

Memorandum of Understanding

for

**Monitoring of Integrated Watershed Programme (IWMP)
Watersheds using Geospatial technologies**

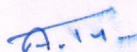
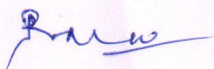
between

Deputy Director, RSA
National Remote Sensing Centre
ISRO, Dept. of Space, Govt. of India,
Balanagar, Hyderabad-500 037.

And

Department of Remote Sensing & GIS,
University of Jammu, Jammu

Signed on this day August, Year 2017



1. PREAMBLE

In a pioneering effort to monitor ecological improvement brought in by watershed development, Ministry of Rural Development has associated with ISRO to use geo-information for supporting development activity. Indian Remote Sensing images in tandem with smart phone based inventory followed by GIS service on ISRO's web GIS portal, Bhuvan, will serve as supporting evidence for development activities done on the ground. High resolution IRS images in multispectral and panchromatic region can help to detect changes in vegetation, water and structures.

Integrated Watershed Management Programme is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development, Government of India. Watershed Management is one of the key interventions for improving water resources and conserving soil in the rain fed areas of the country. Space technology currently with the high spatial and temporal resolution satellite data is envisaged for effectively planning, monitoring and evaluating activities done under watershed management. Further such data will be of immense help in tracking the implementation, apply midcourse corrections and for assessing long-term effectiveness of the programme.

2. PARTIES

2.1 *Indenting party:*

National Remote Sensing Centre, Indian Space Research Organization (ISRO) under Dept. of Space, Govt. of India, Balanagar, Hyderabad hereinafter called as **NRSC**.

2.2 *Executing party:*

Department of Remote Sensing & GIS, University of Jammu

3. AUTHORISED SIGNATORIES

3.1 *For and on behalf of Indenting party (NRSC):*

Dr. P.V.N.Rao Deputy Director RSA, NRSC, ISRO, Department of Space, Govt. of India, Balanagar, Hyderabad – 500 037, Telangana.

3.2 *For and on behalf of Executing Party(PI):*

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4. FUNCTIONARIES AND CONTACT ADDRESS, PHONE, EMAIL, ETC

4.1 NRSC:

Sl. No	Name	Contact Address	Phone	Email
1	Dr.T. Ravisankar	Group Director LRUMG, RSA A NRSC/ISRO, Dept. of Space, Govt. of India, Balanagar, Hyderabad – 500 037	040- 23884214	ravisankar_t@nrsc.gov.in
2	Dr. K. M.Reddy	Group Head, PPEG & RDWMD, NRSC, ISRO, Hyderabad	040- 23884555	reddy_km@nrsc.gov.in
3	Shri. M.V.Ravi Kumar	Group Head ASD&CIG RSA, NRSC, ISRO, Hyderabad	040- 23884228	ravikumar_mv@nrsc.gov.in
4	Shri. M. Arul Raj	Manager BWS NRSC, ISRO, Hyderabad	040- 23884589	arulraj_m@nrsc.gov.in

4.2 Partner Institution

Sl. No	Name	Contact Address	Phone	Email
1.	Prof. Avtar Singh Jasrotia	Department of Remote Sensing and GIS University of Jammu, Jammu-180 006	9419133793	asjasrotia@yahoo.co.uk

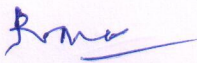
5. EFFECTIVE DATE AND DURATION

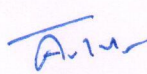
5.1 *Commencement* : This MOU will come into effect from the date of receiving the funds.

5.2 *Duration* : This MOU will be valid from date of signing upto March 2020

6. SCOPE OF WORK

Memorandum of Understanding





The project is being implemented at NRSC and geo spatial tools have been developed (Srishti – a web GIS interface on Bhuvan and Drishti – a mobile based android application). The project duration is up to March 2020.

The project envisages monitoring and evaluation of IWMP projects for the state of - Jammu & Kashmir for the sanctioned projects from 2011-12 to 2014-15. Each project has to be monitored for a period of 5 years.. The scope of the work of this project include Processing of high resolution satellite data – LISS-IV and Cartosat; Correction / fine tuning of Watershed boundaries based on SIS-DP database; Generation of LULC maps, NDVI maps , evaluation and assessment based on drishti photographs , preparation of maps showing change detection in projects , limited ground truth and report generation for each project area year wise in suggested format.

