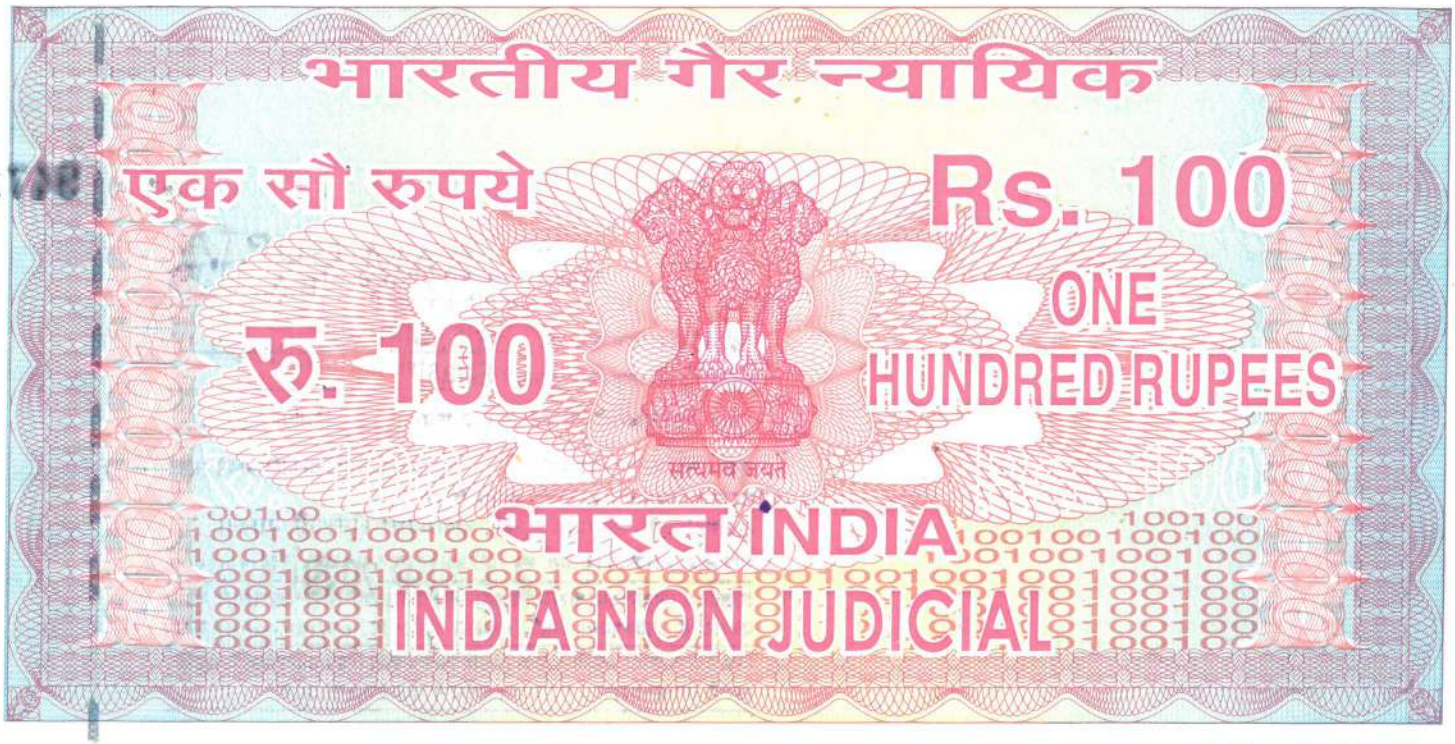

महाराष्ट्र MAHARASHTRA ◐ 2019 ◐ VV 498820

प्रधान मुद्रांक कार्यालय, मुंबई
प.म.नि.क्र. 6000090
17 SEP 2019
सक्षम अधिकारी
श्री. सी. टी. आंबेकर

MEMORANDUM OF UNDERSTANDING

BETWEEN

NANAJI DESHMUKH KRUSHI SANJEEVANI PRAKALP, GOVERNMENT OF MAHARASHTRA

AND

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
For

INTEGRATING ELEMENTS OF CLIMATE RESILIENCE IN MICRO-WATERSHED PLANS UNDER Project on Climate Resilient Agriculture (PoCRA)

This Memorandum of Understanding is entered into at Mumbai on **3rd of October 2019** hereinafter called 'Agreement' or 'MoU'.

BETWEEN

Nanaji Deshmukh Krushi Sanjeevani Prakalp (NDKSP), Government of Maharashtra represented by Project Director (hereinafter referred to as **'First Party'**) having its office located at 30B, Arcade, World Trade Centre, Cuffe Parade, Mumbai- 400005 which term and expression shall mean and include, unless repugnant to the context, its successors, assignees, administrators of the First Party

AND

Indian Institute of Technology Bombay (hereinafter referred to as **'Second Party'**), represented by Dean, Research and Development, IIT Bombay, having its registered office at Powai, Mumbai 400076 which term and expression shall mean and include, unless repugnant to the context, its successors, assignees, administrators of the Second Party

1.0 Source of Funding: The First Party will receive financing from the World Bank which will be used for this Agreement and the First Party wishes to have the Second Party perform the services hereinafter referred to, and WHEREAS, the Second Party is willing to perform these services.

2.0 Preamble:

Government of Maharashtra (GoM) is implementing the World Bank aided project on climate resilient agriculture namely Nanaji Deshmukh Krushi Sanjeevani Prakalp (NDKSP). The project development objective is to enhance climate-resilience and profitability of smallholder farming systems in project districts of Maharashtra. The project aims to achieve the objective through promotion of climate resilient technologies and commodity value chain across approximately 4,000 drought-prone villages in 15 districts, namely, Jalgaon, Aurangabad, Jalna, Beed, Parbhani, Hingoli, Osmanabad, Latur, Nanded, Buldhana, Washim, Akola, Amravati, Yavatmal, and Wardha and approximately 1000 salinity affected villages in the basin of Purna river spread across Akola, Amravati, Buldhana and Jalgaon districts.

