No.

Date: 08/11/17

To

The Director
CWPRS, Kdk, Pune-24

8/11/2017

Sub: Revised Proposal-Purpose Driven Study- (PDS) under NHP
Ref 1: Minutes of the Expert Committee for PDS proposals presented during First R & D Session on 13-14 July, 2017 at NIH, Roorkee.
Ref 2: Ministry Review Report on 26/10/2017

Madam,

With reference to the above the high cost equipment proposed under the proposal of PDS titled "Study of Surface and subsurface water interaction using Remote Sensing, Geohydrological and Geophysical techniques and its modelling" has been shifted from Component C to Component A and the required changes were made in the Revised Annual Work Plan 2017-18 submitted to PMU, CWPRS (~~copy enclosed~~). However, inadvertently the high cost component of "Underwater Electrical Resistivity Imaging System" of Rs. 60 Lakhs remained in the total cost of the aforesaid PDS proposal.

The remark received vide Ref 2 has been complied with and the total cost of the PDS has now been reduced from Rs. 88.8 Lakhs to Rs. 28.80 Lakhs.

The modified draft is enclosed for your kind approval.

Thanking you,

Yours faithfully,

8/11/17

(C. Krishnaiah)
Scientist – D

8-11-17

Through Shri R. S. Jagtap, Joint Director

Annexure 1

Proforma of Application for Purpose Driven Studies (PDS)
Under National Hydrology Project

Section – 1 (About Organizations involved & Study Team)

1.1 Project Title: Study of surface and subsurface water interaction using remote sensing, geohydrological and geophysical techniques and its modeling.

1.2 Lead organisation

Name of the Organization: Central Water & Power Research Station, Pune
Head of the Organization: Director
Address: CWPRS, Pune
Telephone, Fax 020-24103500/3400
[An Endorsement from Head of Institution (format given in guidelines) to be provided]

1.3 Principal Investigator (PI) from Lead Organization

Name & Designation: Dr. C. Krishnaiah, Scientist- D
Date of Birth; 15/07/1960
Address: Geophysics Division, CWPRS, Pune 24
Telephone, Fax, Mobile: +919890766223
E-mail: krishnaiah_c@cwprs.gov.in

1.4 Co-PIs from Lead Organization

Name & Designation:

1. Dr. C. Ramesh, Scientist – C
   Date of Birth: 02/08/1958
   Address: HMET Division, CWPRS, Pune 24
   Telephone, Fax, Mobile: 9850701868
   E-mail: rchokkanhalli@rediffmail.com

2. Shri M. S. Chaudhari, Scientist – C
   Date of Birth: 01.07.1958
   Address: Geophysics Division, CWPRS, Pune 24
   Telephone, Fax, Mobile: +919850662545
   E-mail: mukund.chaudhari@gmail.com

3. Mrs. Mandira Majunder, Scientist 'B'
   Date of Birth: 21/10/1985
   Address: Geophysics Division, CWPRS, Pune 24
   Telephone, Fax, Mobile: +918380942995
   E-mail: mandira5ism@gmail.com

4. Shri Ch. Subba Rao, Scientist – B
   Date of Birth: 06/12/1961
   Address: Geophysics Division, CWPRS, Pune 24
   Telephone, Fax, Mobile: 9423208609
   E-mail: chilukuri3_2000@yahoo.com
5. Shri V. Chandrashekhar, Scientist 'B'

Date of Birth: 10/10/1963
Address: Geophysics Division, CWPRS, Pune 24
Telephone, Fax, Mobile: +919637485144
E-mail: vcssai@yahoo.com

6. Mrs. Namita Karki, Assistant Research Officer
Date of Birth: 10/11/1978
Address: Geophysics division, CWPRS, Pune- 411024
Telephone, Fax, Mobile: mob. 7588289153
E-mail: namita.khandka@gmail.com

7. Kamuju Narasayya, Assistant Research Officer
Date of Birth: 03.03.1975
Address: Surface Water Hydraulics, CWPRS, Pune- 411024
Telephone, Fax, Mobile: mob. 0202410 3435, 96 57 27 49 42
E-mail: narasayya03@gmail.com

8. Shri Vivek B. Bagade, Assistant Research Officer
Date of Birth: 3/01/1979
Address: Geophysics division, CWPRS, Pune- 411024
Telephone, Fax, Mobile: mob. 9850363762
E-mail: vivek29bagade@gmail.com

1.5 Partner organisation (if any)

a. Partner Institution:

