalized for implementation to ensure greater participation of women Targets set for participation of women in various activities
Implementation Phase	Implementing priority actions that are finalized during preparatory phase; Ensuring greater participation of women / farming women in activities / sub-activities taken up under each component / sub-components of the project; Taking measures to build the capacity of women farmers in agricultural technologies, marketing,	Participation of women / women farmers in different activities implemented under the project; Reduced gender biasness and positive discrimination to bring gender equity. Inclusion of women and their active involvement ensured with better operational and management capabilities;

	institution management etc., as per the project requirements; Ensuring measures that are legally binding like equal and minimum wage norm, prevention of women harassment at work place, membership of women in different committees etc.; Monitoring of actions taken under the project for inclusion of women by project component / sub-components and initiating corrective measures accordingly; Documenting success and learning from different initiatives undertaken by the project that ensures greater participation of women.	Parity in wage (equal work equal pay) payouts ensured and legal provisions are abided by.

6.4.2.4 Gender Development and Inclusion Plan

Table 32 Gender Development and Inclusion Plan

Activity	**Sub-Activity**	**Key Challenges**	**Project Approach and Strategy**
Supply Chain Development of Client Resilient Seeds	Mapping women farmer's preferences / needs	Capturing needs of women farmers and their seed preferences	Emphasis on identifying needs of women farmers by land holding pattern. Listing seed preference of women
	Identification of seed farmer group/FPOs or FPCs	Involvement of women farmers in multiplication & Replacement of seeds	Giving priority to the interest of women, involving them in seed multiplication activity. Membership of women farmers in the FPOs / FPCs.
	Engagement of FPCs for Seed Multiplication, Processing and Marketing	Involvement of women members of the FPC in seed processing and marketing	Ensuring involvement of women members in feasible processing and marketing activities
Promotion of farm mechanization	Establishment of Custom Hiring Centre (CHC)	Access of women farmers to farm machineries	Operational guidelines for equal accessibility of women farmers, first come first serve basis. Women farmers may be given preference in feasible cases.
Promotion of Protected Cultivation	Shed-net / Poly House	Accessibility of women farmers to shed net / poly house	Emphasis for coverage of women farmers through awareness and motivational inputs. Provision of subsidy to women farmers as per Govt. norms. Proportionate inclusion of women farmers during selection & enrolment
Saline land Reclamation	FLDs of Climate resilient technologies, gypsum, BBF, Green manuring, contour cultivation & trainings	Coverage of women farmers under FLDs for learning under demonstration	Operational guidelines for inclusion of women farmers under FLDs Measures for FLDs in women fields in suitable cases. Proportionate coverage of women farmers under FLD, in case individual FLDs.

Creation of water source, ground water recharge along with water lifting and emitting systems	Farm ponds	Involvement of women farmers as beneficiary and their enrolment in availing farm ponds.	Proportionate coverage of women farmers under individual farm pond based on their interest. In community farm ponds, equal access to water for irrigation to women farmers.
	Well and bore well, artificial recharging	Involvement of women farmers in availing artificial recharging facility	Proportionate coverage of women farmers having recharge wells based on their interest.
Water use Efficiency improvement	Promotion of Drip and Sprinkler irrigation system	Coverage of women farmers in availing the benefit.	Proportionate coverage of women farmers under drip / sprinkler irrigation system. Demonstration and training on use of irrigation system
Post-harvest infrastructure creation	Establishment of aggregation centre with Grading and packing facility and processing units	Involvement of women in aggregation centre activities	Required measures for ensuring involvement of women in aggregation centre activities, based on work suitability.
	Establishment of Godowns /warehouse	Access of women farmers to store their agricultural produces	Equal access to women farmers for storing, as per operational norms
Strengthening of Commodity specific FPOs / FPC	Promotion of FPC	Inclusion of women farmers / entrepreneurs / investors in the FPOs / FPCs	Exclusive inclusion criteria for ensuring women membership and participation Formation of FPCs from the women SHGs Capacity building of women members on management of FPO/FPC
Promotion of Community / Cluster Institutions	Formation of Climate resilient committee (Cluster)	Membership & participation of women in the committee	Special provision for ensuring women membership and participation in the committee Ensuring women member as member of the managing committee (Minimum of 1/3rd of the total members)

6.4.2.5 Land Availability for Agricultural Infrastructure

Land is required for the purpose of creation of infrastructure such as (1) Custom Hiring Centre (CHC), (2) Agro-processing units, (3) sorting, grading and packing houses, (4) godowns / storage infrastructures, (5) cold storage etc. However, the project will not cause any involuntary displacement for creation of agribusiness infrastructure or any infrastructure that are supportive to agriculture promotion. As it is proposed that the FPCs will be the owner of such facilities and managing it, FPCs should have their own land for the creation / establishment of such infrastructures. The FPCs having suitable land can only apply for such infrastructure based support. The principles to be followed are;

1. No activities under the project components will be taken-up if it involves physical displacement of local people, either from their residences and/or commercial places.

2. Before taking up infrastructural activity, a screening process will be followed to understand involvement of any land acquisition or forceful eviction because of the activity. If execution of any of the project activities involves acquisition of land, which is involuntary in nature, project will take conscious decision to explore alternatives.

3. In cases, if encroachment is observed and the encroached land is proposed for infrastructure development by any of the FPCs, the project will not take up any such activity in the encroached land that is expected to upset the livelihood of the family depending upon that patch of land.

Following rules shall govern securing of lands for the project. The local appropriate authority should take required measures accordingly.

1. The land must be free of squatters, encroachers, share cropping or other claims or encumbrances;
2. The facilities requiring land should not be site specific (exploration of alternative);
3. This should not result in any physical relocation;
4. This should not result in restrictions on accesses and transit;
5. In case of voluntary donation of land, required legal process should be followed with verification by appropriate authority. Under no circumstances, the land user will be subjected to any pressure, directly or indirectly, to part with the land;
6. It is to be ensured that there shall be no significant adverse impacts on the livelihood of the household donating / selling the land.
7. Provision shall be made for redressal of grievances, if any.

6.4.3 Citizen Engagement Grievance Redressal

Broadly the following grievance redressal mechanism will be followed in the project:

1. All the project staff related matters and their grievance procedures will be in line with the procedure laid down either in their contract and as per government rules. At PMU level, project director will constitute a grievance committee with at least one women member.
2. For all conflicts at the village level, every attempt should be made to resolve all conflicts at that level itself through the VCRMC, failing which, through the Gram Sabha. The social mobiliser, Krushi Mitra and cluster executive will facilitate the villagers in this regard.
3. The SDAO will resolve the conflict among GPs, GPs and service providers. If Gram Sabha feels that a formal arbitration is required, a five-member committee will be set up for this purpose. It shall comprise the SDAO, a relevant technical member (preferably from the location and familiar with the dispute) a nominee each from the Gram Sabha concerned.
4. If either party is dissatisfied with decision of the SDAO they can appeal to DSAO. The decision of the DSAO shall be final and binding on all parties.

The grievances of service providers procured as per the World Bank Procurement Guidelines and resource agencies partnering with PMU through MoU will be governed as per their contract conditions and condition of the MoU.

Annexures

Annexure-I

No. of Clusters & Villages Selected

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
Akola	Akot	180	11	77219	14	82	96
	Telhara	101	10	56259	14	46	60
	Murtizapur	163	20	79427	18	94	112
	Patur	95	3	69886	19	0	19
	Barshitakali	159	3	76489	25	0	25
	Balapur	98	13	63194	13	44	57
	Akola	190	21	105869	23	106	129
Akola Total		**986**	**81**	**528343**	**126**	**372**	**498**
Amrawati	Tiosa	95	1	55985	8	0	8
	Daryapur	150	19	80688	0	150	150
	Anjangaon Surji	127	10	50299	11	45	56
	Dhamanagaon Railway	112	1	63843	13	0	13
	Bhatkuli	137	11	58080	6	110	116
	Amrawati	129	13	76435	19	18	37
	Morshi	166	1	79145	24	0	24
	Nandgaon Khandeshwar	161	2	78265	9	0	9
	Chandur Bazar	169	10	68754	26	27	53
	Achalpur	171	6	61778	7	6	13
	Chikhaldara	193	4	61590	12	0	12
	Dharni	156	4	80667	18	0	18
	Warud	139	1	71438	12	0	12
	Chandur railway	92	1	54073	11	0	11
Amrawati Total		**1997**	84	**941041**	**176**	**356**	**532**
Aurangabad	Vaijapur	166	16	154491	65		65
	Sillod	131	8	117599	45		45
	Aurangabad	185	7	116721	54		54
	Kannad	211	10	148461	61		61
	Phulambri	92	6	68770	29		29
	Gangapur	221	6	124986	49		49

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
	Paithan	189	7	135344	57		57
	Soegaon	85	6	64237	25		25
	Khultabad	76	5	48923	21		21
Aurangabad Total		**1356**	**71**	**979532**	**406**	**0**	**406**
Bid	Bid	226	5	150793	54		54
	Ashti	176	11	145134	55		55
	Dharur	68	2	57473	21		21
	Georai	197	6	145227	62		62
	Kaij	121	4	109703	43		43
	Parli	105	4	77785	25		25
	Patoda	105	4	76921	30		30
	Manjlegaon	125	2	90247	25		25
	Shirur (kasar)	94	4	64643	26		26
	Wadwani	45	3	41039	15		15
	Ambejogai	106	5	90121	35		35
Bid Total		**1368**	**50**	**1049088**	**391**	**0**	**391**
Buldana	Jalgaon (jamod)	124	12	50223	10	45	55
	Sangrampur	122	12	51846	10	38	48
	Mehkar	160	5	108705	17		17
	Khamgaon	149	3	123386	30		30
	Motala	123	3	77919	22		22
	Nandura	111	15	52942	11	35	46
	Chikhli	145	5	111436	21		21
	Sindkhed raja	113	3	73598	20		20
	Deolgaon raja	64	2	47335	6		6
	Buldana	97	1	78055	14		14
	Lonar	90	2	63606	15		15
	Malkapur	73	7	45994	12	10	22
	Shegaon	73	12	50400	17	38	55

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
Buldana Total		**1444**	**82**	**935444**	**205**	**166**	**371**
Hingoli	Hingoli	153	6	94679	51		51
	Sengaon	133	7	112000	50		50
	Aundha (nagnath)	122	7	81429	47		47
	Kalamnuri	151	7	93661	46		46
	Basmath	152	6	88608	46		46
Hingoli Total		**711**	**33**	**470378**	**240**	**0**	**240**
Jalgaon	Amalner	154	3	77491	34		34
	Bhadgaon	59	5	43452	17		17
	Bhusawal	50	2	39442	14		14
	Bodvad	53	3	37940	14		14
	Chalisgaon	142	7	117345	50		50
	Chopda	119	5	72377	31		31
	Dharangaon	89	4	48670	22		22
	Erandol	65	2	50389	20		20
	Jalgaon	87	5	75477	26		26
	Jamner	159	4	130933	53		53
	Pachora	127	4	80474	31		31
	Parola	116	4	77930	37		37
	Raver	117	6	66179	22		22
	Yawal	91	4	65714	27		27
	Muktainagar	85	11	61655	24	38	62
Jalgaon Total		**1513**	**69**	**1045468**	**422**	**38**	**460**
Jalna	Jalna	149	6	111945	53		53
	Mantha	117	2	78219	36		36
	Ghansawangi	117	9	110594	50		50
	Jaffrabad	101	3	72138	33		33
	Partur	97	5	72959	31		31

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
	Badnapur	91	2	74814	27		27
	Bhokardan	158	7	117798	50		50
	Ambad	137	7	111053	54		54
Jalna Total		**967**	**334**	**749520**	**334**	**0**	**334**
Latur	Latur	122	6	97789	36		36
	Renapur	79	2	57112	19		19
	Nilanga	162	6	108875	37		37
	Ausa	130	6	122082	44		44
	Ahmadpur	123	6	75216	33		33
	Chakur	85	4	68766	25		25
	Jalkot	47	2	34370	15		15
	Shirur-anantpal	48	3	31490	17		17
	Udgir	98	5	76687	32		32
	Deoni	54	2	39286	12		12
Latur Total		**948**	**42**	**711673**	**270**		**270**
Nanded	Naigaon (Khairgaon)	91	3	57648	25		25
	Mudkhed	53	2	30980	11		11
	Nanded	85	2	33673	22		22
	Himayatnagar	73	1	48213	15		15
	Kinwat	189	7	151211	65		65
	Dharmabad	54	2	29609	12		12
	Deglur	115	4	66796	28		28
	Loha	125	2	83753	28		28
	Kandhar	127	4	80469	30		30
	Mukhed	151	4	95293	36		36
	Biloli	89	2	54144	17		17
	Umri	66	2	41199	16		16