A GIS-based scientific planning methodology based on water balance has been developed and deployed in PoCRA project through the ongoing partnership of IIT Bombay with PoCRA. This was done through the design of soil water balance model, its implementation as a GIS plugin usable in a spatio-temporal manner and its conversion to village-level water budgets to estimate supply-demand parameters based on cropping pattern, existing soil and water conservation interventions and supply availability through rainfall. The runoff estimates generated through this method are being used to set planning targets and limits in project villages.

These tools and methods were further refined based on real-time and more granular weather datasets made available through other agencies. Collaborations were made with technical agencies (such as NBSS&LUP, GSDA) and agricultural universities for further refinement of project area database and model, based on validation and feedback. Extensions of current tools were developed in the form of monitoring dashboard extendable for overall monitoring and planning. Frameworks for monitoring and evaluation of water productivity indices, beneficiary prioritization guidelines catering to project objectives were designed and water balance visualization charts for community comprehension were designed and deployed.

Some of the important aspects of ensuring resilience are 1. assuring the availability of soil moisture at the critical stages of the crops, 2. crop planning commensurate with water balance, 3. participatory action research for enhancing climate resilience, 4. decision support system for planning, implementation and monitoring of the project and 5. Mainstreaming of inputs of technical agencies in the planning process. 6. To ensure the access to energy for irrigation. The present Agreement attempts to address these aspects and provides support for building capacities within the project implementation machinery.

3.0 Objective and Scope of the Assignment:

This Agreement builds upon the groundwork already done through the partnership of PoCRA - IIT Bombay. It will cater to further validation, formalization and extension of the developed models and planning methodology based on it, as well as scaling up of extension mechanisms through overall development of IT toolsets, dashboard based contingency planning and advisory framework in collaboration with Central Research Institute for Dryland Agriculture (CRIDA) and above-mentioned institutes (such as National Beaureau of soil Survey and land Utilization Planning (NBSS&LUP), Ground Water Survey and Development Agency (GSDA)) and support from PoCRA Project Management Unit (PMU). It will also incorporate work for developing simpler yet sound thumb-rules based versions of the water budget for improving community comprehension and its use for agricultural planning at the field level.

In addition to the above scope, this Agreement adds on a component related to energy usage in irrigation. An important objective of POCRA is to increase on-farm availability of surface water and groundwater for protective irrigation to deal with the effects of erratic rainfall. This will result in an increased dependence on energized irrigation leading to potential shortfall in the energy infrastructure capacity thus exacerbating uncertainty. Important steps towards resilience are, reducing hindrances related to energized irrigation, understanding the cost of water and energy in crops, energy and water productivity, and the role of water in crop choices. The deliverables related to energy address these objectives.

The further objectives of the Agreement include

- To attain resource optimization through enhanced energy efficiency.
- To support and assist the technical partners of PoCRA with institutional knowledge of IIT Bombay and mainstream their inputs.
- To carry out studies and participatory action research activities which will help the project attain the result indicators.
- To help PoCRA in conceptualization and setting up a Climate Innovation Centre (CIC).

4.0 Implementation Arrangements: Deliverables, Methodology and Outputs

Deliverables:

I. **Refined Water balance framework and support to PMU**

1. Mainstreaming of inputs from external technical agencies for formalization of model and planning methodology
2. Design and support for the development of Contingency Planning Framework based on inputs from CRIDA and other agencies.

3. IT tools: Extending Dashboard for various applications ranging from monitoring of project activities, biophysical parameters, water-related status indicators, contingency planning across a variety of user themes. Development of farm-level applet usable for various purposes such as computing water productivity, marking interventions etc.
4. Extension activities and research for better community comprehension.
5. Delivery of models, tools, reports, applications along with source code, training material and manual for scaling up.

II Energy

1. Calculations of water productivity and cost of water/energy in crop production based on protective irrigation measurements and water balance calculations.
2. A framework to identify and evaluate risks in access and quality of power to farmers as a constraint to farming and its mitigation.
3. Design of an extension program to improve pump selection and water infrastructure thus improving system performance and making energy use more efficient.
4. Report on village level irrigation energy infrastructure and its determinants and impacts on access.
5. Delivery of framework, tools, reports and dashboard facility.

Outputs and Methodology:

I Water Balance and Project Support

A. Refinement and further development of the Water Balance Framework

Tasks

1. Development of GIS Framework for regional flows.
2. Development of Stream simulation framework and incorporation of near-stream budgets.
3. Coordination with external agencies on run-off measurements and improvements in water balance.

A3 component will require support from PMU for procurement of instruments, and liaison with field agencies for construction and installation.

B. IT Innovations and extensions

Tasks

1. Mainstreaming and maintenance of existing dashboard. (throughout one year - based on ongoing variations)

2. Design of new project-based and other indicators and expansion of dashboard on existing attributes.

3. Web-access and publishing to district level functionaries (IT part) - Role-based login access to data such as level-wise status details for visualization using dashboard.

This will require APIs from PMU that provide authentication support and the relevant data meant for visualization.

4. Integrating architecture with other project activities. - Design and Integration with other project activities like FFS, MLP, Contingency plans.

5. Designing different functionalities on the dashboard based on the role of the user and the purpose of the functionality within PMU, in-house, technical agencies, etc.
    a. These will be based on different types of datasets such as weather data, soil-water balance model data, field data such as from FFS, beneficiary data, project activity status data, other linked data sets as per availability such as census data, command area etc.
    b. Advisory/triggers - provision to generate different advisories/triggers such as irrigation application, pest management will be made based upon contingency planning designed as per inputs from SAU's, CRIDA and data made available from PMU.

6. Tools for access to dashboard backend: There are quite a few special tasks like adding /modifying /deleting geo-referenced data sets that are done occasionally although not routinely. Correspondingly tailored tools will be developed that enable accomplishing these tasks.