7. METHODOLOGY

The work involves monitoring the changes due to implementation of IWMP activities and evaluate the impact accordingly as per the project technical manual. Brief steps in the approach are :

- High resolution satellite data will be provided for online interpretation for the years of project monitoring.
- Correction of the project and micro watershed boundaries using the drainage layer of SISDP and satellite image. The project boundaries procured from respective state nodal agencies (SLNA) will be provided to the respective state centre in shape format.
- Online image analysis / interpretation need to be carried out for generation of LULC maps project wise, site specific vegetation index changes and maps showing change detection as impact of IWMP implementation.
- The changes which are observed on image other than pointed out by POI's will also have to be detected (point changes) and mapped (area changes) towards assessing comprehensive change in the project area. In this overall process Detailed project reports (DPR) for respective projects need to be accessed from SLNA and understanding needs to be developed for assessing the change.
- The vector layer of LULC prepared under SIS –DP will be used as base line data for determining the change and impact. This thematic layer needs to be updated annually.

- About 10- 20% random sample ground checks need to be undertaken to assess change areas.
- Interpretations carried out using base line and time sequence satellite data will be subject to two levels of quality evaluation namely internal (100%) and external check (10%).
- IWMP Project wise reports incorporating thematic maps , change area maps, ground truth, etc to be prepared in the prescribed format.

8. DELIVERABLES AND GUIDELINES ON DATA / MAP SECURITY

8.1 Deliverables

- Corrected micro watershed / project boundaries
- IWMP Project wise LULC maps for five years of monitoring for each of the project in geodatabase format along with statistics;
- Change assessment with statistics and cross-matrix table; map compositions; point vector layer showing locations of specific change;
- Analysis of drishti photographs IWMP project wise
- Base layer containing roads, settlements, water bodies, railway line and drainage
- Status report for the IWMP project year wise.

Department of Remote Sensing and GIS, University of Jammu, Jammu as per applicable law or as may be required to all parts of the Project during the operation phase. The data shall be utilized for the bonafide official purposes only .

9. PROJECT SPECIFICATIONS :

- It is envisaged to use high resolution satellite data from Cartosat, IRS-LISS-IV and other similar data from other sensors.
- Monitoring of watersheds using high resolution satellite data for 5 years using Bhuvan services.
- Land cover change analysis for the watersheds using visual interpretation / digital techniques.

- Preparation of project report.

10. **APPLICABLE DOCUMENTS:** Technical Manual will be prepared by NRSC to enable guidance to the participating institutes in the project.

11. RESPONSIBILITIES OF EACH PARTY

11.1 Responsibilities of NRSC

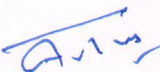
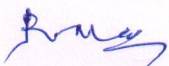
1. NRSC will make available the non corrected shape files of micro watersheds / IWMP projects
2. Orthorectified satellite data
3. Technical manual for the execution of project
4. Supervise the implementation, conduct monitoring & evaluation of the project from time to time.

11.2 Responsibilities of the Partner Institution

1. The partner institution (PI) will nominate a Project Manager for the project
2. It should identify a separate team for executing the project.
3. The work should be executed strictly following the technical manual maintaining high quality standards, which will be checked and certified by the internal quality team exclusively identified by the PI for quality assurance. Prior to final submission of outputs to NRSC, approval of external quality assurance team as identified by NRSC is to be obtained. The QC reports given by internal as well as external teams have to be submitted to NRSC along with the final outputs.
4. Any inaccuracies noticed during quality inspection will have to be corrected to the satisfaction of the functionaries from NRSC (as mentioned at 4.1) / Project Quality Assurance Team without any additional cost.
5. Provide monthly progress report and Utilization Certificate before the release of the installments. For final release of the amount Utilization certificate for 2nd installment and also a consolidated Utilization Certificate for the total fund received has to be sent to NRSC.
6. NRSC at his discretion will conduct inspection of the work at working place of the Dept. / Organization / University and also carry out field inspection if required. Such inspection will be done by authorized representative(s) from NRSC at such intervals as deemed

necessary for which the Dept./Organization/University should provide the transport and necessary facilities.