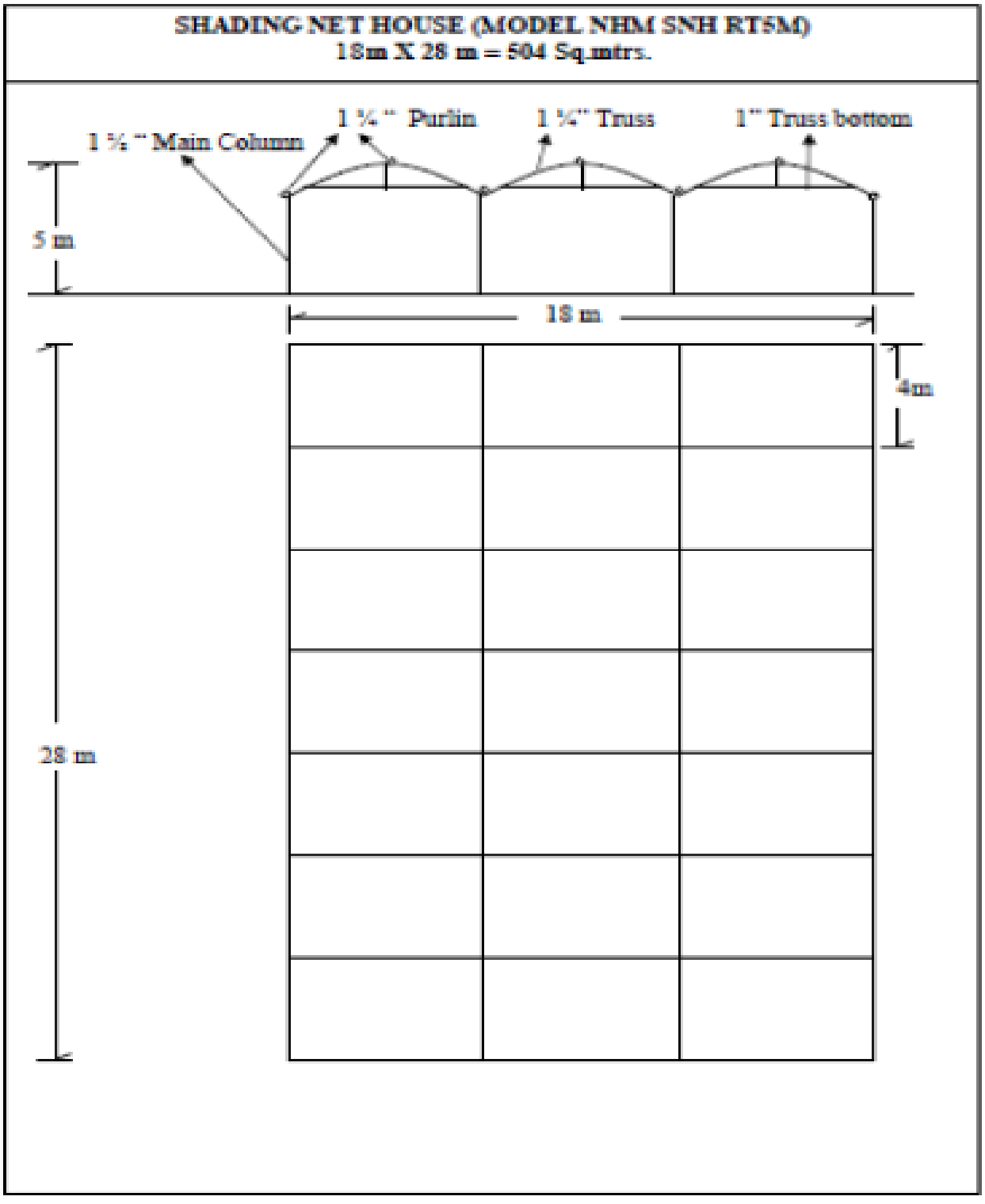
District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
	Hadgaon	154	5	105051	40		40
	Ardhapur	56	1	29384	8		8
	Bhokar	82	2	64643	17		17
	Mahoor	93	2	51981	14		14
Nanded Total		**1603**	**45**	**1024046**	**384**		**384**
Osmanabad	Bhum	96	8	83226	31		31
	Tuljapur	123	12	149765	56		56
	Washi	54	8	55261	25		25
	Lohara	47	7	54799	23		23
	Osmanabad	127	14	133984	48		48
	Kalamb	94	8	92200	33		33
	Umarga	96	9	98424	40		40
	Paranda	96	7	83050	31		31
Osmanabad Total		**733**	**73**	**750710**	**287**		**287**
Parbhani	Parbhani	130	11	108478	48		48
	Jintur	171	10	122764	54		54
	Purna	93	5	61695	24		24
	Sailu	94	6	68509	30		30
	Gangakhed	106	5	65073	34		34
	Sonpeth	57	2	36180	14		14
	Manwath	54	6	49404	22		22
	Pathri	56	5	53638	25		25
	Palam	82	2	48870	24		24
Parbhani Total		**843**	**52**	**614611**	**275**		**275**
Wardha	Arvi	220	1	79703	16		16
	Seloo	170	2	63727	16		16

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
	Wardha	148	2	72623	17		17
	Deoli	150	2	67252	25		25
	Ashti	158	1	45459	14		14
	Karanja	121	2	60609	11		11
	Hinganghat	187	2	90300	15		15
	Samudrapur	222	3	92657	11		11
Wardha Total		**1376**	**15**	**572330**	**125**		**125**
Washim	Karanja	167	4	83925	21		21
	Manora	137	2	77623	20		20
	Malegaon	122	4	91971	17		17
	Washim	128	2	88443	20		20
	Risod	99	6	82067	18		18
	Mangrulpir	136	5	77567	20		20
Washim Total		**789**	**20**	**501596**	**116**		**116**
Yavatmal	Kalamb	143	2	75140	32		32
	Kelapur	140	2	81601	10		10
	Umarkhed	157	2	120907	22		22
	Mahagaon	116	2	89602	13		13
	Pusad	187	1	115412	16		16
	Ralegaon	133	2	75627	30		30
	Wani	160	2	90201	19		19
	Ner	116	1	66239	24		24
	Yavatmal	145	5	108652	38		38
	Babulgaon	141	4	57029	14		14
	Digras	80	2	54654	13		13
	Darwha	145	1	84145	16		16
	Arni	111	2	84371	15		15
	Zari-jamani	128	1	70901	18		18
	Ghatanji	120	2	93342	16		16

District	Tahsil	Total Villages	Clusters	Geographical area (ha)	No. of villages proposed for selection (Drought Proffing)	No. of Villages in *Saline Area*	Total Proposed villages for selection (No.)
	Maregaon	115	1	60739	13		13
Yavatmal Total		**2137**	**32**	**1328561**	**309**		**309**
Grnad Total(15 Districts)		**18771**	**790**	**1,22,02,334**	**4066**	**932**	**4998**

Annexure –II

Design No.3.1 Shadenet house (RTSNH 5 M)
18 m X 28 m = 504 Sq.mtrs.



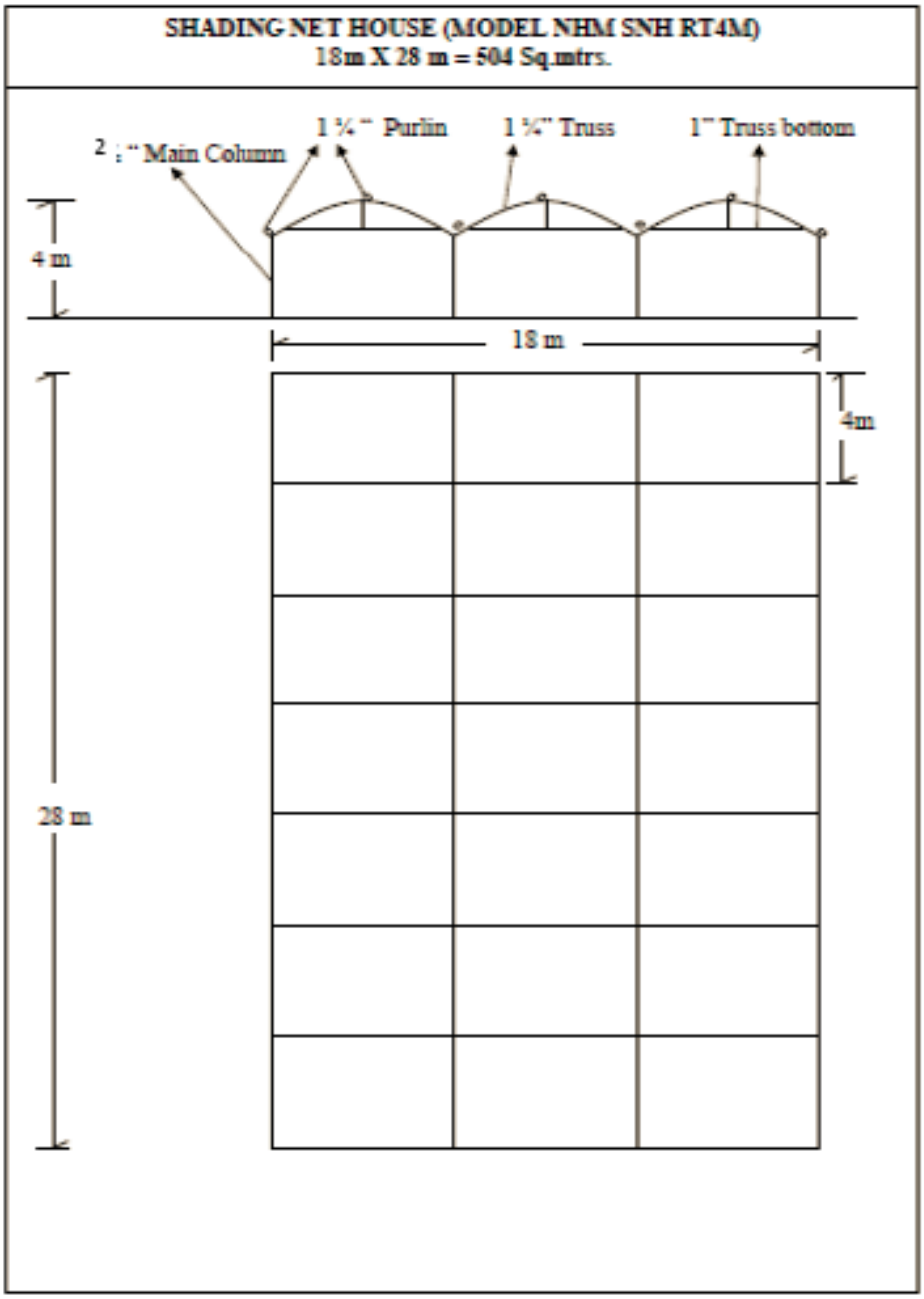
The detail estimates of RTSNH-5M models

Table 3.1 The detail estimates of **RTSNH-5M-500** model

Model	RTSNH-5M-500
Structural material	G.I. Pipes
Size	504 sq m
Dimensions	18 m x 28 m
Height	Minimum 5 m at center

Sr. No.	Particulars	Rate (Rs)	Unit	18 m x 28 m	
				504	
				Quantity	Amount
A	**Cost of Material**				
1	GI Pipes	**65**	Kgs.	2225	144625
2	Shade Net (Tapenet on roof)	**30**	Sq.mtrs	653	19590
3	Insect Net (on sides)	**40**	Sq.mtrs	313	12520
4	Laminated woven film (apron)	**45**	Sq.mtrs	148	6660
5	Aluminium Profiles	**40**	Mtrs.	223	8920
6	Locking spring	**6**	Mtrs.	324	1944
7	Self drilling tapping Screws	**1.5**	Nos.	426	639
8	Clamps & Accessories	**15**	Sq.mtrs	504	7560
9	High Tensile Nuts & Bolts	**8**	Sq.mtrs	504	4032
10	UV stabilised FRP-Door	**2000**	Nos.	1	2000
	Sub Total				**208490**
	VAT	**5%**			10425
	Total Material Cost				**218915**
B	**Foundation-civil material**	**150**	Nos.	34	**5100**
C	**Labour Cost**				
1	Fabrication	**48**	Sq.mtrs	504	24192
2	Foundation	**120**	Nos.	34	4080
3	Installation	**48**	Sq.mtrs	504	24192
	Total Labour cost				**52464**
D	**Service Tax on Labour cost**	**14.00%**			**7345**
E	**Transport cost**	**2.00%**			**4170**
F	**a) Control Head - 500**	78	Rs/Sq.mtr	504	39312
	b) Irrigation System	25	Rs/Sq.mtr	504	12600
	c) Fogging System	25	Rs/Sq.mtr	504	12600
	Irrigation System	**128**	Rs/Sq.mtr	**504**	**64512**
	Grand Total				**352505**
	Total Unit Rate		Rs/Sq.mtr		**699**

Design No.4. 1 Shadenet house (RTSNH 4 M)18 m X 28 m = 504 Sq.mtrs.



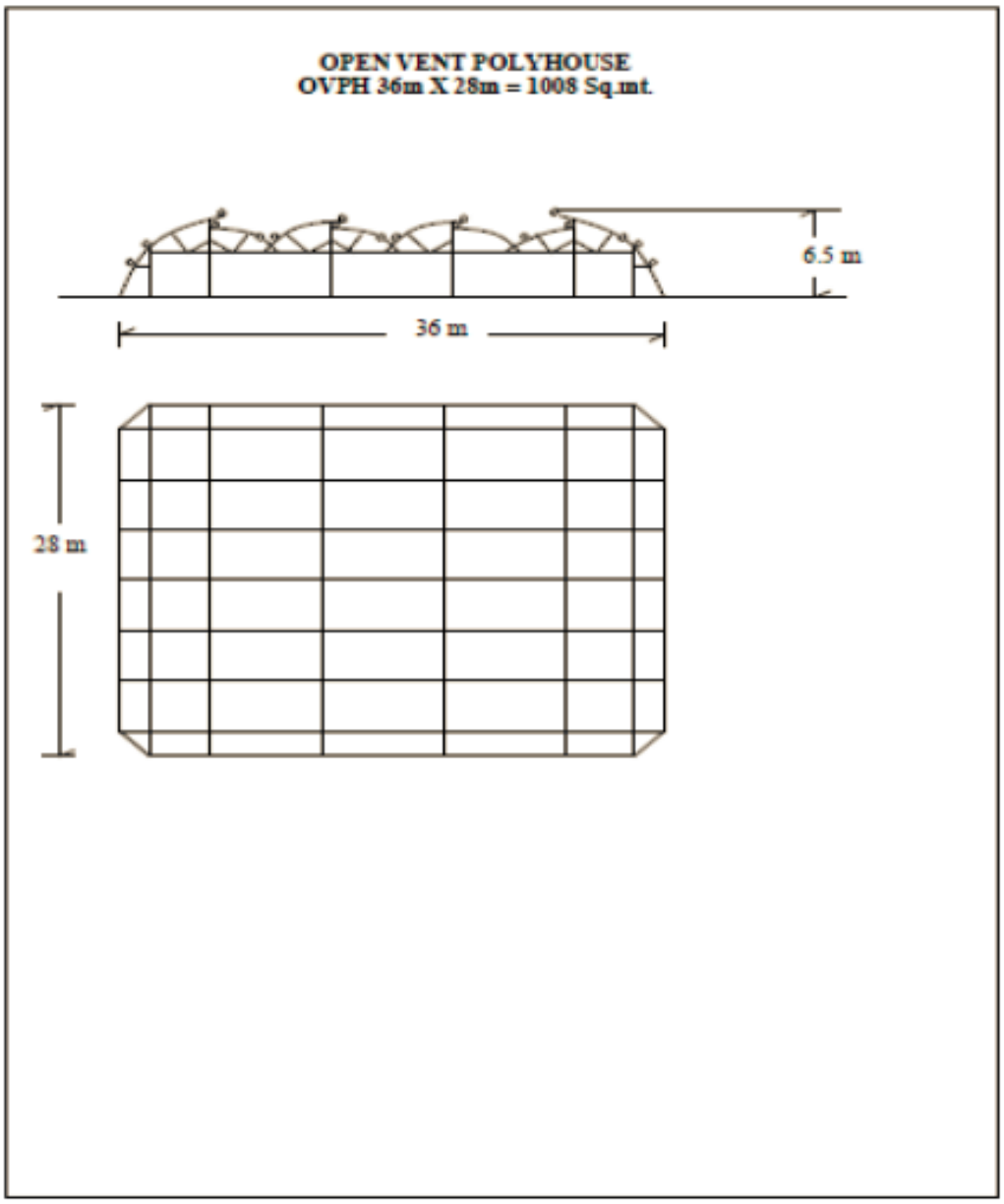
The detail estimates of RTSNH-4M models

Table 4.1. The detail estimates of **RTSNH-4M-500** model

Model	RTSNH-4M-500
Structural material	G.I. Pipes
Size	504 sq m
Dimensions	18 m x 28 m
Height	Minimum 4 m at center