7. Improved Farm-level and village-level applet.
    a. Farm-level App - features for computation of water productivity, economic productivity, crop contingencies, etc. and collection of corresponding data
    b. Village-level - Integration of Spatio-temporal data with village-level maps.

C. Contingency Planning Framework Design and Support

Tasks

1. Development of contingency planning as scale-trigger-action-analysis (listing of risks stagewise, the threshold to generate a trigger, contingency include market risks, climate risks and other social risks) and analysis-trigger-action-scale framework.
    a. Identify risks with different stages of crops.
    b. Identifying farm level crop-wise and region-wise contingencies
    c. Downscaling the contingency planning to cluster and village level
2. Integrated implementation plan for SREP, DIP and Contingency planning for climate resilience.
3. Interface with CRIDA and SAUs to provide contingency planning support.
    a. Enhancement of Dashboard
    b. Extension and evaluation of contingency activities as research component of SREP, based on inputs from CRIDA, DIP for translation to the dashboard.
    c. Data gathering - mechanism will be finalized by PMU for collection of data for contingencies finalized to be implemented
4. Rabi contingency (crop stress): Rabi contingency framework will be developed using the following data.
    1. GSDA well observation data
    2. Remote sensing

3. Energy consumption
4. Inputs from the field (functionaries & farmers)

D.Case studies:-

Task

1. Review of remote sensing based water balance and crop identification, area sown etc.
2. Survey of existing material on teaching of climate resilience in primary and secondary schools by educational activities like village map reading, school painting, collection of existing data
3. Studies on utilization of water resources in extremely vulnerable clusters in the project area
4. Study on water balance in command areas

E. Main-streaming of inputs of technical agencies

Tasks

1. NBSSLUP - Engagement and integration of new data with existing data and computational frameworks.
2. Analysis of GSDA plans (Recharge plans) and integration with PoCRA water balance
    a. Integration of GSDA GW extraction data at cluster level with current model and method to compute physical AET.
    b. Usage of GSDA recharge priority maps and methodology in integration with current model for planning of GW open wells and farm-ponds in village.

F. Support for Mainstreaming

Tasks

1. Research on Development of thumb rules for simplified understanding and discussion of water budget at village level to be usable for decision making -
2. Design of community comprehension of WB and collective decision-making framework for village.
3. Training of RAWE students, agricultural officer and PoCRA field staff
    a. Literature survey about current ongoing training to Agricultural officers
    b. Selection of training topics such as water budget, maintaining krushi diary, PoCRA app etc
    c. Preparation of selected training topics
    d. Training to agricultural officers
4. Other extension activities like study of Jal Saksharta booklets being used in schools and preparation of manuals, toy tools for inclusion in syllabus.
5. Preparation of research papers and reports.
6. Development of research and training potential of key PMU staff.

G. Improvements in the management, planning of the project.

Tasks.

1. Study of Existing Literature on FFS, technology, methodology, FFS inputs

2. IT and Other Support
3. Analytical Support

II Energy

H. Calculation of water productivity

Tasks

1. Design of suitable methodology for the project. Set up liaisons, permissions, data from MSEDCL.
2. Installation of required number of energy and water monitors.
3. Survey of kharif, Rabi, summer, annual, perennial and offseason cropping data and feeder level energy correlations
4. Crop water and energy usage in offseason and summer
5. Crop water and energy usage data and productivity analysis for Kharif crops
6. Crop water and energy usage data and productivity analysis for rabi crops and perennial crops
7. Framework for use of feeder level energy consumption to determine crop-wise energy and water productivity

I. identify and evaluate risks in access and quality of power to farmers

Tasks

1. Design of suitable methodology for the project. Set up liaisons, permissions, data from MSEDCL;
2. Energy infrastructure analysis for 25% Distribution Transformers (DT) in a village, geo-tagging of water sources
3. Energy infrastructure analysis for rest of the 75% DTs in a village, geo-tagging of water sources
4. Design of Energy infrastructure framework to identify constraints and suggestions for resolution by POCRA and higher policy changes
5. Integration of indicator for hotspot DTs on the dashboard

J. Design of extension program to improve pump selection

Tasks

1. Survey of pump selection practices through POCRA and otherwise
2. Measuring operational efficiency of electrical and diesel pumps in the farms

K. Measure village level irrigation energy infrastructure, its determinants and impacts on access

Tasks

1. Energy infrastructure analysis including water transfer structures
2. Analysis of reasons for diesel usage, pending grid connections, and latent demand for grid connections

5.0 Reporting Obligations of the Second Party

COMPOSITION OF REVIEW COMMITTEE TO MONITOR THE SECOND PARTY'S ACTIVITIES

The review committee from PoCRA PMU will consist as below -

1. Soil Science Expert
2. Agronomist
3. Hydrologist
4. Agricultural Engineer

6.0 Terms and Conditions:

6.1 Services:

(i) The Second Party shall perform the services specified in Annexure I Reporting

(ii) The Second Party shall submit to the First Party, the reports listed in Annexure I of the Second Party and Review Mechanism within the time periods listed therein.

(iii) The Second Party shall provide the personnel listed in Annexure I, to perform the Services.

6.2 Term:

The Second Party shall perform the Services during the period commencing 15th November 2019 or an effective date as agreed by the parties in writing but no later than 31st December, 2019, subject to receipt of funds, and continuing through twenty-four months or any other period as may be subsequently agreed by the parties in writing.

6.3 Payment:

A. Ceiling

For Services rendered pursuant to Annexure - I, the First Party shall pay the Second Party an amount not to exceed Rs. 2,04,36,000 (Excluding applicable taxes). This amount has been established based on the understanding that it includes all of the Second Party's costs and overheads.