7. All the deliverables as specified in Clause 8.1 need to be submitted to NRSC, in the prescribed format.
8. The outputs produced by the Dept./Organization/University will be the property of NRSC (ISRO) /DOS and the property / intellectual right vests with ISRO / DOS. The partner institution shall *necessarily take prior permission before sharing the data to any agency and also duly acknowledge NRSC /DOS while publishing.*
9. The monthly progress report in the prescribed proforma has to be submitted to NRSC, in the first week of the following month.
10. The Project Manager is wholly responsible for smooth implementation of the project. In the event if Project Manager is not able to complete the project for what so ever reason, the institution should nominate another person as project manager and arrange for proper handing over and carrying out the unaccomplished project work for smooth functioning of the project
11. To provide IP address of the system for data security.



12. PROJECT SCHEDULE

The detailed schedule is given below:

S.No.	Activity 2017-18	Month
01	Signing of MoUs – Release of First installment of project fund	One month
02	Correction of MWS / IWMP project boundaries	Two months
03	LULC map preparation /Change detection map	Three months
04	Statistics and report generation and submission of data	Two month
	Activity 2018-19	
01	Correction of MWS / IWMP project boundaries	Two months
02	LULC map preparation / Change detection map	Eight months
03	Statistics and report generation and submission of data	One month

This time schedule will repeat every year upto March 2020

12. SCHEDULE OF PRICES

The total cost for carrying out the project is given below:

Budget breakup details for Partner Institutions

Name of the State : Jammu & Kashmir
Number of IWMP projects sanctioned upto 2014-15 : 158

	Batch-I (Sanctioned in 2009-10)	Batch-II (Sanctioned in 2010-11)	Batch-III (Sanctioned in 2011-12)	Batch-IV (Sanctioned in 2012-13)	Batch-V (Sanctioned in 2013-14)	Batch-VI (Sanctioned in 2014-15)	Total
Jammu & Kashmir			41	43	46	28	158

Each IWMP project @ Rs. 4275 /yr

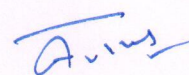
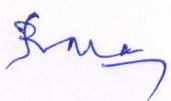
The cost of each project was arrived considering the man power analysis cost, ground truth collection, generation of maps and records and institutional charges.

GRAND TOTAL for 158 IWMP projects Rs. 33.77 Lakhs

First Installment (25%) Rs. 08.44 lakhs

Note: The final project cost will be based on the exact number of IWMP projects executed by the respective state and the same will be adjusted in the installments.

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13. SCHEDULE OF INSTALLATION, SUPPLY AND ACCEPTANCE TEST

- 14.1 The deliverables are to be supplied upon completion of all process steps as mentioned under Clause-7 (Methodology).
- 14.2 The schedule delivery period for the theme needs to be strictly adhered to (as per clause 12)
- 14.3 The responsibility of data accuracy checks and acceptance of the deliverables lies with NRSC.

14. CONSIDERATION

- 15.1 As per schedule of prices

15. TERMS AND CONDITIONS OF PAYMENT

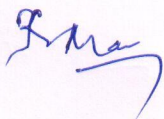
- 16.1 25% advance payment after signing of the MoU, the second and, third installment amounting to 25 % each of the project cost will be released on completion of interpretation and ground truth for the allocated area and upon the receipt of Utilization Certificate. The last installment of 25 % would be released upon receipt of deliverables along with the Utilization Certificate for the third installment at the end of the project.

16. TRAINING

Orientation training program will be provided by NRSC, schedules of which will be communicated to the participating PIs.

17. WARRANTY

- 18.1 The contents or the information provided by the PI's to be true and realistic along with supporting ground information.
- 18.2 PI to guarantee the accuracy and specifications as mentioned under Clause-9 (specifications).
- 18.3 If any errors are brought out by the Quality team of NRSC within the project duration, the same shall be rectified by PI, if the errors are beyond the specifications.



18. PROJECT MONITORING

- 19.1 Partner Institution will establish a mechanism to monitor the progress under the project and will report to NRSC / ISRO on monthly basis. NRSC/ISRO will carry out periodic review of the progress of work quarterly.

19. CONFIDENTIALITY

- 20.1 During the tenure of the agreement and thereafter both Partners undertake on their behalf and on behalf of their employees / representatives / associates to maintain strict confidentiality and prevent disclosure thereof, of all the information and data exchanged/ generated pertaining to work under this agreement for any purposes other than in accordance with this agreement.