Sr. No.	Particulars	Rate (Rs)	Unit	18 m x 28 m 504	
				Quantity	Amount
A	**Cost of Material**				
1	GI Pipes	**65**	Kgs.	1700	110500
2	Shade Net (Tapenet on roof)	**30**	Sq.mtrs	653	19590
3	Insect Net (on sides)	**40**	Sq.mtrs	206	8240
4	Laminated woven film (apron)	**45**	Sq.mtrs	148	6660
5	Aluminium Profiles	**40**	Mtrs.	208	8320
6	Locking spring	**6**	Mtrs.	303	1818
7	Self drilling tapping Screws	**1.5**	Nos.	397	596
8	Clamps & Accessories	**15**	Sq.mtrs	504	7560
9	High Tensile Nuts & Bolts	**8**	Sq.mtrs	504	4032
10	UV stabilised FRP-Door	**2000**	Nos.	1	2000
	Sub Total				**169316**
	VAT	**5%**			8466
	Total Material Cost				**177781**
B	**Foundation-civil material**	**150**	Nos.	34	**5100**
C	**Labour Cost**				
1	Fabrication	**45**	Sq.mtrs	504	22680
2	Foundation	**120**	Nos.	34	4080
3	Installation	**45**	Sq.mtrs	504	22680
	Total Labour cost				**49440**
D	**Service Tax on Labour cost**	**14.00%**			**6922**
E	**Transport cost**	**2.00%**			**3386**
F	**a) Control Head - 500**	78	Rs/Sq.mtr	504	39312
	b) Irrigation System	25	Rs/Sq.mtr	504	12600
	c) Fogging System	25	Rs/Sq.mtr	504	12600
	Irrigation System	**128**	Rs/Sq.mtr	504	**64512**
	Grand Total				**307141**
	Total Unit Rate		Rs/Sq.mtr		**609**

Design No. 1. 3 Open Ventilated Polyhouse.(1008 Sq.mtrs)
OVPH 36 m X 28 m =1008



The detail estimates of NHM-OVPH models

Table 1.3 The detail estimates of NHM-OVPH-1000 model

	Model	NHM-OVPH-1000
	Structural material	G.I. Pipes
	Size	1008 sq m
	Dimensions	28 m x 36 m
		36 m x 28 m
	Height	Minimum 6 m at center

Sr. No.	Particulars	Rate (Rs)	Unit	28 m X 36 m		36 m X 28 m	
				1008		1008	
				Quantity	Amount	Quantity	Amount
A	**Cost of Material**						
1	GI Pipes	**65**	Kgs.	6156	400140	6235	405275
2	UV stablised Poly Film	**55**	Sq.mtrs	1809	99495	1862	102410
3	GI Gutter	**65**	Kgs.	287	18655	325	21125
4	Aluminium Profiles	**40**	Mtrs.	676	27040	699	27960
5	Clamps & Accessories	**22**	Sq.mtrs.	1008	22176	1008	22176
6	Shade Net (Tapenet on roof)	**30**	Sq.mtrs.	840	25200	832	24960
7	Insect Net (on sides)	**40**	Sq.mtrs.	353	14120	353	14120
8	Laminated woven film (apron)	**52**	Sq.mtrs	176	9152	176	9152
9	Locking spring	**6**	Mtrs.	983	5898	1017	6102
10	High Tensile Nuts & Bolts	**8**	Sq.mtrs.	1008	8064	1008	8064
11	Self drilling tapping Screws	**1.5**	Nos.	1290	1935	1335	2002.5
12	GI Wire	**55**	Kgs.	24	1320	24	1320
13	Plastic Rope	**4**	Mtrs.	231	924	218	872
14	Curtain Clamps	**10**	Nos.	93	930	93	930
15	Pulley assembly	**30**	Nos.	16	480	12	360
16	Curtain Rings	**2**	Nos.	108	216	84	168
17	UV stabilised FRP-Door	**2000**	Nos.	1	2000	1	2000
	Sub Total				**637745**		**648997**
	VAT (compulsory)	**5%**			31887		32450
	Total Material Cost				**669632**		**681446**

B	**Foundation-civil material**	**150**	Nos.	83	12450	82	12300
C	**Labour Cost**						
1	Fabrication	**64**	Sq.mtrs.	1008	64512	1008	64512
2	Foundation	**120**	Nos.	83	9960	82	9840
3	Installation	**64**	Sq.mtrs.	1008	64512	1008	64512
	Total Labour cost				**138984**		**138864**
	Total				**821066**		**832610**
D	**Service Tax on Labour cost**	**14.00%**			19458		19441
E	**Transport cost**	**2.00%**			12755		12980
F	**a) Control Head - 1000**	67	Rs/Sq.mtr	1008	67536	1008	67536
	b) Irrigation System	25	Rs/Sq.mtr	1008	25200	1008	25200
	c) Fogging System	25	Rs/Sq.mtr	1008	25200	1008	25200
	Irrigation System	**117**	**Rs/Sq.mtr**	**1008**	**117936**	**1008**	**117936**
	Grand Total				**971215**		**982967**
	Total Unit Rate		Rs/Sq.mtr		**964**		**975**
	Eligibility as per MIDH Guidelines		Rs/Sq.mtr		**935**		**935**

Plastic Tunnel-

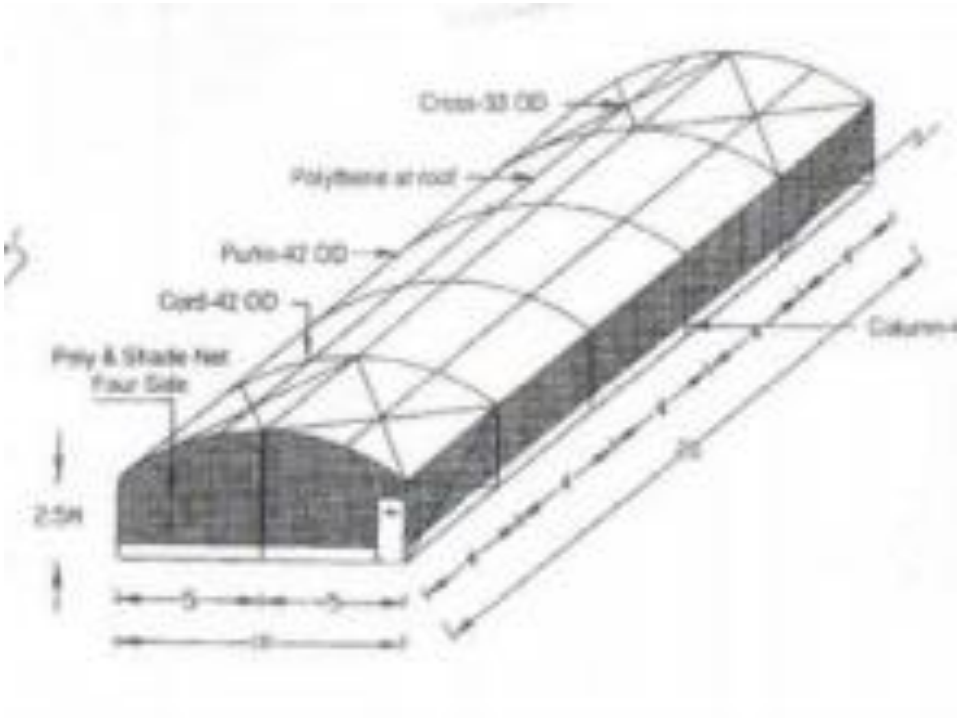
It is low cost model used or cultivation of vegetables, hardening of grafts/saplings & floriculture. PVC or LDPE plastic film of ५० to १२० micron & plastic net of २० mesh is used for setting up of plastic tunnel. The length is kept up to ३० M for ease of operations. Metal or cane material can be used in construction of plastic tunnel.

SIte Selection-

१) It should be well drained site.

२) It will get maximum sun light

३) Tunnel length should not be across the wind direction.



Pack House

It is a physical structure where harvested produce is consolidated and prepared for transport and distribution to markets. Various operations include cleaning, sorting/grading, pre-treatments, packing, cooling, storage and dispatch to market

Component Description

A modern integrated pack-house unit enables small lot sourcing of horticulture produce, and should be built close to farming area.

A maximum admissible cost norm of 50 lakhs per integrated pack-house unit is applicable for each beneficiary. The actual value of the equipment will vary as per design options.

The unit capacity of an integrated pack-house is considered at 16 MT per day and is considered for output of 2MT/hour sorting grading line, running for 8 hours a day. The design capacity of each project will be considered pro-rata – for example a 32 MT per day throughput will be equivalent to 2 pack-houses.

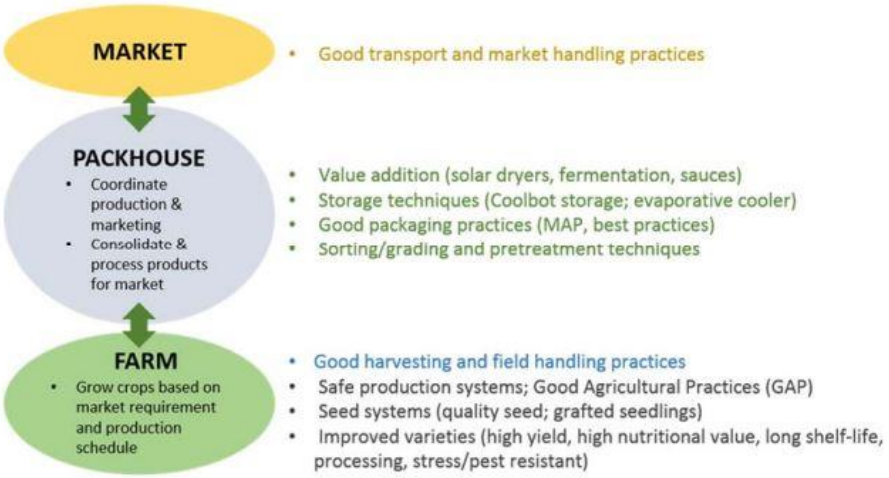
The included equipment are weighing scales, mechanised facilities like conveyer belt for sorting, grading units and where applicable washing, drying units.

The component “Integrated Pack-house” includes:

1. Receiving area, covered: a covered shaded area for arriving produce to be off-loaded and undergo pre-selection and weighing.
2. Enclosed covered sorting and grading area: a food handling hall with mechanised handling and cleaning equipment.
3. Sorting and grading conveyors: mechanised roller or belt based system to allow working personnel to selectively pick and choose produce for next activity, capable of handling 15 MT of output per day. Water based conveyor system used for some crops.
4. Washing/Drying equipment: where required, mechanised washing and drying lines.
5. Packaging area: designated area where produce is manually packaged into market lots.
6. Electricity generator: a DG set to produce power for equipment operations. Where alternate energy options (bio-mass based generators, solar powered generators, etc.) are used, add-on technology component (MIDH Appendix II - xv) will apply.

An area of 9 x 18 metres is the indicative minimum enclosed area for each pack-house. Each pack-house appraised under this component should have minimum equipment to facilitate the basic sorting and grading. Additionally washing, drying and weighing equipment can also be installed so that product is readied for packaging. In special cases, such as bulk storage for perishables like apples, sorting grading facility is built adjoining the storage facility

to sort storable quality. These pack-house facilities can handle upto 150MT per day. Where the sorting grading line incorporates electronic sorting, the related add-on technology component can be applied for.



Reference Data Sheet

#	**Component: Integrated Pack house**	**Description**
1	Pack house Handling capacity	Specify total incoming volume of raw produce in MT/day.
2	Products to be handled	Describe the details of the products planned for value addition.
3	Area of the pack house	Specify the total Plinth area of the construction in m2.
4	Receiving Area (L x W x H)m	Provide the dimensions of the receiving, weighing and preliminary handling area.
5	Dimension of the building (L x W x H) m	Provide the total covered area of the building.
6	Handling Area (L x W x H)m	External dimensions of the designated sorting, grading, cleaning and packing area.
7	Roof Details	Provide the construction material and specifications of roof.
8	Outer walls and Flooring Details	Description of the outer walls and flooring of enclosed area (food grade materials).
9	Lighting - Internal and External	Type of lighting used (CFL/LED/Normal – total numbers and wattage).
10	Door/ Window Details	Number and Dimensions of openings - doors and windows.
11	Pest control details	Number and details of pest control used (air curtains, other equipment, etc.).
12	Fumigation Details	Specify the details of fumigation if used.
13	De-sapping tables	Specify use of de-sapping tables if used.
14	Mechanised Conveyor system & capacity	Dimensions of conveyor system – belt or roller based, and throughput handling capacity in tons/hour.

15	Washing and Drying machinery (if used)	Specify the details of throughput capacity/motors/pumps/ belts used.
16	Power generating unit	Details of electric generator installed (kVA). If using alternate energy or hybrid systems, provide specifications.
17	Inclusion of Pre-cooling chamber in pack-house	Yes/No
18	Inclusion of staging cold-room in pack-house	Yes/No
19	Layout Drawing	Provide layout drawings of the complete pack house including pre-cooler and staging cold room.

All mandatory rules & regulations (BIS, ISO, IS etc.) relevant to the item must be complied with.

Sources:

- **Guidelines & minimum System Standards for Implementation in Cold-chain Components,** by NCCD

Ripening Chamber

Ripening is the process by which fruits attain their desirable flavor, quality, color and other textural properties.

On the basis of ripening behavior, fruits are classified as:

i. Climacteric: Climacteric fruits are defined as fruits that enter 'climacteric phase' after harvest i.e. they continue to ripen. During the ripening process the fruits emit ethylene along with increased rate of respiration. Ripe fruits are soft and delicate and generally cannot withstand rigors of transport and repeated handing. Small dose of ethylene is used to induce ripening process under controlled conditions of temperature and humidity. Climacteric fruits are mango, banana, papaya, guava, sapota, kiwi, persimmon, fig, apple, passion fruit, apricot, plum and pear.

ii. Non-Climacteric: Non-climacteric fruits once harvested do not ripen further. Non-climacteric fruits produce very small amount of ethylene and do not respond to ethylene treatment. There is no characteristic increased rate of respiration or production of carbon dioxide. Non-climacteric fruits are citrus, pineapple, grape, strawberry, pomegranate, lichi, watermelon and cherry.

Sl.No	Items / Particulars	Minimum Technical Specification
1	Civil Structure-building design	i. Structural Safety – Structural design as per BIS Code ii. Adherence to local Building Regulation iii. Concrete floor with sufficient load bearing capacity. iv. Chamber size is not smaller than 50 Cu M for preventing v. Building up of high concentration of ethylene.