B. Schedule of Payments:

The schedule of payments is specified below:

Phase	Duration	Payment#
Phase I	Inception Report	10% of Agreement cost
Phase II	Within 2 months from commencement of work	20 % of Agreement Cost
Phase III	5 Months from commencement of work	20 % of Agreement cost

Phase IV	8 months from commencement of work	20 % of Agreement cost
Phase V	12 Months from commencement of work	15 % of Agreement cost
Phase VI	15 Months from commencement of work	5 % of Agreement cost
Phase VII	24 Months from commencement of work	10 % of Agreement cost

Payment shall be made after acceptance by PMU, PoCRA of the deliverables mentioned in Phase I - VII.

C. Payment Conditions

Payment shall be made in Indian Rupees within thirty (30) days following submission by the Second Party of invoices in duplicate to the Coordinator designated in Para 6.4.

Payments shall be made to Second Party's bank account

Name of Account Holder: Registrar IIT Bombay, Project and Consultancy Account

Contact Details: Adishankaracharya Marg, Powai, Mumbai, 400076

Contact no. 91-22-25767020/ 7032/ 9769257032

Fax no.: 91-22-25764034

Email Address: registrar@iitb.ac.in / ar.accounts@ircc.iitb.ac.in

Bank Name: State Bank of India

Bank Branch: IIT Powai

Branch Address: Adishankaracharya Marg, Powai, Mumbai 400076

Contact no.: 91-22-25722894/ 1103 / 2900/ 5305

Email id: sbi.01109@sbi.co.in

Account no.: 10725729173

ECS/MICR Code: 400002034

Account Type: Current

SWIFT/BIC/IBAN :SBININBB519

NEFT / RTGS / IFSC:SBIN0001109

Branch Code: 1109

BSR Code: 0001109

6.4 Administration:

A. Coordinator

The First Party designates the Agronomist of the PMU as First Party's Coordinator; the Coordinator shall be responsible for the coordination of activities under this Agreement, for receiving invoices for payment, and for acceptance of the deliverables by the First Party.

The Second Party designates the Project Coordinators as the Project Investigator and the Co-Project Investigator from IIT Bombay as Second Party's Coordinators: the Coordinators shall be responsible for the submission of deliverables by Second Party.

B. Reports

The reports listed in Annexure I shall be submitted in the course of the assignment and will constitute the basis for the payments to be made under paragraph 6.3.

6.5 Performance Standards:

The Second Party undertakes to perform the Services with the highest standards of professional and ethical competence and integrity. The Second Party shall promptly replace any personnel assigned under this Agreement as may be mutually agreed between the Parties.

6.6 Inspections and Auditing:

After commencement of this Agreement, the Second Party shall make available the accounts related to this assignment to First Party. The report of the internal/external audit done by the Second Party shall be made available to the First Party.

6.7 Confidentiality:

The Second Party shall not, during the term of this Agreement and within two (2) years after its expiration, disclose any proprietary or confidential information relating to the Services, this Agreement or the First Party's business or operations without the prior written consent of the First Party.

6.8 Ownership of Material:

Any studies, reports or other material, graphic, software or otherwise, prepared by the Second Party for the First Party under this Agreement shall belong to and remain the property of the First Party. The Second Party may retain a copy of such documents and software1.The Second Party can use it for research and academic purposes with the prior approval from the First Party. Any equipment procured by the Second Party for the purpose of this assignment will be handed over to the First Party at the end to the assignment.

6.9 Left Blank:

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1 Restrictions about the future use of these documents and software, if any, shall be specified at the end of Para 6.8

6.10 Insurance:

The Second Party will be responsible for taking out any appropriate insurance as required.

6.11 Assignment:

The Second Party shall not assign this Agreement or Subcontract any portion of it without the First Party's prior written consent.

6.12 Law Governing this Agreement and Language:

This Agreement shall be governed by the laws of India, and the language of all the Agreement related documents shall be English.

6.13 Dispute Resolution[2]:

Any dispute arising out of this Agreement, will be amicably settled between the parties.

6.14 Termination:

6.14.1. Either party hereto may terminate this Agreement by provision of a thirty (30) days notice to the other party citing reasons.

6.14.2. The First Party may terminate this MOU with at least ten (10) working days prior written notice to the Second Party after the occurrence of any of the events specified in paragraphs (a) through (d) of this Clause:

(a) If the Second Party does not remedy a failure in the performance of its obligations under this MOU within seven (7) working days after being notified, or within any further period as the First Party may have subsequently approved in writing;

(b) If the Second Party finds it necessary to cancel the assignment and/ or shorten or extend its duration or becomes insolvent or bankrupt;

(c) If the Second Party, in the judgment of the First Party or the Bank, has engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices (as defined in the prevailing Bank's sanctions procedures) in securing or in executing this MOU.

(d) If the First Party, in its sole discretion and for any reason whatsoever, decides to terminate this MOU.

6.14.3. In the event of termination, the Second Party shall refund to the First Party, all payments made for providing remaining part of activities and the Second Party shall provide the First Party any reports or parts thereof, any other information and document gathered under this MoU prior to the date of termination.

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2 The provision may be modified appropriately if both the First Party and the Second Party are Government Entities.

7.0 Annexures:

Annexure – I: Second Party's Deliverables, Detailed Activities, Personnel and corresponding Unit Rates and Budget

Annexure - II: Key Staff and Professionals

In affirmation and witness whereof the parties hereto have caused this Agreement and a copy thereof on their respective behalf by their duly authorized officials on the date and place herein above mentioned.

FOR THE 'FIRST PARTY'

Signed by .....

Title.....

Date .....

Place .....

Seal: Project Director
Project on Climate Resilient Agriculture
Cuffe Parade, Mumbai - 400005.

In the presence of the following witnesses:

Witnesses:

1. Vijay Kolekar
Agronomist

2. G. S. Mandlik
Agril. Engg.

FOR THE 'SECOND PARTY'

1/10/2019 [A.M.Pradeep]

Signed by .....

Title. Associate Dean (R&D)

Date .....

Place ...Mumbai.....