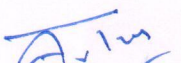
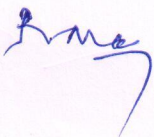
20. INTELLECTUAL PROPERTY RIGHTS

- 21.1 Partner Institution shall have to consult NRSC to commercially exploit / use the intellectual property generated in the Projects. In such an event, the fee and royalty and other terms and conditions for the commercial exploitation / use of the aid intellectual property created in the project shall be decided by NRSC, ISRO for which a separate agreement shall be entered into.

During the work envisaged under the agreement in the event of NRSC, ISRO Scientists exploring, inventing or discovering results over than the specific objectivities of the project, NRSC, ISRO and **Department of Remote Sensing and GIS, University of Jammu, Jammu** shall retain absolute rights on such results.

21. CHANGE IN SCOPE OF WORK

- 22.1 No amendment or modification of this agreement shall be valid unless the same is made in writing by both parties and their otherwise representatives and specifically stating the



same to be amendment of this agreement. The modification/changes shall be effective from the date on which they are made / executed, unless otherwise agreed to.

22. MODIFICATIONS

Any further modifications to this MoU, if required, would be through amendments with mutual consent.

23. FORCE MAJEURE

- 24.1 Neither party shall be held responsible for non-fulfillment of their respective obligation under the agreement due to the exigency of one or more of the unforeseen events such as but not limited to Acts of God, war, flood, earthquake, strike, lockouts, epidemics, riots, civil commotion etc. provided on the occurrence and cessation of any such events, the party affected thereby shall give a notice in writing to other party within one month of such occurrence or cessation. If the force-majeure conditions continue beyond six months, the parties shall then mutually decide about the future course of action.

24. INDEMNITY

- 25.1 I shall exercise reasonable skill, care and diligence in the performance of the contract and indemnify and keep indemnified NRSC/ISRO in respect of any loss, damage or claim howsoever arising out of or related to breach of contract, statutory duty or negligence by employees, agents or sub-contractors in relation to the performance or otherwise of the services to be provided under this contract.

25. DISPUTE RESOLUTION

- 26.1 In the event of any dispute or difference between the parties hereto, such disputes or differences shall be resolved amicably by mutual consultation. If such resolution is not possible, then unresolved disputes or differences will be resolved as per latest rules of Government of India on the subject.
- 26.2 Pending the submission of and/or decision on a dispute, the Parties shall continue to perform all of their obligations under this MOU without prejudice to final decision in regard to dispute
27. Pending the submission of and / or decision on a dispute, difference or claim or until the arbitral award is published; the parties shall continue to perform all of their obligations under this Contract without prejudice to a final adjustment in accordance with such award.

28 JURISDICTION

Any dispute arising out of the MOU or the terms shall be subject to the exclusive jurisdiction of courts of **Hyderabad** only.

29. Termination: (for Cause, Convenience, and Force Majeure)

During the tenure of the agreement, either Party may terminate and nullify this Agreement/MOU by providing prior written notice of 30days to the other party for any of the reasons - Cause/convenience/Force Majeure.

- 29.1 Termination for Convenience: For convenience without assigning any reason.

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29.2 Termination for Cause: For the breach of any obligations/responsibilities/conditions of this agreement by the other party, with an opportunity to cure/rectify such a situation within thirty (30) days to the defaulting party and no remedial action is taken to the satisfaction of the aggrieved party.

29.3 Termination for Force Majeure: in the event of "Force Majeure" as defined in clause #25.0

29.4 Obligations upon Termination

Following termination or expiration of this Agreement, in addition to any other obligations existing hereunder or otherwise at law or in equity,

(a) The rights and obligations of the parties thereto shall be settled by mutual discussion; the financial settlement if any shall take into consideration not only the expenditure incurred but also the expenditure committed by the parties hereto.

(b) The agreement arrived at between the parties hereto for the utilization of the intellectual property (defined in clause #22.0) shall survive the termination of the agreement

B. May

A. 12

SEAL OF PARTIES

In witness whereof the parties hereto have signed this agreement on the day, month and year mentioned hereinbefore.

THE PARTIES HAVE EXECUTED THIS MEMORANDUM OF UNDERSTANDING (MOU) IN DUPLICATE ON THIS DAY OF August, 2017 IN THE PRESENCE OF WITNESS INDICATED.