2	Ripening Room Dimensions	i. Ripening Room dimensions will depend on number of tiers and number of pallets to be stored. ii. Number of chambers may vary from four to eight depending on ripening cycle in terms of number of days. Chambers will be generally identical in dimension. iii. Further Increase in number of chambers in multiple of ripening cycle may be undertaken but situation in which mechanized handling is possible, multi tier ripening chamber is an alternative option available. Number of tiers may go up to three.
3	Ripening Room Construction	**Construction Features** i. Ripening Room Chambers should be designed and constructed to hermetically seal with appropriate closures / doors. The key feature of ripening rooms is that conditioned air is forced through the product rather than the product just being stored in a temperature controlled room. The system passes air though each pallet or series of pallets before returning to the evaporator. Therefore, any "air-stacking" or "cross-stacking" of boxes is not necessary, and the result is less space requirement, lesser handling of the fruit and improved product quality. It is for this reason that they are recommended even for ripening of fruits in crates and are mandatory for fruits in CFB boxes and single or multi-tier stacking system. ii. The airflow within the ripening rooms is to be designed to penetrate all boxes of fruit with an even airflow throughout the room resulting in all fruit being ripened uniformly. Recommend air flow is 0.3 cfm per pound of bananas or 2000 m3/ per hour / per metric ton of product. If the pulp temperature difference between the warmest and coolest fruit is less than 1oF or 0.55oC then there is adequate airflow. Plenum chamber is recommended so as to equalise pressure through the product for uniform distribution/flow of air and ethylene through the product. iii. Ripening rooms may be constructed of PUF panels or by application of suitable thermal insulation with vapour barrier and cladding on walls, floor and ceiling of civil structure. Panels are prefabricated building components filled with insulation, clad on both sides with facing materials and arranged with a jointing means to connect panels and may be preferred. In any case, inner chamber surface should be of food grade cladding. iv. The insulation envelope shall be designed to ensure that air pressure created by fans does not affect the integrity of the cold store structure or the panel joints.

		v. The height of wall panels is often such that care must be taken to ensure that adequate stability of the wall panels is maintained. If ceiling support are provided, the Ceiling support system shall be connected to the main structure in a manner which takes into account: a. The method of supporting the insulating ceiling panels, b. The position of the supports to avoid local over stress within the supports, the suspended ceiling or the main structure, c. The expansion and contraction of the main structure.
4	Ripening Room Doors	Ripening doors should be designed for minimal gas leakage. In general. i. For single tier loading, hinged doors, and in some cases, sliding doors are used. The doors should be designed for rugged operation and easy access for incoming and outgoing fruits on pallets. ii. When stacking is multi-tier and handling of pallets is mechanised, wider openings of doors are required. iii. Care should be taken when positioning doors adjacent to fans to avoid ingress or egress of air as significant changes in store pressure can occur when such doors are opened. Where possible the door should be located on the external (warm side) of the cold store insulation. iv. Suitable gaskets shall be provided to form a seal around the door opening. v. Large doors shall be supported by a sub-frame independent of the insulating panels. vi. Automatic doors shall open and close promptly. vii. Automatic doors shall incorporate a safety device to avoid injury to personnel or damage to product in the case of accidental closure. viii. All doors required for means of escape purposes shall be easily and immediately operable from the inside at all times. Doors, which open automatically, are not acceptable for means of escape unless they have a manual override and can be opened manually in the event of a power failure. ix. In case of multi tier stacking, doors are rolling up type and therefore, following desirable safety features for doors should be ensured. a) Internal Door Release b) Bottom Edge Pressure Operated Safety Stop c) Cable Break Electrical Safety Stop d) Spring Break Mechanical Safety Stop e) Vision Panel with emergency Knock out panel

		f) Vertical "D" section flexible seal for effective sealing in condition of reverse airflow for uniform ripening. Seal should be strong enough to withstand impact from pallets during loading operations and flexible enough to create an adequate seal between air distribution system and product. Horizontal pallet seals should be supported continuously along the full length of room but should be easy to remove a seal for cleaning or replacement. g) Door protection by Goal Post Protection which protect door perimeters or Single Fixed Bollards doors suitable for ripening chamber.
5	Insulation material	**i. Insulation Material** a) Some manufacturers recommend Rockwool or Polyisocyanurate (PIR) core composite panels for fire proofing. However, Polyurethane (PUR) Foam / EPS /Extruded polystyrene are also used. b) PUF panels are advisable for ripening chambers. Minimum 60 mm thick up to 120mm thick (PUF) insulated sandwiched panel (minimum density of 40 Kg / M3) depending on the design requirements; or any other insulation material having minimum R value of 2.6 M2.K / W are recommended for easy in-situ construction and vapour barrier effect. Floor shall have PUF slab 60 mm (minimum density of 40 Kg / M3) or any other equivalent insulating material is recommended. c) Covering floor insulation with 100mm concrete is recommended. Floor finish should be smooth with polymer coating so has to be kept clean. ii. Facing Materials- One of the following coverings may be used; the first three are used more frequently than the others and a minimum total coated thickness of 0,5 mm is recommended. A vapour seal shall be used on the outer facing of materials, which are permeable, such as brick masonry: a) Galvanized steel sheeting b) Suitable plastic coated galvanized steel sheeting c) Polyester coated galvanized steel sheeting d) Stainless steel sheeting e) Aluminium sheeting f) Aluminium/zinc protected steel sheeting g) Glass reinforced plastics iii. Adhesives

		a) Certain adhesives have a combustible solvent base which can be absorbed by and remain in the panel insulation. These solvents should, therefore, be avoided. b) Certain adhesives should be stored under controlled conditions and the manufacturer's requirements should be strictly observed; many adhesives have a maximum shelf life. c) Adhesives should not have a lingering taint
6	Temperature & Humidity levels	Ripening is preferred at a lower temperature but above level of chilling injury. System has to be designed to achieve prescribed ripening conditions in terms of temperature and relative humidity for target fruits. Generally, RH level of 90- 95% is recommended to prevent moisture loss.
7	Heat Load Calculation and Refrigerant	Cooling and heating system needs to be designed based on heat load calculation. As per Kyoto Protocol standards, any eco friendly refrigerant should be used including ammonia, R-134a and R 404a.
8	Cooling / Heating coils and plenum chamber	i. Cooling coils are manufactured from Copper or Stainless chamber Steel Tubes and Aluminium Fins. The coils must provide exceptionally large surface area to ensure high natural humidity levels within ripening rooms. In case of ammonia as refrigerant, copper tube shall not be used. ii. In case of a plenum chamber; cooling coils and fans must be easily accessible via single access hatch located above or at the end of the plenum chamber at roof level. Ceiling voids should be fully illuminated to facilitate inspection of coils at regular intervals. iii. Electric heating elements should be used for heating ripening room during lower temperature season as per design requirement and be placed in easily accessible locations. Open flame type chamber heating should never be used due to explosive nature of ethylene. iv. Fixing of the cooler shall be arranged to avoid disturbance of the ceiling panel support system. Ceiling panels in the vicinity of the cooler units will be subjected to continual variations in temperature and therefore, relative movement during defrost cycles.
9	Material to be used for ripening	Ethylene gas with suitable detection and dosing equipment to maintain ethylene concentration within required levels depending on product (Range 10 to 200 ppm).
10	Ethylene Generator and Dosing device	i. Ethylene may be introduced in ripening chambers in one of the three ways- by using independent ethylene generator with regulator; ethylene cartridges and ethylene-nitrogen mixture (5% ethylene + 95% nitrogen) cylinder. Whichever method is used, the duty holder should ensure that there are adequate means of dispersing the ethylene gases throughout the ripening room on its release.

		ii. Centralized Ethylene supply with Automation for multiple chambers for controlled and safe dosing of ethylene may be preferred for larger units. iii. If a generator containing ethanol based solution requires to be moved, it should be switched off, the mains cord removed from the socket outlet, and the manufacturer's instructions closely followed. iv. It may be borne in mind that ethylene in concentration above 27000 ppm may explode.
11	Specification for Air circulation system	i. Minimum air flow should be 2000 M3 per hour, per MT of product ripened at 95%. ii. In Ripening Units type-1, air circulation is modified for uniform ripening by introduction of system of Tarp, Tarp/ Lock Sock System / Air Bag for Vertical Air Circulation or Horizontal Air Flow. iii. In case of Ripening Units type -2, air circulation fans should have adequate static pressure for uniform air/ ethylene flow through the ventilation holes provided in the CFB boxes/ Plastic Crates / Plastic Bags containing fruits. For this, large diameter, reversible axial flow fans should be installed in the false ceiling accessible via a single access hatch for air supply under pressure. Each fan should preferably be equipped with venturi inlet to provide maximum efficiency throughout the ripening process. In such cases, pallet isolation must be provided for energy savings in part load conditions by providing a series of isolation dampers along the length of the ripening chamber. This function is operated by making proper selection for pallet isolation on Computerized Ripening Room Management System.
12	Ventilation System	i. When fruits are ripening, they release carbon dioxide which will build up in a ripening room. The CO2 production begins as the fruit ripens enters the "climacteric" phase, or the period when bananas release ethylene and have an elevated rate of respiration (along with a great deal of other physiological changes). Respiration involves the uptake of oxygen, the release of carbon dioxide, and the breakdown of starches. Carbon dioxide concentrations above 1% (10,000 ppm) will retard ripening, delay the effects of ethylene and cause quality problems. Suitable venting system consisting of fans/dampers/open – shut valves should be installed to maintain CO2 concentration below 5000 ppm. ii. In ripening rooms Type-1, ventilation may be automatic or manual. iii. In case of ripening rooms type-2 with pallet isolation, ventilation may be provided by a roof mounted fan which is identical in specification to the pressure fans.

		iv. In case of automatic forced air exhaust / ventilation system with ducting, a dual inlet / discharge damper operates in parallel with the fan to allow fresh air from outside to replace the air within the room when vent is required. Automatic exhaust fans (either timed or sensor based) or "flow-though" (constant) ventilation are provided at two locations (one near ceiling of chamber and another a little above floor level) in each chamber. This also evacuates the ethylene after the desired exposure period and helps to maintain CO2 concentration low (below 5000 ppm) during the ripening cycle for proper ripening. In such cases, pening and shutoff actuators/ valves control is affected by CO2 sensor and timer device.
13	Sensors and Control devices	a) Suitable sensors and controlled devices should be used for maintaining following parameters. For this, temperature & humidity loggers and Ripening Chamber Air Analysis Kit (for Ethylene and CO2 levels) may be used. i. Temperature ii. Relative humidity iii. Ethylene concentration iv. CO2 Concentration b) PLC device also known as Ripening Room Management System – "RMS" is must in Ripening Unit Type-2. The controller provides total control of the ripening system allowing operators secure and password protected access to following functions. c) Clear real time temperature display and control d) Fan speed and energy usage e) Ventilation intervals f) Relative humidity indicator and control g) Ethylene level monitoring and regulation h) Door control i) Lighting control j) Pallet loading and isolation k) Differential Pressure Display Differential Pressure Display provides the ripener with an indication of air pressure drop cross the fruit pallets. This information along with information from Temperature. Ethylene gas censors located inside chamber, within pallets and within boxes / plastic bags, is used to determine the setting of the inverter drive based on factors such as the type of product packaging and fruit, amount of pallets in the room and current stage of the ripening process. The RMS for multi chamber pressure ripening system should preferably be able to be configured to allow all rooms to be viewed and controlled locally and, or remotely.

14	Electrical plug point	i. For operating Portable Ethylene Generator, an Electrical Plug point is required inside the room. Metal Clad Plug point in the Metal Socket housing with the independent circuit breaker system, in order to isolate the system independent with the rest of the System, is recommended. ii. For centralized gas emission, no electrical connections are required inside the room.
15	Pallet Racking and Material Handling	i. Ripening unit with single tier stacking should have a manually operated pallet lifting and carrying device. Pallet racking system comprises of box section construction which may be designed as per BS 5950 or equivalent IS standards for strength and cleanliness, providing easy access for pallet loading at high level. ii. For multi-tier stacking motorized forklift should be provided. In such cases, in order to assist loading at upper levels, fork lift guides are to be installed to form a centre aisle which are strengthened by back filling with concrete. These guides are to be tapered at the front. To facilitate loading and centralizing the fork lift truck in the drive in racking, the middle and upper tiers of racking are offset from the lower tier. An access ladder is also provided to the rear wall for access to an optional grated walkway at middle and upper pallet levels.
16	Some Useful Appliances and Instrument	Weighing Scales and Fruit Inspection Instruments such as follows a) Weighing Scale b) Firmness Tester c) Refractometer d) Sizers and Callipers e) Produce Knife
17	Safety Certification	i. Various fire detection and prevention systems and devices are commercially available and use of these is good practice. They include detectors for heat and smoke; fixed water-sprinkling system, inert gas snuffing systems smoke release valves, flameproof barriers, fire breaks formed by the separation of chambers, etc. All devices used shall have been tested at low temperatures and shown to be satisfactory. ii. Certification for safe storage of ethylene and for system for prevention of ignition and explosion from competent authority, as per statutory requirement, if any, must be taken. Similarly, safety for workers against suffocation must be ensured. Certification from following Certification Authority is necessary. a) Factory Inspector b) Fire Fighting Inspector c) Electrical Safety Inspector

Sources: National Horticulture Board: - Technical Standards and Protocol for the fruit Ripening Chamber in India

Annexure –III & IV

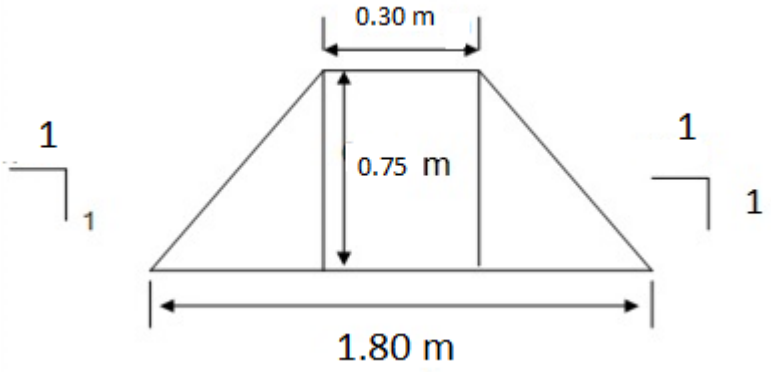
Watershed approach Specified in Guidelines