Seal:
सह संकायाध्यक्ष, शोध एवं विकास
Associate Dean, Research and Development
कृते निदेशक, आय आय टी मुंबई
For Director, IIT Bombay

In the presence of the following

Witnesses:

1. Parth Gupta [PARTH GUPTA]

2. Vidyadhar Konde
[VIDYADHAR KONDE]

Annexure I

Terms of Reference

for

INTEGRATING ELEMENTS OF CLIMATE RESILIENCE IN MICRO-WATERSHED PLANS UNDER PoCRA

Preamble

Government of Maharashtra (GoM) is implementing the World Bank aided project on climate resilient agriculture namely Nanaji Deshmukh Krushi Sanjeevani Prakalp (NDKSP). The project development objective is to enhance climate-resilience and profitability of smallholder farming systems in project districts of Maharashtra. The project aims to achieve the objective through promotion of climate resilient technologies and commodity value chain across approximately 4,000 drought-prone villages in 15 districts, namely, Jalgaon, Aurangabad, Jalna, Beed, Parbhani, Hingoli, Osmanabad, Latur, Nanded, Buldhana, Washim, Akola, Amravati, Yavatmal, and Wardha and approximately 1000 salinity affected villages in the basin of Purna river spread across Akola, Amravati, Buldhana and Jalgaon districts.

A GIS-based scientific planning methodology based on water balance has been developed and deployed in PoCRA project through the ongoing partnership of IIT Bombay with PoCRA. This was done through the design of soil water balance model, its implementation as a GIS plugin usable in a spatio-temporal manner and its conversion to village-level water budgets to estimate supply-demand parameters based on cropping pattern, existing soil and water conservation interventions and supply availability through rainfall. The runoff estimates generated through this method are being used to set planning targets and limits in project villages.

These tools and methods were further refined based on real-time and more granular weather datasets made available through other agencies. Collaborations were made with technical agencies (such as NBSS&LUP, GSDA) and agricultural universities for further refinement of project area database and model, based on validation and feedback. Extensions of current tools were developed in the form of monitoring dashboard extendable for overall monitoring and planning. Frameworks for monitoring and evaluation of water productivity indices, beneficiary prioritization guidelines catering to project objectives were designed and water balance visualization charts for community comprehension were designed and deployed.

Some of the important aspects of ensuring resilience are 1. assuring the availability of soil moisture at the critical stages of the crops, 2. crop planning commensurate with water balance, 3. participatory action research for enhancing climate resilience, 4. decision support system for planning, implementation and monitoring of the project and 5. Mainstreaming of inputs of technical agencies in the planning process. 6. To ensure the access to energy for irrigation. The present agreement attempts to address these aspects and provides support for building capacities within the project implementation machinery.

Objective and Scope of the Assignment:

This agreement builds upon the groundwork already done through the partnership of PoCRA - IIT Bombay. It will cater to further validation, formalization and extension of the developed models and planning methodology based on it, as well as scaling up of extension mechanisms through overall development of IT toolsets, dashboard based contingency planning and advisory framework in collaboration with CRIDA and above-mentioned institutes and support from PoCRA PMU. It will also incorporate work for developing simpler yet sound thumb-rules based versions of the water budget for improving community comprehension and its use for agricultural planning at the field level.

In addition to the above scope, this agreement adds on a component related to energy usage in irrigation. An important objective of POCRA is to increase on-farm availability of surface water and groundwater for protective irrigation to deal with the effects of erratic rainfall. This will result in an increased dependence on energized irrigation leading to potential shortfall in the energy infrastructure capacity thus exacerbating uncertainty. Important steps towards resilience are, reducing hindrances related to energized irrigation, understanding the cost of water and energy in crops, energy and water productivity, and the role of water in crop choices. The deliverables related to energy address these objectives.

The further objectives of the agreement include

- To attain resource optimization through enhanced energy efficiency.
- To support and assist the technical partners of PoCRA with institutional knowledge of IIT Bombay and mainstream their inputs.
- To carry out studies and participatory action research activities which will help the project attain the result indicators.
- To help PoCRA in conceptualization and setting up a Climate Innovation Centre (CIC).

Implementation Arrangements: Deliverables, Methodology and Outputs

Deliverables:

I. Refined Water balance framework and support to PMU

1. Mainstreaming of inputs from external technical agencies for formalization of model and planning methodology
2. Design and support for the development of Contingency Planning Framework based on inputs from CRIDA and other agencies.
3. IT tools: Extending Dashboard for various applications ranging from monitoring of project activities, biophysical parameters, water-related status indicators, contingency planning across a variety of user themes. Development of farm-level applet usable for various purposes such as computing water productivity, marking interventions etc.
4. Extension activities and research for better community comprehension.
5. Delivery of models, tools, reports, applications along with source code, training material and manual for scaling up.

II Energy

6. Calculations of water productivity and cost of water/energy in crop production based on protective irrigation measurements and water balance calculations.
7. A framework to identify and evaluate risks in access and quality of power to farmers as a constraint to farming and its mitigation.
8. Design of an extension program to improve pump selection and water infrastructure thus improving system performance and making energy use more efficient.
9. Report on village level irrigation energy infrastructure and its determinants and impacts on access.
10. Delivery of framework, tools, reports and dashboard facility.

Outputs and Methodology:

I Water Balance and Project Support

A. Refinement and further development of the Water Balance Framework

Tasks

1. Development of GIS Framework for regional flows.
2. Development of Stream simulation framework and incorporation of near-stream budgets.
3. Coordination with external agencies on run-off measurements and improvements in water balance.

A3 component will require support from PMU for procurement of instruments, and liaison with field agencies for construction and installation.

B. IT Innovations and extensions

Tasks

1. Mainstreaming and maintenance of existing dashboard. (throughout one year - based on ongoing variations)

2. Design of new project-based and other indicators and expansion of dashboard on existing attributes.

3. Web-access and publishing to district level functionaries (IT part) - Role-based login access to data such as level-wise status details for visualization using dashboard.

   This will require APIs from PMU that provide authentication support and the relevant data meant for visualization.

4. Integrating architecture with other project activities. - Design and Integration with other project activities like FFS, MLP, Contingency plans.