Parties

For and on behalf of Partner Institute

Signature

Name. Prof. Avtar Singh Jasrotia

Seal

Professor
Deptt. of Remote Sensing & GIS
University of Jammu
Jammu

Witnesses: (Name & Address)

1. Dr. Ajay Kumar Taloor
Assistant Professor
Department of Remote Sensing & GIS
University of Jammu, Jammu

2. Dr Varun Parmar
Assistant Professor
Department of Geology
University of Jammu, Jammu

Date: 14/08/17

Registrar
University of Jammu
Jammu
20/8/17

For and on behalf of PARTY

For and on behalf of NRSC,ISRO,

Signature

Name

डॉ. पी.वी.एन. राव / Dr. P.V.N. RAO
उप-निदेशक, सुदूर संवेदन क्षेत्र
Deputy Director, Remote Sensing Area
राष्ट्रीय सुदूर संवेदन केंद्र/National Remote Sensing Centre
इसरो, अंतरिक्ष विभाग, भारत सरकार
ISRO, Dept. of Space, Govt. of India
बालानगर, हैदराबाद, तेलंगाना
Balanagar, Hyderabad-500 037., T.S.

Seal

Witnesses (Name & Address)

1. (M.A. FYZEE)
SC/ENG SG, RDWMD/LRUMG

2. (B. SHYAM SUNDAR)
SC/ENG SF
RDWMD/LRUMG/RSAA

Date: _____

Atty

Project Report

Monitoring of Integrated Watershed Programme (IWMP) Watersheds using Geospatial technologies, National Remote Sensing Centre (NRSC), Hyderabad

Important aspects & progress made so far: For the year 2011-12 (41 watersheds), 2012-2013 (43 watersheds), 2013-2014 (46 watersheds), 2014-2015 (28 watersheds) covering the entire J&K UT and Ladakh UT have been selected for monitoring LULC changes of Batch 3 (Satellite data covering time periods 2015-16, 2016-17, 2017-18, 2018-19, 2019-18 and 2019-20), Batch 4 (Satellite data 2016-17, 2017-18, 2018-19, 2019-18, 2019-2020 and 2020-21), Batch 5 (Satellite data 2017-18, 2018-19, 2019-18, 2019-2020, 2020-21 and 2021-22) and Batch 6 (Satellite data 2018-19, 2019-18, 2019-2020, 2020-21, 2021-22 and 2022-23) with Geotagging of construction sites in the watersheds using GIS techniques. Status report of 41 projects of the Batch-3, 43 projects of Batch-4, 46 projects of Batch-5 have been successfully done and reports covering the entire J&K UT and Ladakh UT had already been submitted to date.

R&D work done: Project completed, presented and submitted successfully.

Earlier the perspective plan for the watershed development of J&K was generated under IWMP Project and Same was monitored online Under NRSC project. The information was generated in the above said project are available in the Jammu University portal

Geoportal: <https://www.jammuuniversity.ac.in/node/2285>



DEPARTMENT OF REMOTE SENSING AND GIS UNIVERSITY OF JAMMU



PROF. A. S. JASROTIA
Head

No: PGD/RS&GIS/23/ 6050
Dated: 14th Dec., 2023

FORM OF UTILIZATION CERTIFICATE (FOR STATE GOVERNMENTS) (Where expenditure incurred by Govt. bodies only)

S.No	Letter No. & Date	Amount	
1	MOU 21/08/2017	Rs. 5,68,575	<p>Certified that out of Rs 5,68,575 of grants sanctioned during the year 2022-23 in favour of Prof. A.S Jasrotia, Department of Remote Sensing & GIS, University of Jammu, Jammu under the Ministry/Department Letter No. MOU, 21st August, 2017 given in the margin and Rs. Nil on account of unspent balance of the previous year, a sum of Rs. 5,68,575 has been utilized for the propose of project, "Monitoring of Integrated Watershed Programme (IWMP) Watersheds using Geospatial Technologies" for which it was sanctioned and that the balance of Rs. Nil will be adjusted towards the grants payable during the next year 2023-24.</p>
	Unspent balance carry forwarded from previous year	Nil	
	Total	Rs. 5,68,575	
	Utilized	Rs. 5,68,575	
	Unutilized	Nil	

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled/ are being fulfilled and the money was actually utilized for the propose for which it was sanctioned.

(Dr. A.S. Jasrotia)
Principal Investigator

Prof. & Head
Deptt. of Remote Sensing & GIS
University of Jammu
Jammu

Joint Registrar (Finance)
University of Jammu

15/12

Registrar
University of Jammu

18/12/23