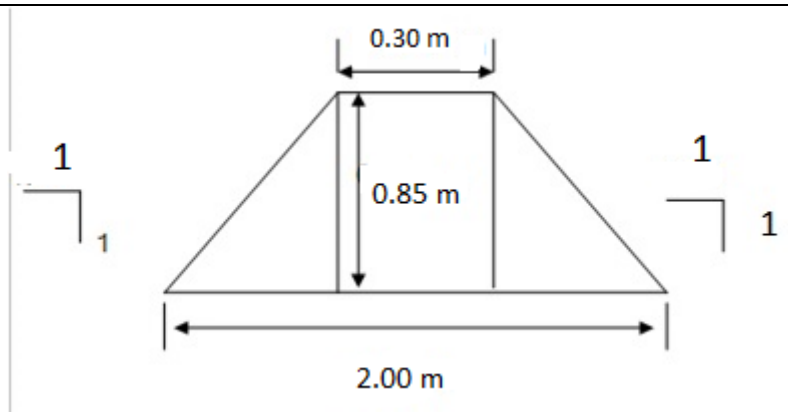
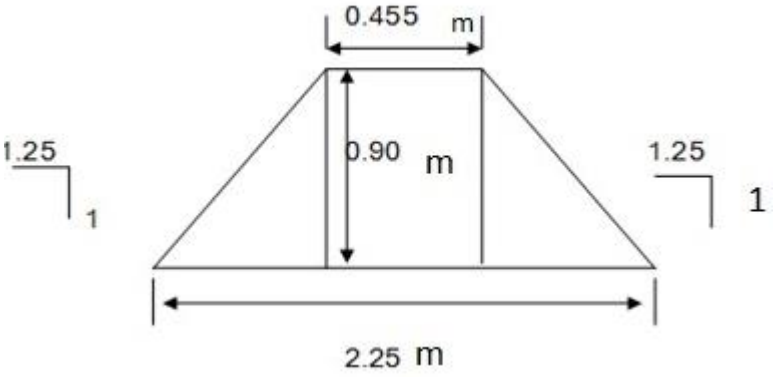
A)Compartment Bunding

Selection of Site-

1. It is a common treatment.
2. Compartment Bunding Treatment is effective for treated as well as non-treated area.
3. Treatment should be executed for area receiving less than 750 mm average annual rainfall
4. Treatment is most appropriate where the slope of the land is upto 4%.
5. Compartment Bunding should be avoided in CCT or TCM treated areas

Diagrams-

Slope - 0 to 4, Soil- Shallow		cross section - 0.80 sq. m

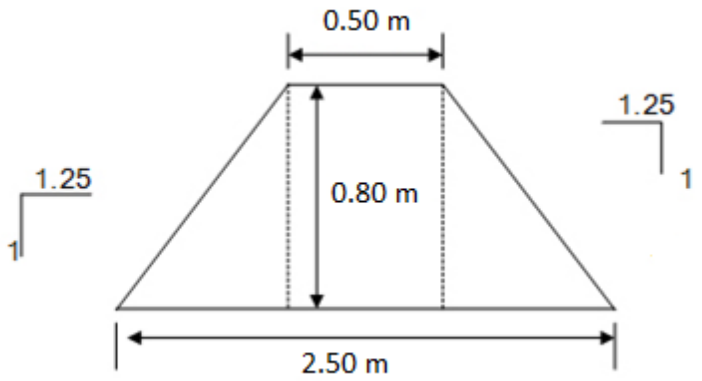
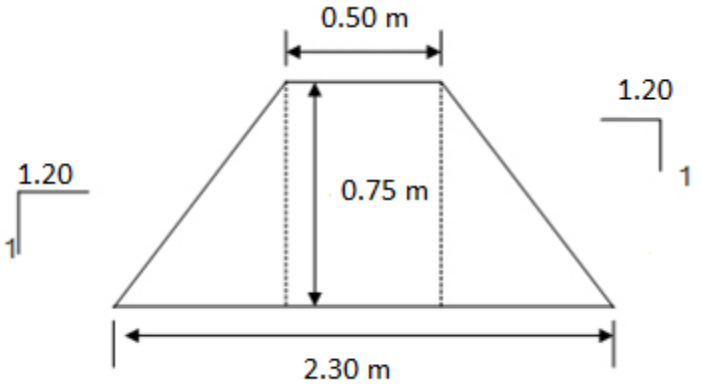
Slope - 0 to 4, Soil- Medium		cross section - 1.00 sq. m
Slope - 0 to 4, Soil- Heavy		cross section - 1.20 sq. m

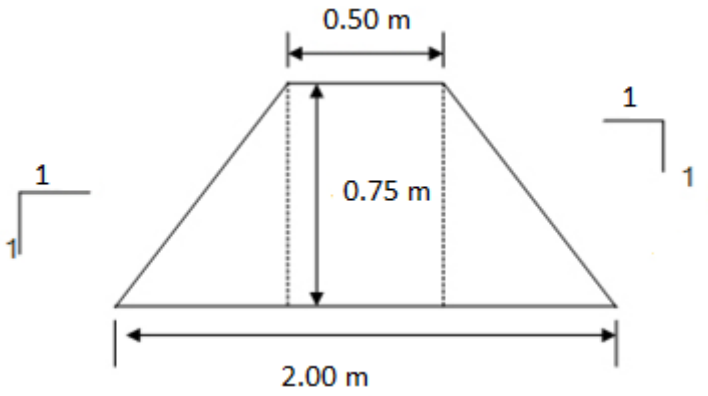
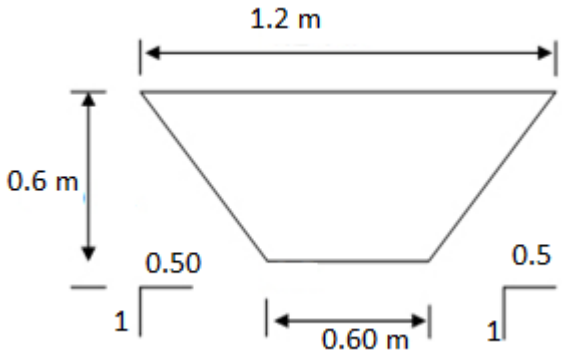
Slope and soil type	Technical Specifications						
	base width (m)	base height (m)	crest width (m)	side slope (m)	trans section of bund (sq m)	length of bund (m)	outlets (no.)
Slope - 0 to 4, Soil-Shallow	1.8	0.75	0.30	1:1	0.80	200	3
Slope - 0 to 4, Soil-Medium	2.00	0.85	0.30	1:1	1.00	200	3
Slope - 0 to 4, Soil-Heavy	2.25	0.90	0.45	1.25:1	1.20	200	3

B) **Graded Bunding**

Objectives-

1. To check soil erosion
2. To slow down the runoff velocity
3. Ground recharge through water percolation

Heavy Soil		cross section - 1.20 sq. m
Medium Soil		cross section - 1.05 sq. m

Shallow Soil		cross section - 0.95 sq. m
Figure of Farm Trench		Cross section of trench - 0.54 sq m Length of trench - 80.00 m

soil type	Technical Specifications							
	base width (m)	base height (m)	crest width (m)	side slope (m)	trans section of bund (sq m)	length of bund (m)	hay outlets (no.)	farm trench (cu. m)
heavy soil	2.5	0.80	0.50	1.25:1	1.20	95	2	43.20
medium soil	2.30	0.75	0.50	1.20:1	1.05	165	3	43.20
shallow soil	2.00	0.75	0.50	1:1	0.95	210	4	43.20

C) **Continuous Contour Trench**

Objectives-

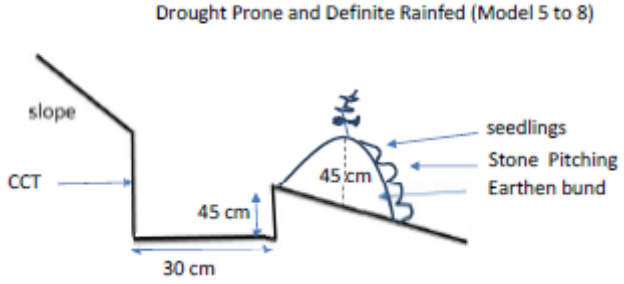
1. To check soil erosion
2. To slow down the velocity of rain water flowing along hill slope
3. To enhance water percolation by trenches and plantation
4. To bring waste land under cultivation
5. To develop marginal treatable waste land substantially

Selection of site –

1. CCT are generally followed on culture able waste land.
2. Approval of waste land holder is necessary.
3. CCT are followed in upper and middle reaches of watershed having slope up to 33%.

Technical specification -

1. Trench Bottom width - 0.60 m
2. Trench depth - 1.00 m
3. Trench top width - 1.90 m
4. Per hectare Trench Length - 102 m



D) **Deep CCT:**

Objectives-

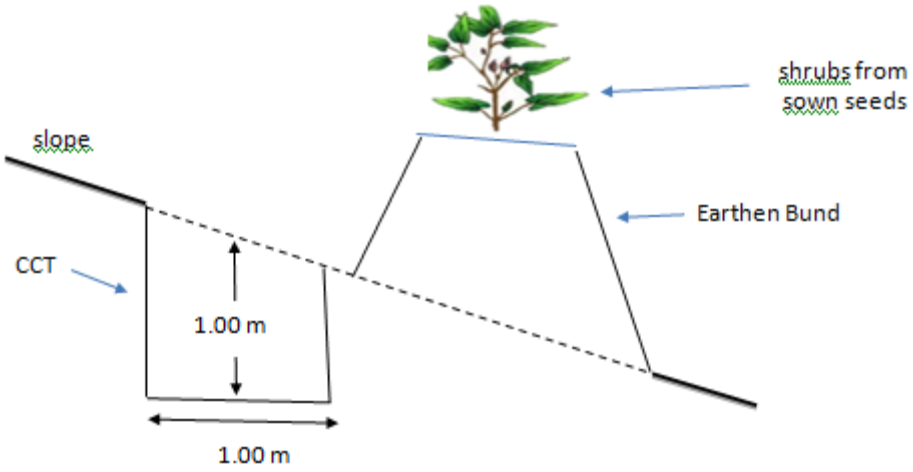
1. To check soil erosion
2. To slow down the velocity of rain water flowing along hill slope
3. To enhance water percolation by trenches and plantation
4. To bring waste land under cultivation
5. To develop marginal treatable waste land substantially

Selection of site –

1. Deep CCTs should be followed in watershed area selected under watershed development scheme.
2. Deep CCTs are constructed on land having slope upto 33%.
4. Deep CCTs should be followed on interested farmer's land who gives Pre Approval in written
5. Beneficiary should be ready to take care and protect plantation along trenches.

Lay out of Construction of Deep CCT

1. Conduct survey of waste land by 30mx30m and get contour lines on toposheet accordingly
2. Using dumpy level, prepare contour line toposheet by 30mx30m and make it sure that slope of land is below 8%.
3. Mark nala, channel, other specific thingss on toposheet; write survey numbers; draw a line to differentiate the toposheet as per local specific condition; name each part as A, B, C, D,...
4. Deep CCT should be planned on contours only.



E) Ground Water recharge using Tube Well

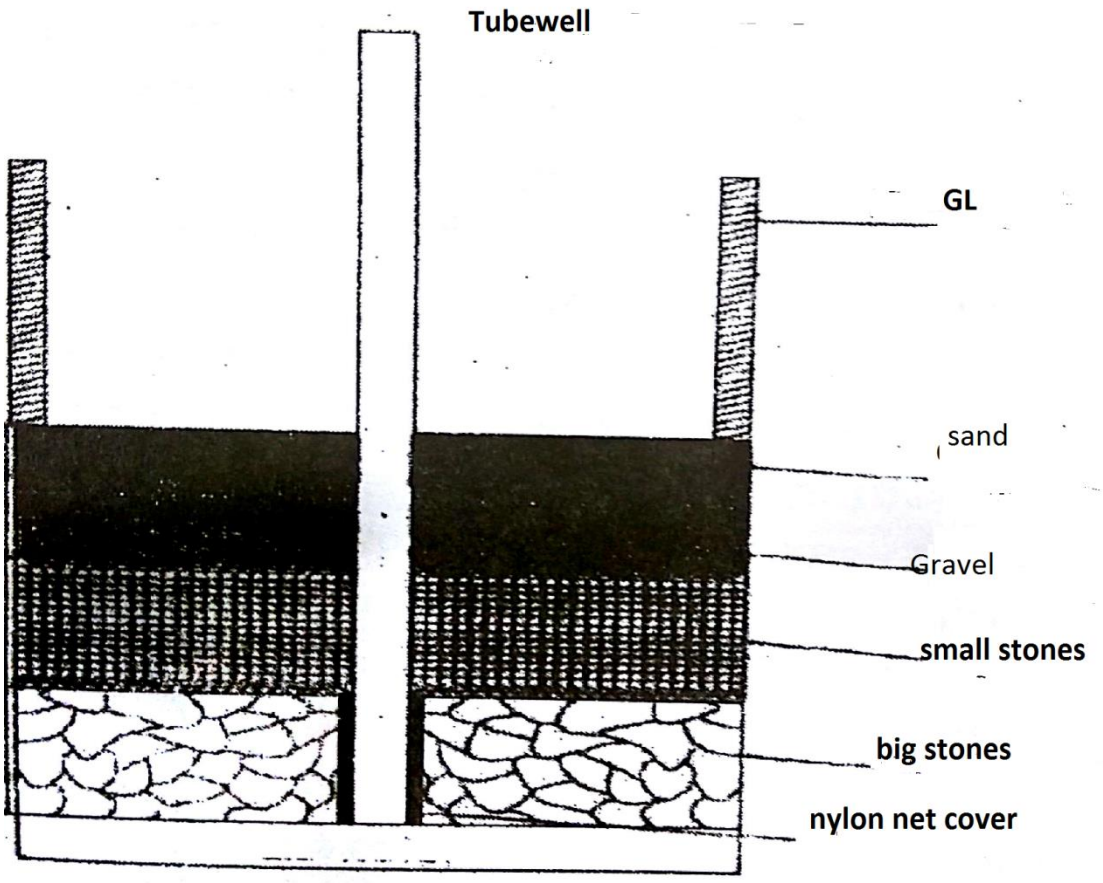
Methodology-

1. Divert stream water near tube well.
2. Pit having size 2x2x2 m is dug around tube well.
3. Holes are made on casing pipe up to ground level at intervals of 1-2 cm.
4. Cover holes with gunny bag.
5. Stones, gravels, sand and cleaned clay should be filled in pit from bottom to top to facilitate filtration.

Precautions-

1. Use Clean, chemical free and salts free water.
2. Industrial waste water should not be used.
3. Filter consisting Stones, gravels, sand and cleaned clay should be cleaned before rainy season.

(pl use following dia.)