5. Designing different functionalities on the dashboard based on the role of the user and the purpose of the functionality within PMU, in-house, technical agencies, etc.
    a. These will be based on different types of datasets such as weather data, soil-water balance model data, field data such as from FFS, beneficiary data, project activity status data, other linked data sets as per availability such as census data, command area etc.
    b. Advisory/triggers - provision to generate different advisories/triggers such as irrigation application, pest management will be made based upon contingency planning designed as per inputs from SAU's, CRIDA and data made available from PMU.
6. Tools for access to dashboard backend: There are quite a few special tasks like adding /modifying /deleting geo-referenced data sets that are done occasionally although not routinely. Correspondingly tailored tools will be developed that enable accomplishing these tasks.
7. Improved Farm-level and village-level applet.
    a. Farm-level App - features for computation of water productivity, economic productivity, crop contingencies, etc. and collection of corresponding data
    b. Village-level - Integration of Spatio-temporal data with village-level maps.

C. Contingency Planning Framework Design and Support

Tasks

1. Development of contingency planning as scale-trigger-action-analysis (listing of risks stagewise, the threshold to generate a trigger, contingency include market risks, climate risks and other social risks) and analysis-trigger-action-scale framework.
    a. Identify risks with different stages of crops.
    b. Identifying farm level crop-wise and region-wise contingencies
    c. Downscaling the contingency planning to cluster and village level
2. Integrated implementation plan for SREP, DIP and Contingency planning for climate resilience.
3. Interface with CRIDA and SAUs to provide contingency planning support.
    a. Enhancement of Dashboard
    b. Extension and evaluation of contingency activities as research component of SREP, based on inputs from CRIDA, DIP for translation to the dashboard.
    c. Data gathering - mechanism will be finalized by PMU for collection of data for contingencies finalized to be implemented
4. Rabi contingency (crop stress): Rabi contingency framework will be developed using the following data.
    1. GSDA well observation data
    2. Remote sensing
    3. Energy consumption
    4. Inputs from the field (functionaries & farmers)

D.Case studies:-

Task

1. Review of remote sensing based water balance and crop identification, area sown etc.
2. Survey of existing material on teaching of climate resilience in primary and secondary schools by educational activities like village map reading, school painting, collection of existing data
3. Studies on utilization of water resources in extremely vulnerable clusters in the project area
4. Study on water balance in command areas

E. Main-streaming of inputs of technical agencies

Tasks

1. NBSSLUP - Engagement and integration of new data with existing data and computational frameworks.
2. Analysis of GSDA plans (Recharge plans) and integration with PoCRA water balance
    a. Integration of GSDA GW extraction data at cluster level with current model and method to compute physical AET.
    b. Usage of GSDA recharge priority maps and methodology in integration with current model for planning of GW open wells and farm-ponds in village.

F. Support for Mainstreaming

Tasks

1. Research on Development of thumb rules for simplified understanding and discussion of water budget at village level to be usable for decision making -
2. Design of community comprehension of WB and collective decision-making framework for village.
3. Training of RAWE students, agricultural officer and PoCRA field staff
    a. Literature survey about current ongoing training to Agricultural officers
    b. Selection of training topics such as water budget, maintaining krushi diary, PoCRA app etc
    c. Preparation of selected training topics
    d. Training to agricultural officers
4. Other extension activities like study of Jal Saksharta booklets being used in schools and preparation of manuals, toy tools for inclusion in syllabus.
5. Preparation of research papers and reports.
6. Development of research and training potential of key PMU staff.

G. Improvements in the management, planning of the project.

Tasks.

1. Study of Existing Literature on FFS, technology, methodology, FFS inputs
2. IT and Other Support
3. Analytical Support

II Energy

H. Calculation of water productivity

Tasks

1. Design of suitable methodology for the project. Set up liaisons, permissions, data from MSEDCL.
2. Installation of required number of energy and water monitors.
3. Survey of kharif, Rabi, summer, annual, perennial and offseason cropping data and feeder level energy correlations
4. Crop water and energy usage in offseason and summer
5. Crop water and energy usage data and productivity analysis for Kharif crops
6. Crop water and energy usage data and productivity analysis for rabi crops and perennial crops
7. Framework for use of feeder level energy consumption to determine crop-wise energy and water productivity

I. identify and evaluate risks in access and quality of power to farmers

Tasks

1. Design of suitable methodology for the project. Set up liaisons, permissions, data from MSEDCL;
2. Energy infrastructure analysis for 25% Distribution Transformers (DT) in a village, geo-tagging of water sources
3. Energy infrastructure analysis for rest of the 75% DTs in a village, geo-tagging of water sources
4. Design of Energy infrastructure framework to identify constraints and suggestions for resolution by POCRA and higher policy changes
5. Integration of indicator for hotspot DTs on the dashboard

J. Design of extension program to improve pump selection

Tasks

1. Survey of pump selection practices through POCRA and otherwise
2. Measuring operational efficiency of electrical and diesel pumps in the farms

K. Measure village level irrigation energy infrastructure, its determinants and impacts on access

Tasks

1. Energy infrastructure analysis including water transfer structures
2. Analysis of reasons for diesel usage, pending grid connections, and latent demand for grid connections

Phase	Deliverables	Duration
I	Inception Report containing methodologies and timelines for completion of the assignment	Within 15 days from commencement of work
II	**I Water Balance and Project Support** **Documents** Design of project-based indicators Literature and Preparation of Material for selected training topics such as water budget, maintaining krushi diary, **Software** Incorporation of project-based indicators on the dashboard **Support** Analytical Support **II Energy** **Document**: Detailed project plan and methodology for crop water productivity measurements including the selection of villages and farmer locations Detailed project plan and methodology for village selection to evaluate grid infrastructure constraints and risks	Within 2 months from commencement of work
III	**I Water Balance and Project Support** **Documents** Development of SATA (Scale-Analysis-Trigger-Action) Framework for contingency planning Study on water balance in command areas of 2 clusters and extension of methodology. Case study report **Software** Role-based web access to data on the dashboard Design and Integration with available data APIs from PMU like FFS, MLP, etc. **Support** Interface with CRIDA, Manage and SAUs to provide contingency planning support. IT and other support Training of Agricultural officers, VCRMC, agriculture students (RAWE Fieldwork)	5 Months from the commencement of work