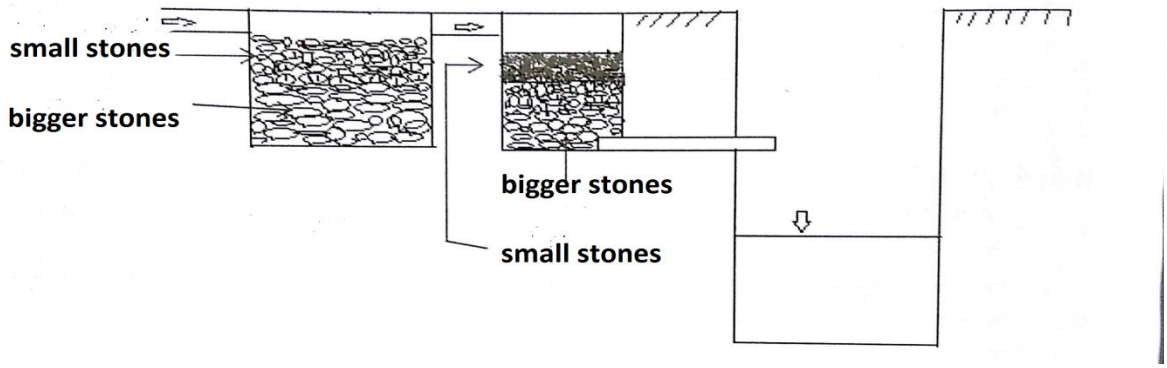
F) **Well Recharge**

Objectives-

1. Facilitate ground water recharge
2. Enhance the quality of water
3. Improvement in rural livelihood.

Technical specification-

1. Cluster approach according to irrigation and drainage
2. Well should be deep enough and bed rock must had be broken in order to facilitate artificial ground water recharge.
3. Those wells should be selected which could retain minimum water for rabi or water table in moth of October is below 4 m.
4. Select most of the wells of the village for artificial ground water recharge to fulfil the need of village.
5. Saline, low lying land and polluted area should be avoided.
6. Do not allow 1st rain shower and muddy water to enter in filter.
7. Dig trenches to insure availability of water for artificial ground water recharge with the help of beneficiary.
8. Avoid flooded situation.



Annexure-V

A) Farm Pond-

Objective-

The main objective of farm pond is to harvest rainwater, which otherwise would have flowed out of the field. There may be long dry spell induring rainy season. Such prolonged dry spells may actually ruin the kharif crop. The farm pond would be goo source for protective irrigation to avoid crop failure.

Benefits of Farm pond-

1. Enhance ground water recharge
2. Protective irrigations in contingency situation
3. Supplementary irrigations increases crop productivity
4. Minimise the problem of water logged soils
5. Multiple enterprises like fish culture, duck farming increases farmers' income.
6. Food security by enhancing the crop productivity and climate resilience.
7. Facilitate ferti-gation, spraying operations etc.

Types of farm ponds-

1. Dug out type
2. Dugout cum embankment type
3. Spring or creek fed ponds
4. Off stream storage pond

Selection of site-

1. Soil of the dugout should be impermeable so that water can be stored for longer time.
2. Not appropriate in every project of Irrigation Department
3. Soils like Clayey soil, saline soils, gravelly soil and soils with porous rocks are suitable
4. Rainfall should be taken into consideration to determine size of farm pond.
5. Watershed area should be appropriate with farm pond size.

6. Farm pond can be dug out on upper side of terracing.
7. Land slope should be up to 3%.
8. Farmers intervention and pro-activeness is important.

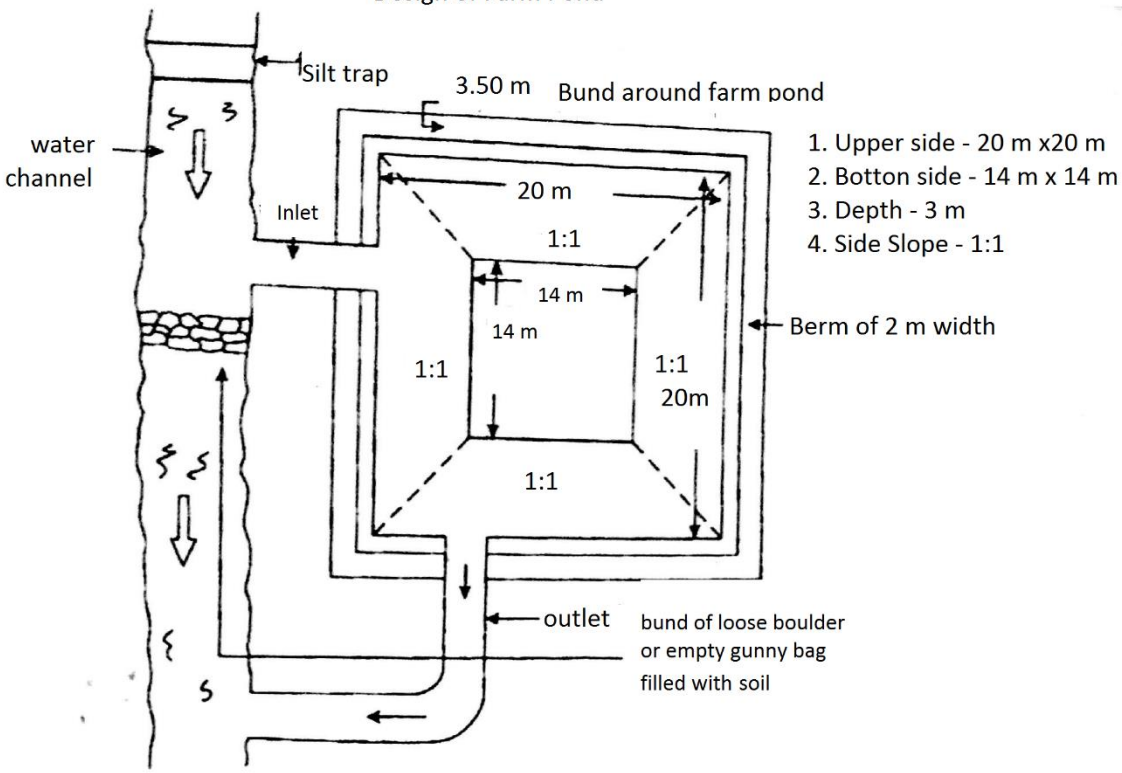
Different sizes of farm ponds-

Farm pond size is depend upon watershed area and drainages-

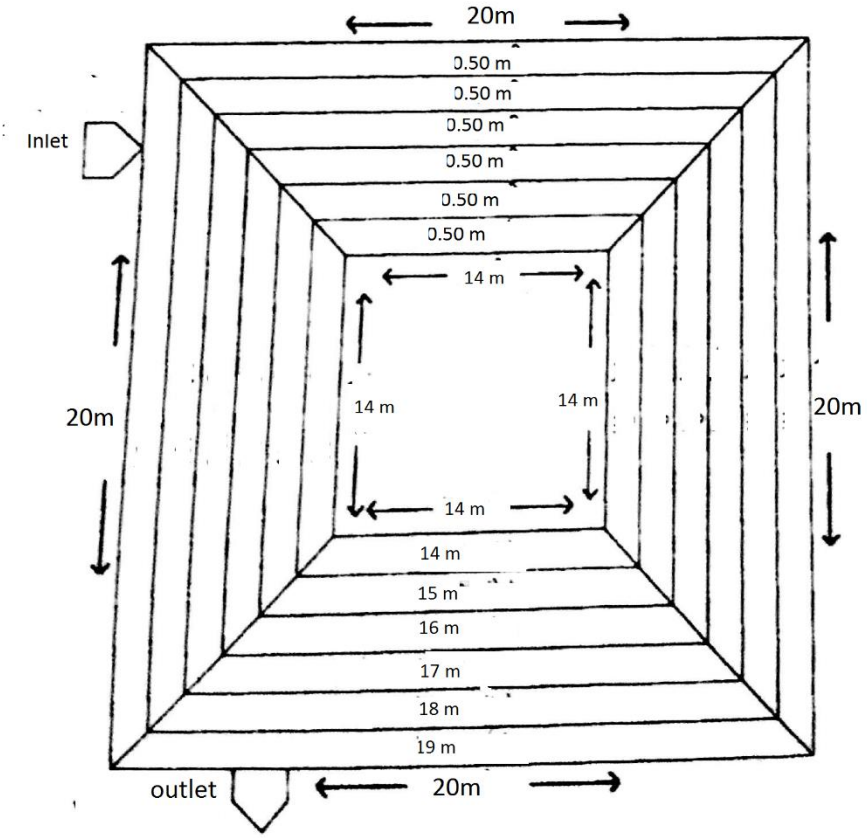
Sr no	Size of farm pond (m)	Water storage (TCM)
1	30x30x3	2.196
2	25x25x3	1.791
3	25x25x3	1.461
4	25x20x3	1.131
5	20x20x3	0.876
6	20x15x3	0.621
7	15x15x3	0.441
8	15x10x3	0.261
9	10x10x3	0.156

If we want to provide 10 cm of protective irrigation to the crop over 1 hectare, we need 1000 cum of water. Volume of water required = Area to be irrigated x depth of irrigation = 1 hectare x 10 cm. = 10,000 sq.m. x 0.1m. = 1000 cum. A DOP whose dimensions are 25m x 20 m x 2.5 m will yield this amount of water. Such a DOP will occupy 25m. x 20m. = 500 sq.m. in 1 hectare, i.e., 5% of the area to be irrigated (500/10,000 = 5%). That is why this is sometimes referred to as the 5% model.

Design of Farm Pond



Plan of Farm Pond



B)COMMUNITY FARMPONDS

1. BENEFITS OF POND LINING WITH PLASTICS FILMS:

- Reduction in seepage losses to the maximum extent (95%)
- Harvesting and storing of rain water from early monsoons.
- Utilization of harvested rain-water for short during crops as well as during off season.
- Lining of ponds and reservoirs with plastics film improve water availability over a longer period of time.
- It is highly useful in porous soils where water retention in ponds and water harvesting tanks is minimal.
- Economical and effective method of storing water.
- Eliminates water logging and prevents upward intrusion of salts into stored water.
- Prevents soil erosion.
- Technique is also suitable for lining of effluent ponds and channels to reduce soil and ground water contamination.
- It can also be used in the lining of saltpans for improving productivity as well as quality of salt.
- The water from bore wells, canals during the rainy (peak) season can be stored in these ponds and which can be used during lean season.

2. GENERAL CRITERIA FOR POND CONSTRUCTION (RECOMMENDED BY NCPAH):

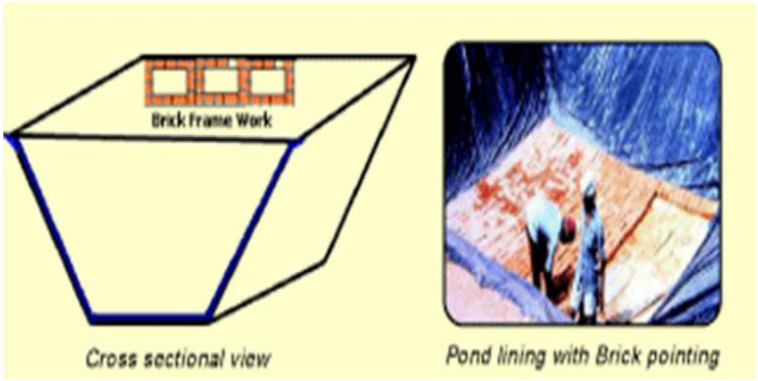
- **Survey of water resources/catchments:** The most important factor for designing farm ponds is water source. There should be enough water available either by perennial, seasonal, runoff through watershed areas or by other sources to fill the pond.

- **Selection of Site:** Site should be selected from where maximum area can be covered for supplemental irrigation of the water stressed crops. The natural tendency of soil and elevation should also be taken into consideration.

- **Selection of size of tank**: The selection of size of tank is very important depends on the irrigated area, sources of water available, types of soil, frequency of irrigation and volume of water required etc. The slope and shape of trapezoidal pond depends on the types of soil and its topography.

- **Depth of pond**: Depth of the pond should range from 3 to 5 m. Greater than 2 m of depth are advantageous as the surface area is less resulting in minimum evaporation loss and maintenance hazard. If sufficient land is not available, this can be off set to some degree by increasing the depth of the pond.

- **Slope of pond**: Slopes lies “between” 1.5V:1H to 3V:1H have been recommended for clay to sandy loam soil.



DESIGN CRITERIA OF POND:

Design criteria for constructing farm pond play an important role that includes excavation, slope, shape, leveling and compacting the soil after considering all general criteria. The following parameter should be kept in mind while designing a pond.

A) Preparation of pit:

- Mark out the outer corner of the selected field using pegs
- Measure the bottom dimension of the pond by calculating depth and slope ratio. It appears in center of the outer corner of the selected site and marked it before excavation process.
- Excavate marked area first up to desired depth.
- After that, excavate rest area in inclined manner from one edge of bottom to top of the outer edge of same side and repeat the same for next three sides.
- Spread the excavated soil in the depressions for leveling and also on edges to make bunds of desired height from ground level.
- Level the excavated pond in order to suppress the angular projection
- Cut soil must be sealed or compacted unless the site is dug into a tight, clay formation so that film could be saved from puncture caused by these projections.
- After compaction, the whole area of pond should be treated with 4% atrazine (Weedicide solution) so that the plastic film could be saved from puncture caused by root infestation.
- After that all surface of pond should be smoothened properly.
- Excavate a trench of one cubic feet size on top of the bund at distance of 0.75 - 1.0 m from the inner edge of the pond for anchoring the HDPE film.

B) HDPE (high density poly-ethylene, with carbon black)

This lining material shall be UV light resistant and one of the best available to last many years (generally 100 plus). It is used in lining under gasoline storage tanks, public dumps, toxic settling ponds, aquaculture ponds, etc. It can be heat-welded together. A minimum of 0.5 mm (500 micron) film is best suited for regular ponds.

C) Laying of HDPE films:

For laying of HDPE films minimum of 0.5mm (500 micron) film are best suited for lasting of film and the following procedure are taken into consideration:

- Choose the film as per BIS /ISI mark (IS: 15351 / IS: 10889 / IS: 2508)
- Use minimum of 500 micron black HDPE film
- Calculate the film requirement for dugout pond and cut it accordingly
- Measure and cut the film as per calculation.
- HDPE films manufactured into panels of standard widths. Therefore convert the film into a single sheet as desired either mechanically by heat-sealing machine like Hot Air fusion welding machine or manually (by overlapping 15 cm of the edge of two sheet and scrubbed lightly using emery paper or sand paper (120 grade) using bitumen/Synthetic Rubber adhesive No -998 made by fevicol so that it fit exactly to fit into the pond.
- Monitor the film in sunlight for searching/puncture hole if any, sealed the hole with bitumen/adhesive or by heat-sealing procedure.
- The ends of the film at the surface have to be firmly buried in a trench at the bank of the pond to avoid sagging in of the film.
- Care should be taken to avoid the wrinkles and film must be pleated at the corner.

D) Pointing over the film

To protect the film from damage pointing over the laid film is required. Generally locally available material / easily available material to be used

- Over laying works can be done in many ways but most suitable and economic ways are one of them is overlaying brick alone completely on all four sides, bunds and bottom of the lined tank. Secondly construct a brick work frame of size 2’ x 2’ and place mortar of cement and soil (1:8) inside the frame.
- Install water inlet and outlet pipes duly fixing them in brick masonry post over laid plastic film and to measure the discharge of water from the tanks, a ‘V’- notch weir can be constructed.
- Drainage channel all along the border of the field is formed according to the gradient/slope.
- Live grass/ Turf is established on the bunds of the pond to prevent soil erosion.

E) Cost economics of pond:

Sl.No.	Work components	Pond No 1
1	Dimension of pond	100 m x 100 m
2	Bottom dimension	91 m x 91 m
3	Depth of pond	3 m
	Slope	1.5:1
4	Capacity of pond	27420 m^3
5	Excavation and spreading the soil in depressions and on bunds	Rs. 572800/-
6	Lining with 500 micron PE film	Rs. 634040/-
7	Formation of brick pointing / frame work (2' x 2') and over laying with cement and soil (1:8)	Rs. 204500/-
8	Labour, fixing, jointing, anchoring etc	Rs. 275675/-
9	Laying charges & others	Rs. 60/-
10	Total cost (Rs)	Rs. 1687015/-

18. DO'S & DON'TS:

- Site selection must be at appropriate place of water sources
- Cultivable command area should be near the pond.
- Avoid hard rock area, it will be labour expensive and angular projection in dugout pond may damaged the laid films.
- Level the excavated pond in order to suppress the angular projection
- The top layer of tank basin sub grade should be compacted to at least 90% of proctor's density by mechanical equipment like vibratory compacter or by other suitable equipments.
- Any weak and soft spots present shall be removed and shall be replaced with compacted fills.
- Standing water or excess moisture in dugout pond should not be allowed for laying of films.
- Films rolls should be packed properly and should be of ISI marked.
- Keep the film rolls in original packing prior to actual use or laying the film
- See the uniform pressure is applied while sealing the film
- Don't handle roughly and don't drag the film rolls as they may get damaged in the process.
- Don't walk on the film while lining operation is in process to avoid any damage to the film
- Don't slide cover overlaying material like bricks, tiles etc. on the film to avoid any damage and displacement.
- Don't use hooks for lifting the rolls of film
- Don't use reprocessed HDPE films as the quality is not guaranteed and may lead to premature failure of the film.

Annexure-VI

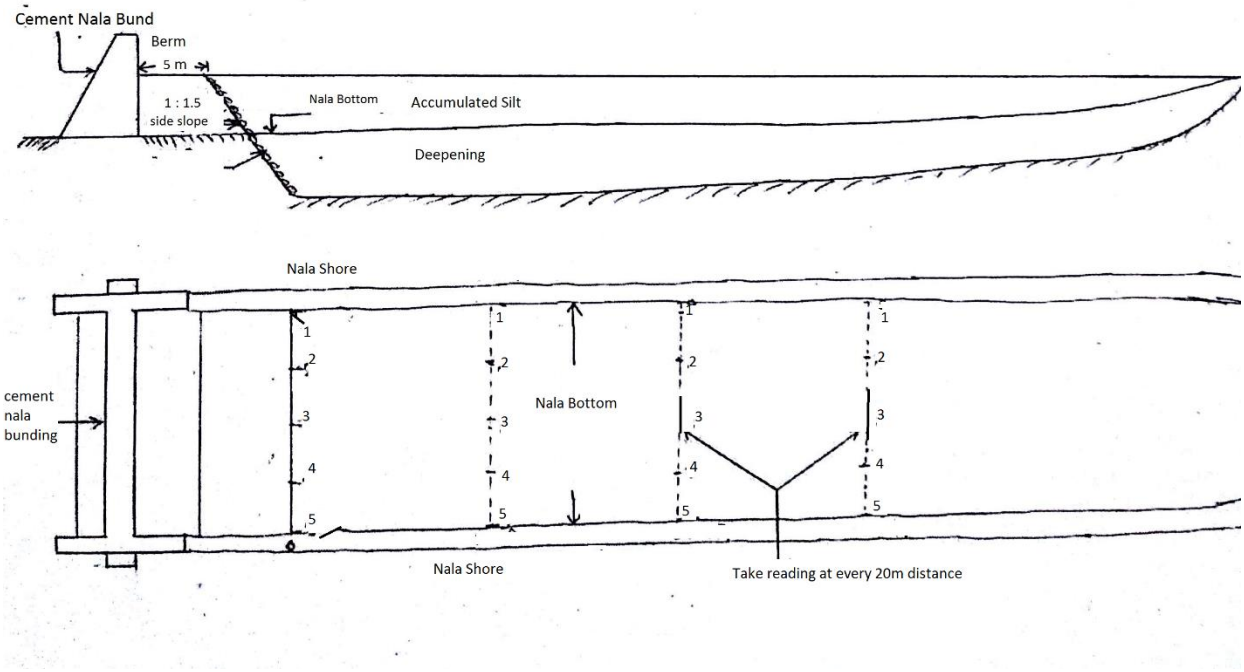
Desilting of Cement nala bunds

Objectives-

1. To harvest surface runoff
2. Recharging of ground water
3. To retain water carrying capacity of stream
4. Flood water removes away fertile top cover of soil. Desilting of bunds avoid spread of flood water in surround area and minimise fertile soil erosion.
5. Heavily silted bunds become useless. Desilting of bunds can retain more water and thus avoid excess expenditure on construction of new bunds in down stream.
6. Provide drinking water
7. Generation of rural employment and improvement in rural livelihood.

Technical and Financial specification –

In Maharashtra basaltic rocks, metamorphic rocks, sedimentary rocks are found in 96% of total area. While alluvial terrain is present on 4% of area. Methodology varies accordingly. Hence, Financial specification is as per Regional Schedule of rates. Use of machinery is mandatory.



Desilting of nala

Annexure No. VII

Drainage Line Treatment

Loose Boulder Structure

Objectives –

1. To reduce the water flow rate
2. To reduce soil erosion;
3. To trap silt for slowing down the rate of siltation in water bodies in the lower reaches of the watershed. It enhances conversion of waste land into cultivable land.
4. To induce water recharge
5. Plantation around the LBS will helps in increasing vegetative cover.

Types of Loose Boulder Structure –

According to Watershed area

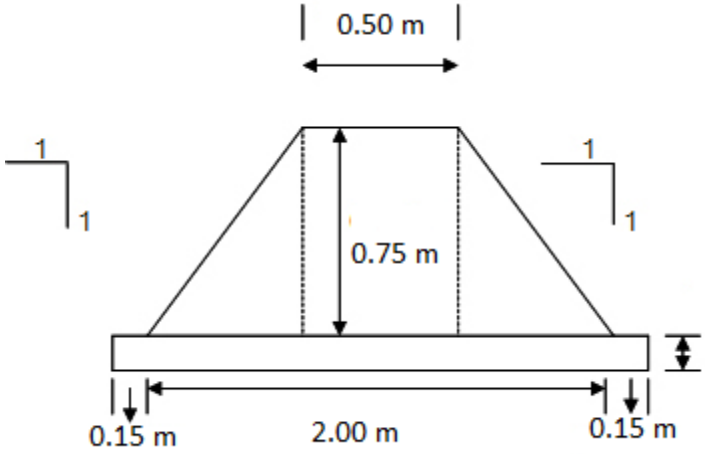
Sr no	Boulder structure type	Watershed area	Height of Watershed area
1.	Small Loose Boulder Structure	Up to 5 ha	0.75 m
2	Large Loose Boulder Structure	5 to 10 ha	1.00 m

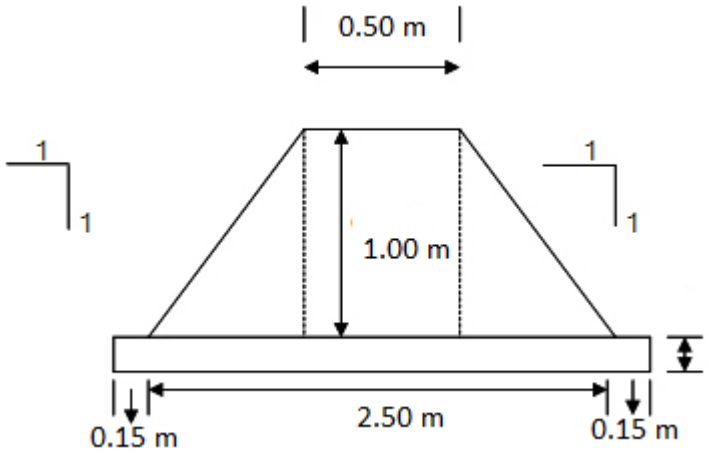
Site Selection –

1. The independent catchment should not be more than 5 ha for small LBS and should be between 5 to 10 ha for large LBS.
2. Place of LBS is to be decided as per L -section drawn as per gully or channel. The height of the embankment at the location of the structure must be at least equal the maximum depth of flow in the stream plus

the design height of the structure in the central portion of the drainage line or simply height between upper and lower embankment should be adjusted more than 1m.

3. LBS should not be located in nala, lake or open rock.
4. Boulder checks should be made where boulders are available in large quantities in the requisite size.

Upper Reaches		Cross section of bund - 0.94 sq m Depth of base - 0.30m

Middle Reaches		Cross section of bund - 1.50 sq. m Depth of base - 0.30m

Slope grouped	technical specification				
	base width (m)	bund height (m)	crest width (m)	side slope	TS of bund (sq. m)
upper reaches	2.00	0.75	0.50	1:1	0.94
middle reaches	2.50	1.00	0.50	1:1	1.50

Gabian Bandhara

Objectives-

1. To reduce the water flow rate
2. To reduce soil erosion;
3. To trap silt for slowing down the rate of siltation in water bodies in the lower reaches of the watershed. It enhances conversion of waste land into cultivable land.
4. To induce water recharge

Selection of site-

1. Stability of the embankments is the primary consideration. The less stable and more erodible the material on the embankments, the weaker the structure is likely to be. In such a situation, making the structure stronger would render it too expensive.
2. The width of the gabion must not exceed 2 metres
3. Embankments should not be on turn of nala.
4. Site should be between upper and middle reaches of watershed.
5. Gabian Bandhara is meant for soil conservation. The height of the embank -ments should not be less than 1 m or less than 1/3 of the depth gully.
6. The material composing the bed of the drainage line upstream of the structure should not be completely impermeable.
7. It is ideal for gully's where other structures are not workable.
8. It is most suitable above the site CNB/ Nala bandh, digged pond

Diagram-

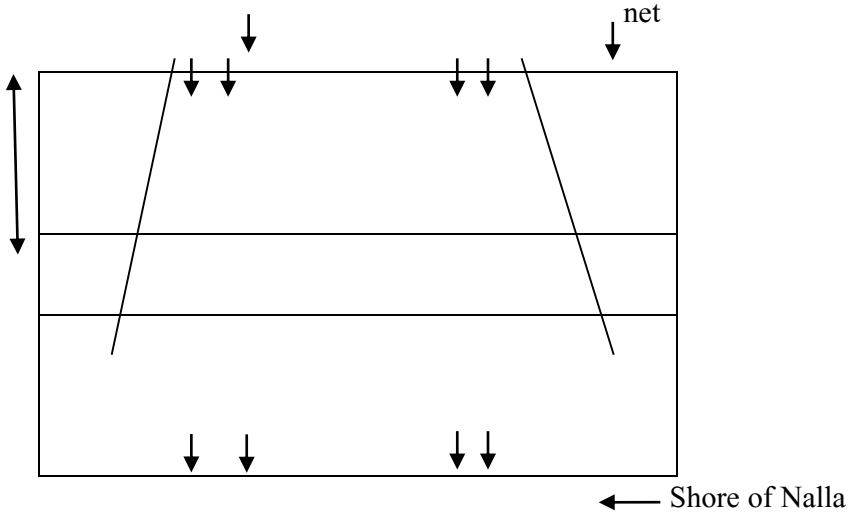
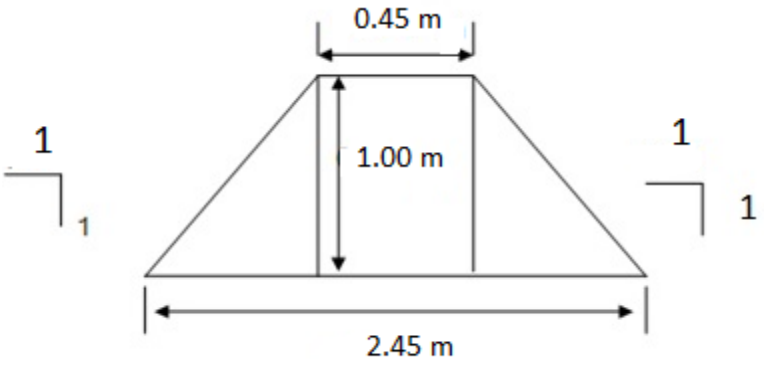
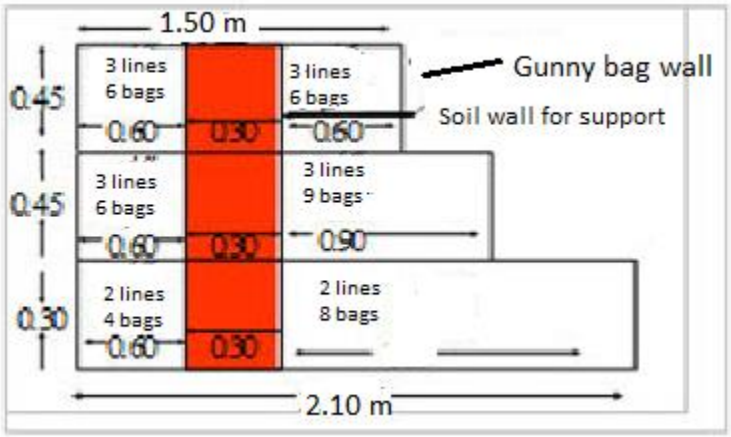


Figure	 Cross section of *Bundhara*	Cross section of bund - 1.45 sq. m

Vanrai Bhandara

Selection of site -

1. Vanrai bandhara can be constructed in catchment area as well as in non-catchment area.
2. Narrow and deep stream is chosen for constructing bunds. Stream should have sufficient flowing water.
3. Bottom slope should be in the range of 2-3%.
4. Height of vanrai bandhara should not exceed 1.5 m.
5. Vanrai bandhara should be near village/ hamlet. It should not be constructed in any irrigation project area.