	II Energy Documents / Data: Estimates of water and energy productivity data for key rabi crops, estimates of energy used in water transfers, rabi energy intensity High level water and energy infrastructure analysis and geo-tagging of grid-connected water sources in part of a village (25% number of Distribution Transformers in the village) and identification of constraints.	
IV	**I Water Balance and Project Support** **Documents** Rabi contingency planning Translation of existing water budget model to simplified, easy-to-compute and reasonably accurate water budget at the village level, by developing thumb rules Case study report **Software** Village level App 1 Tools for access to dashboard backend for special tasks like adding/modifying/deleting data sets. NBSSLUP Soil - engagement - integration with our data **Support** Interface with CRIDA, Manage and SAUs to provide contingency planning support. Educational activities like village map reading, school painting Community comprehension of WB IT and other support **II Energy** **Documents / Data:** Report on current practices for water infrastructure including pumps and pipeline selection, pump efficiencies in field, and propose guidelines for pump / pipes selection Improved village energy infrastructure framework including geo-tagging of all grid-connected water sources for select village and identification of constraints Energy infrastructure analysis including water transfer structures Estimates of water and energy off-season consumption	8 Months from commencement of work
V	**I Water Balance and Project Support** **Documents** Review of remote sensing-based water balance and crop identification, area sown etc Research documentation, consolidation,	12 Months from commencement of work

	dissemination and publishing Analysis of GSDA plans, recharge priority map, stream proximity, its incorporation in PoCRA (A1,A2 and E2 will be combined document) Case study report **Software** Design and Integration with other project activities, Contingency plans. Mainstreaming and maintenance of the dashboard Designing and incorporating different role-based functionalities for newly added features like contingency plans, etc. Integrated implementation plan for SREP, C-DAP and Contingency planning for climate resilience Village . level App 2 GIS framework for regional flows **Support** Interface with CRIDA, Manage and SAUs to provide contingency planning support. Study of Existing Literature on FFS, technology, methodology, FFS inputs Groundwater and stream proximity Coordination with GSDA **II Energy** **Documents** Water and energy productivity analysis for kharif crops with/without protective irrigation; Feeder-level energy correlations in kharif crops Final energy infrastructure framework to identify constraints and suggestions for resolution by POCRA and higher policy changes Design of extension programs on training and awareness for farmers, (non-MSEDCL) wiremen, pump mechanics, for community-wide improvement in energy services Report on diesel usage, pending grid connections, and latent demand for grid connections. Suggestions for betterment - POCRA and high level policy suggestions **Software** Dashboard inclusion of flags / data from Distribution Transformers of selected village	
VI	**II Energy** **Documents** Crop water and energy usage data and productivity analysis for rabi crops and perennial crops Framework for use of feeder level energy consumption to	15 month from commencement of work

	determine crop-wise energy and water productivity	
VII	**I Water Balance and Project Support** **Support** Support for project extended activities to PMU;	24 month from commencement of work

Schedule of Payments

The schedule of payments is specified below:

Phase	Duration	Payment#
Phase I	Inception Report	10% of Agreement cost
Phase II	Within 2 months from commencement of work	20 % of Agreement Cost
Phase III	5 Months from commencement of work	20 % of Agreement cost
Phase IV	8 months from commencement of work	20 % of Agreement cost
Phase V	12 Months from commencement of work	15 % of Agreement cost
Phase VI	15 Months from commencement of work	5 % of Agreement cost
Phase VII	24 Months from commencement of work	10 % of Agreement cost

Payment shall be made after acceptance by PMU, PoCRA of the deliverables mentioned in Phase I - VII.

Detailed Activities

I Water and Project Support

Components	Activity	Man Months	Research	Technical	Extension	IT Design	IT	Items	Output
			(Man-Month)	(Man-Month)	(Man-Month)	(Man-Month)	(Man-Month)	(Quantity)	
A. **Water Balance Framework Expansion**									
A1	GIS framework for regional flows	4	3			1			Document

A2	Stream system simulation and budgets	4	2			2			;Software
A3	Coordination with agencies on run-off measurements	8	2	2		4			
B. **IT innovation and extensions**									
B1	Mainstreaming and maintenance of the dashboard	1				1			Software
B2	Design of project-based indicators and expansion of dashboard on existing attributes	3	0.5	0.5		1	1		Document ;Software
B3	Web-access and publishing to district level functionaries. Role-based access to data	3		1		2			Software
B4	Design and Integration with other project activities like FFS, MLP, Contingency plans.	4		1		3			Software
B5	Designing and incorporating different role-based functionalities for newly added features	2				2			Software
B6	Tools for access to dashboard backend for special tasks like adding/modifying/deleting data sets.	2				2			Software
B7	Village level App 1 and 2	7	1	2			4		Software
C. **Contingency Planning Framework Design and Support**									
C1	Development of SATA (Scale-Analysis-Trigger-Action) framework for contingency planning	4	4						Document
C2	Integrated implementation plan for SREP, C-DAP and Contingency planning for climate resilience.	3			2	1			Software
C3	Interface with CRIDA, Manage and SAUs to provide contingency planning support.	2		2					Support