Earthen Nala Bund

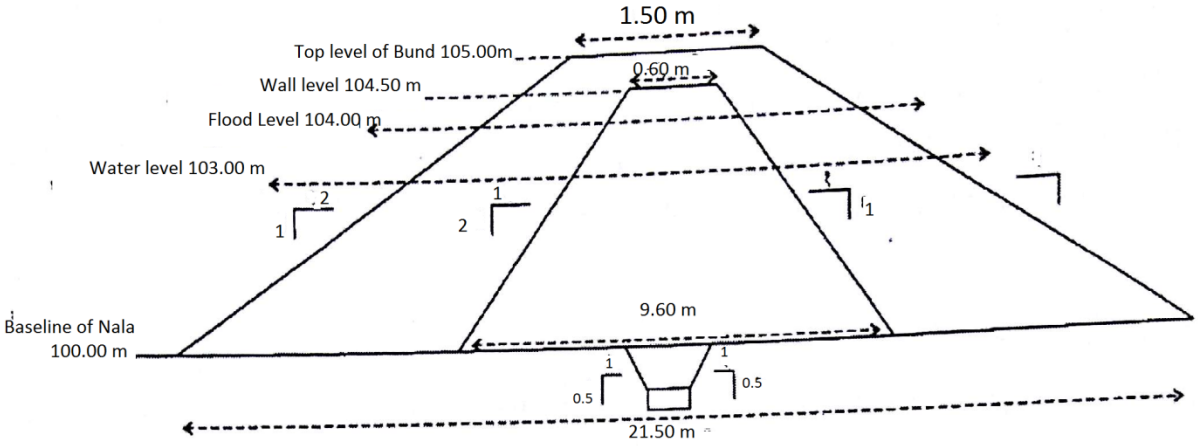
Objectives-

1. It is suitable for both flood control as well as gully control.
2. Velocity of runoff is greater in nala or gully due to heavy rainfall which erodes shores and increases adjacent pan of nalla. Earthen nala bunds are placed in gully or nala to restrict its widening.
3. Percolation dams are constructed for recharging groundwater. Such structures are usually made on the upper part of the catchment area. Water stored here percolates to wells and tube wells located in the lower part of the catchment.
4. The kharif crop needs to be drought-proofed through 'protective' irrigation, applied to overcome soil moisture deficits within the rainy season. Such structures are especially important in areas which are poor in groundwater resources and which do not have access to canal irrigation.
5. Drinking water source for cattle.

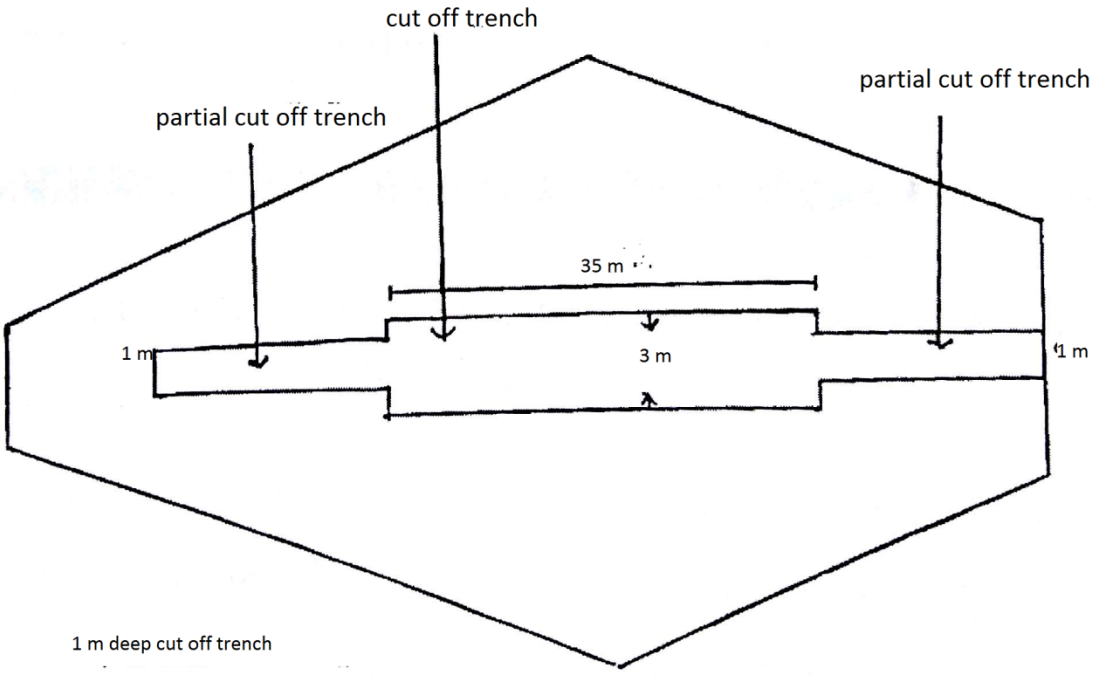
Selection of site-

1. Embankment is suitable for nala's having catchment area between 10 ha to 500 ha.
2. Downstream slope should not be more then 3%.
3. Stream width should not be less than 5 m.
4. Stream depth should not be less than 1 m.
5. Water logging condition should not happen after ENB.
   pH of soil should be 6.5 to 8.
6. Embankment should be constructed where stream is narrow in order to reduce earthen work.
7. Non sloppy land should be above embankment to facilitate more retention of water.
8. Excavation for bund construction should be done at a place where hard rock is found.
9. Avoid a site near electric poles or just below the electric wires.

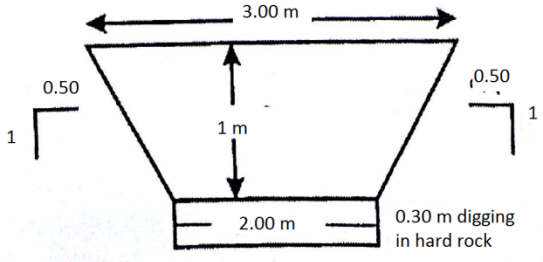
Earthen Nala Bund
Model No. 7
Water Level 3.00 m



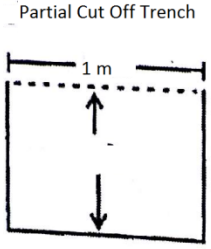
Cut Off Trench



1 m deep cut off trench



Eg.
1. Model 3 to 7
2. Hard Rock above 1.00 m



10.

Cement Nala Bund

Objectives-

1. To check soil erosion
2. To slow down the velocity of runoff
3. To enhance percolation of water in order to improve local soil moisture profile
4. Increase area under irrigation
5. Minimise soil erosion from hill and due to flood
6. Increase water table in wells
7. Protective irrigations

Selection of site-

1. Suitable for watershed area between 40 ha to 1000 ha.
2. Bottom slope of stream should not be more than 3%.
3. Bottom width of stream should not be less than 3 m and more than 50 m.
4. The banks of the drain should be high and firm.
5. Construction of bund should be done in hard rock.
6. More suitable for area where earthen naala bund is not preferable.
7. Water logging should be avoided. Flood line should be taken into consideration.
8. Prohibit silting of CNB.

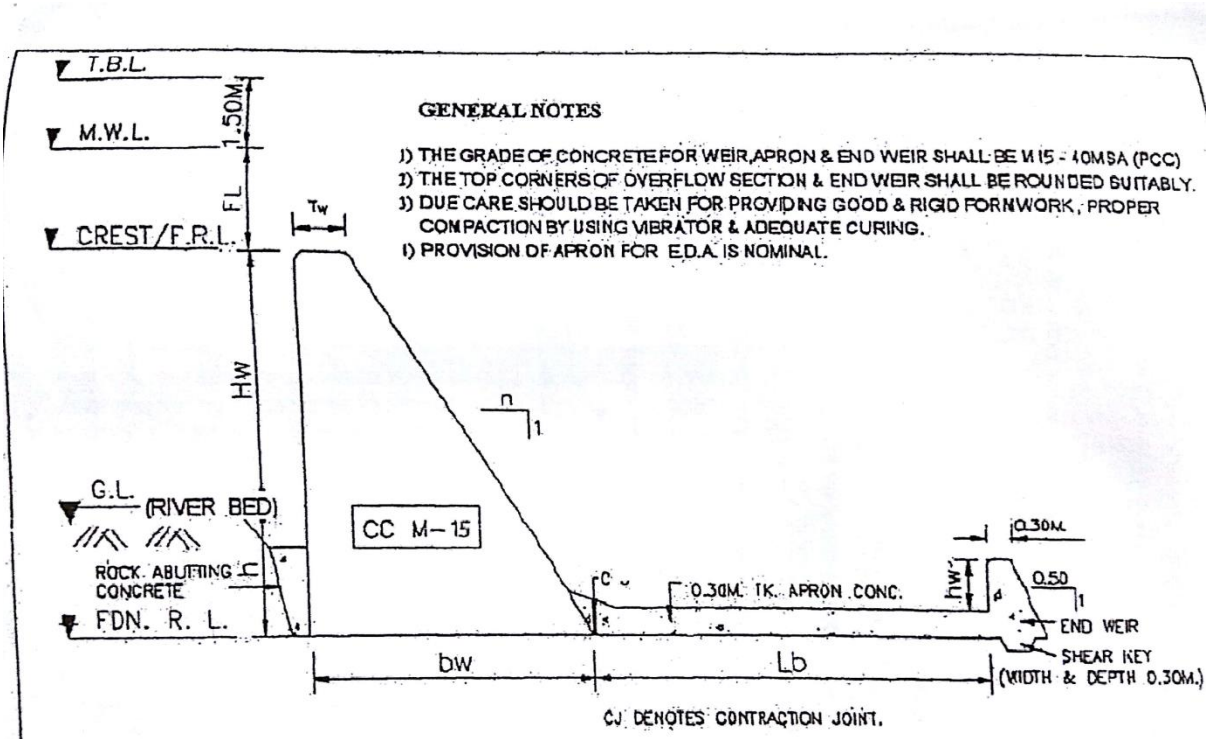


FIGURE SHOWING TYPICAL SECTION OF WEIR

Contingency planning approach for PoCRA project

Contingency planning steps and approach

A two stage contingency planning approach is suggested for CRA project. The detailed approach and steps for the two stage Contingency Planning is presented below.

Stages	***Timeline***	***Task***
Stage - I	First year of the CRA project	- Adaptation of CRIDA contingency planning (at district level)
Stage - II	Second year of the CRA project (for the remaining part of the project)	- Constitute "Contingency Plan Expert Committee" - Develop Real Time Contingency Plan (RTCP) for cluster of village - Implement and monitor

STAGE – I: Contingency planning – Year – I

Step 1	Select the districts under CRA project
Step 2	Select the CRIDA contingency plans for the district – cropping systems + agronomic practices + water management for different rainfall scenarios
Step 3	**Workshop:** Conduct workshop involving CRIDA + SAU + KVK in 2 divisions (Vidharbha and Marathwada) + climate change experts **Objective:** To discuss and modify if necessary CRIDA contingency plans, based on the experience SAUs and District KVKs
Step 4	**Communication Strategy**: Develop information dissemination strategy and plan to communicate to farmers the contingency plans
Step 5	**Seed Supply**: Organize seed supply and other services
Step 6	**Monitor and assess:** The effectiveness of the contingency plans in building resilience in the farming community of the project area

Stage - II: Real Time Contingency Planning

Sl No	***Task***	***Institution***
1	Workshop to evaluate "CRIDA" approach and develop approach and methodology for Real Time Contingency Planning for ***Cluster of Villages*** specific contingency plan development	PMU
2	*"Contingency Plan Expert Group"* – Form Contingency Plan Expert Group for each project region involving - Scientists from the respective SAU + CRIDA experts + climate change experts + seed supply agency + other experts as required	PMU
3	Generate all the data required for contingency planning at Cluster level – historical rainfall + climate change rainfall projections + soil + water balance + other factors. *Develop Contingency Plan database* for each cluster.	KVK, SDAO, Cluster Assistant
4	Develop a set of climate or rainfall and cropping system scenarios – along with recommended crops + agronomic practices + water management + other practices. Develop Decision Support System for selecting Contingency Plans	Contingency Plan Expert Group
5	Develop contingency plans for each of the three regions of the CRA project area by involving the local SAU; by using the *Contingency Plan database* and the weather prediction data from IMD.	Contingency Plan Expert Group
8	Expert workshop during March-April every year to develop a set of contingency plans at Cluster level.	Contingency Plan Expert Group
9	Contingency Plan Expert group – to continuously monitor on a fortnightly basis the rainfall events and sowing practices on the ground based on some sample of villages surveys	Contingency Plan Expert Group
10	Contingency Plan Expert Group – to meet and modify the contingency plan based on the progress of the monsoon and farmers response – on a fortnightly basis during June – July and on monthly basis during August - December.	Contingency Plan Expert Group
11	Organize seed supply according to the contingency plan recommendations	DPMU
12	Periodically monitor the effectiveness and impact of "Real Time Contingency Plans"	External agency

Annexure No. IX

Staffing Structure

Sr.No.	Designation	Pay Scale/pay(per Month)	No. of posts
PMU			
1	Project Director	37400-67000(10000)	1
2	Dy. Project Director	15600-39100(6600)	1
3	Assistant Project Director	15600-39100(5400)	1
4	Agronomist	15600-39100(6600/5400)	1
5	Soil Scientist	15600-39100(6600/5400)	1
6	Agril. Engineer	15600-39100(6600/5400)	1
7	Hydrologist	15600-39100(6600/5400)	1
8	Finance Specialist	15600-39100(6600/5400)	1
9	Procurement Specialist	Up to Rs.150000	1
10	Monitoring & Evaluation Specialist	Up to Rs.150000	1
11	Sociologist	Up to Rs.150000	1
12	Agri business expert	Up to Rs.150000	1
13	GIS Specialist	Up to Rs.150000	1

14	Assistant (Deputation)	9300-34800 GP 4300	6
15	Assistant (Contractual)	Rs.40000	12
16	Stenographer	9300-34800 GP 4300/4400	2
17	Clerk cum typist	5200-20200 GP1900	6
18	Peon/ Messenger	Rs.25000	8
19	Account Officer	9300-34800 GP 4600	1
20	Asst. Account Officer	9300-34800 GP. 4400	2
21	Dy. Account	9300-34800 GP 4200	3
22	Account/Cashier	9300-34800 GP 4200	1
23	Account Clerk	5200-20200 GP 1900	6
24	Technical officer	9300-34800 GP 4400/4600	9
25	Environment Specialist	Rs.100000	1
26	Communication Specialist	Rs.100000	1
		Total	71
District Level			
1	Agril. Specialist	9300-34800 GP4400	15

2	Procurement Specialist	Rs.35000	15
3	Agri-business expert	Rs.35000	15
4	Project Specialist (HR)	Rs.35000	15
5	Project Acct. Assistant	Rs.25000	30
		Total	90
Subdivision Level			
1	Acct. Officer/ Asst. Acct. Officer	9300-34800 GP 4600/4400	36
2	Project Assistant	5200-20200 GP2400/4200	36
3	Project Acct. Assistant	Rs..15000	72
		Total	144
Cluster Level			
1	Cluster Assistance	Rs.15000	500
		All Total	**805**