C4	Rabi contingency planning	2	2						Document
D. **Case studies**									
D1	Review of remote sensing based water balance and crop identification, area sown etc	3	2				1		Document
D2	Educational activities like village map reading, school painting	1			1				capacity building
D3	Studies on utilization of water resources in extremely vulnerable clusters in the project area	4	3	1					Document
D4	Study on water balance in command areas of 2 clusters and extension	3	3						Document
E. **Main-streaming of inputs of technical agencies**									
E1	NBSSLUP Soil - integration of new data with existing	3			1	1	1		Document ;Support
E2	Analysis of GSDA plans, recharge priority map, stream proximity, its incorporation in PoCRA	2		1			1		Document ;Support
F. **Post Project Main-streaming**									
F1	Translation of existing water budget model to simplified, easy-to-compute and reasonably accurate water budget at village level, by developing thumb rules	4	2		2				Document ;Capacity Building
F2	Community comprehension of WB	3			3				Capacity Building
F3	Training of , Agri officers, VCRMC, agriculture students (RAWE Fieldwork)	3			3				Capacity Building
F4	Literature and Preparation of Material for selected training topics such as water budget, maintaining krushi diary,	2		2					Document

F5	Research documentation, consolidation, dissemination and publishing							8	Paper
F6	Development of research and training potential of key PMU staff							3	(3 years)
G. **Improvements in the management, planning of the project.**									
G1	Study of Existing Literature on FFS, technology, methodology, FFS inputs	4		2	2				Integration with software
G2	IT and other support	15		4		5	6		Software
G3	Analytical Support	4		2	2				Support
	Total	100	21.5	22.5	17	25	14	23	

*A3 component will require support from PMU for procurement of instruments, and liaison with field agencies for construction and installation.

II Energy

Components	Activity	Man Months	Research (Man-Month)	Technical (Man-Month)	Extension (Man-Month)	IT Design (Man-Month)	IT (Man-Month)	Items (Quantity)	Output
Calculation of water productivity									
H1	Methodology for farmer selection for meters	2		2					Document, Data
H2	Installation of water meters	2		2					Report
H3	Water and energy productivity estimates for rabi crops	2	2	1					Document

H4	Water and energy consumption measurements in offseason / summer	2		2					Document
H5	Crop water and energy usage data and productivity analysis for kharif crops	1		1					Document
H6	Crop water and energy usage data and productivity analysis for rabi crops and perennial crops	2	1	1					Document
H7	Framework for use of feeder level energy consumption to determine crop-wise energy and water productivity	1	1						Document
identify and evaluate risks in access and quality of power to farmers									
I1	Methodology for selection of village	1		1					Document
I2	Geotagging of all water resources and analysis of grid infrastructure (25%)	2	1	1					Document
I3	Geotagging of all water resources and analysis of grid infrastructure (75%)	3		3					Document
I4	Framework design	3	3						Document
I5	Dashboard integration	3	1	2					Software
Design of extension program to make improve pump selection									
J1	Survey of pump selection process	3	1	2					Document
J2	Design of extension program for pump selection	3	3						Document
Measure village level irrigation energy infrastructure, and impact on access and quality									

K1	Survey of energy infrastructure and analysis including water transfer structures	4	2	2					Report
K2	Analysis of reasons for diesel usage, pending grid connections, and latent demand for grid connections	4	2	2					Report
	Total	37	15	22					

Second Party's Personnel and corresponding Unit Rates

Sr. No	Name of Personnel	Unit Rate (Rs. per month)	Number of Man - Months	Total (lakh)
A. Water budget and Project Support				
1	Prof. Milind Sohoni	30000	50	20.0
2	Parth Gupta	80000	12	9.6
3	Shubhada Sali	70000	12	8.4
4	Rahul Gokhale (external consultant, Full-time)	120000	12	14.4
5	Hemant Belsare	120000	12	14.4
6	Vidyadhar Konde	50000	12	6.0
7	IT	70000	12	8.4
8	IT+Technical	100000	12	12.0
9	Support to key staff for research			3.0
10	Support in second Year	150000	12	18.0
Total Human Resource				**114.2**
Head-wise totals				

Human Resources				114.2
Research Dissemination				8.0
Travel + Logistics: Funding for Experiments, workshop instruments contingency				10.0
Total (A)				**132.2**
B. Energy		**Unit Rate (per month)**	**Number of Months**	**Total (lakh)**
1	Prof.Priya Jadhav	30000	30	9.0
2	Team Leader	70000	15	10.5
3	Mid-level support	40000	12	4.8
4	Students (2)	10000	12	1.2
Travel + Logistics: Funding for Experiments, workshop instruments contingency				5.7
Energy and water meters				6.9
Total (B)				**38.1**
Total (A+B)				**170.3**
Final Amount (with 20% overhead) *				**204.36**

*** Exclusive of all taxes**

*** Phase wise payment will be made as per 'B. schedule of payments' in point 6.3**

Note

1. The manpower and salaries are indicative. Allocations may be changed across various heads for effective implementation.

Annexure II

Key Staff / Professionals required

Sl No.	Positions	Qualification and Experience	Number
1	Project Coordinator (CV indicating the qualifications and experience to be enclosed)	Professor or equivalent position with experience in management of multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling etc	1
2	Project Coordinator (CV indicating the qualifications and experience to be enclosed)	Faculty with experience in management of multi-disciplinary projects related to Agricultural water and energy consumption	1
3	Team Leader (CV indicating the qualifications and experience to be enclosed)	Masters or higher degree in natural resource management with experience in management of multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling etc	2
4	Team Leader (CV indicating the qualifications and experience to be enclosed)	Masters or higher degree in natural resource management with experience in management of projects related to and Electrical Engineering and pumping systems	1

5	Middle level professional -1 (CV indicating their qualifications and experience to be enclosed)	Bachelor's or higher degree with experience in management of multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling etc	2
6	Middle level professional -1 (CV indicating their qualifications and experience to be enclosed)	Bachelor's or higher degree with experience in management of multi-disciplinary projects related to Electrical Engineering and pumping systems	1
7	Middle level professional -2 (CV indicating their qualifications and experience to be enclosed)	Bachelors or higher degree with experience in development and management of IT Systems (Android apps, Java, Salesforce etc)	1
8	Consultant (CV indicating their qualifications and experience to be enclosed)	Masters or higher degree in natural resource management with experience in development and use of IT tools for multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling etc	2