Directorate, Ground Water Survey and Development Agency,
Maharashtra State, Pune.
Tel Phone 020-25513715/16/18, email- hp2.gsda@gmail.com

b. Consultant:

Proposed (to be finalized after approval)
Department of Geology, Savitribai Phule, Pune University, Government of Maharashtra.
Telephone, Fax: 25696061/25690062/25696064/25696065
[An Endorsement from Head of Institution (format given in guidelines) to be provided]

1.6 Principal Investigator (PI) from ~~Partner Organization/~~ Consultant

Proposed (to be finalized after approval)

1.7 Co-PIs from Partner Organizations

1. Name & Designation: Dr. P.P. Reddy, District Senior Geologist
Date of Birth: 21.04.1976
Address: Directorate, Ground Water Survey and Development Agency, Bhujal Bhavan, Shivaji Nagar, Pune, Maharashtra- 411005
Telephone: 09371535022
E-mail: rpramod21@gmail.com

2. Name & Designation: Mrs A. B. Kharat, Junior Geologist
Date of Birth: 14.12.1976
Address: Directorate, Ground Water Survey and Development Agency, Bhujal Bhavan,

Shivaji Nagar, Pune, Maharashtra- 411005
Telephone: 09975748124
E-mail: aruna.kharat@rediffmail.com

3. Name & Designation: Mrs. T.U. Yewale, Junior Geologist, Pune District
Date of Birth
Address: Directorate, Ground Water Survey and Development Agency, Bhujal Bhavan,
Shivaji Nagar, Pune, Maharashtra- 411005
Telephone: 09096399664
E-mail: moretg23@gmail.com

Section – 2 (Summary of the Proposal)

2.1 Project Title: ***Study of surface and subsurface water interaction using remote sensing, geohydrological and geophysical techniques and its modeling.***

2.2 End-user Department/Organization/Agency: General Public and Water Resources Planners and practitioners of Government of Maharashtra.

2.3 Duration of the project: Three years

2.4 Lead Organization: Central Water & Power Research Station, Pune

2.5 Partner Organization : Directorate, Ground Water Survey and Development Agency, Pune District

2.6 PI and Co-PI from Lead Organization

PI: Dr. C. Krishnaiah, Scientist-D
Co-PI: Dr. C. Ramesh, Scientist – C
Shri M. S. Chaudhari, Scientist - C
Mrs. Mandira Majumder, Scientist - B
Shri Ch. Subba Rao, Scientist – B
Shri V. Chandrashekhar , Scientist B
Mrs. Namita Karki, Assistant Research Officer
Shri Kamuju Narasayya, Assistant Research Officer
Shri. Vivek Bagade, Assistant Research Officer

2.7 PI and Co-PI from Partner Organization:

a. Partner Organization:

Co-PI: Dr. P.P. Reddy, District Senior Geologist, GSDA, Pune District
Co-PI: Mrs A. B. Kharat, Junior Geologist, GSDA, Pune District
Co-PI: Mrs. T.U. Yewale, Junior Geologist, GSDA,Pune District

b. Consultant

Proposed (to be finalized after approval)
Department of Geology, Savitribai Phule, Pune University, Government of Maharashtra.
Telephone, Fax: 25696061/25690062/25696064/25696065

2.8 Total Cost of Project (Rs.)

a) Lead Organization: 14.8 lakh
b) Partner Organization: 2 lakh
c) Consultant Organization: 12 Lakh

2.9 Project Summary (Max. 200 words)

Geology, density of lineaments, geomorphology, drainage pattern and temporal change of land use and land cover influence recharging of subsurface water. A systematic study of these would help in estimating the recharge component.

Based on the analysis of remotely sensed data and study of geology and hydrogeological setup, location of geophysical studies will be decided. These studies shall be carried out to decipher the subsurface structures that control groundwater occurrence and its movement. Infiltration and pumping tests will be conducted at representative locations along with geoelectrical studies to establish relationship between geoelectric and hydraulic parameters for estimating the spatial distribution of hydraulic conductivity of the subsurface. Geophysical studies also shall be carried out to map thickness of sediments at lake bottom and its longitudinal conductance for establishing leakance factor.

Different thematic maps derived from the above analysis would be integrated into GIS environment for a study of the aquifer regime. Surface and subsurface flow components would be evaluated by SWAT modeling.

Midlands and plains of the Bhima basin which include Ghod, Kukdi and Mina rivers and the command area of the Ghod reservoir has been taken as the study area. This study would be useful in mapping the subsurface flow regime and evaluating its spatial interaction with the surface water. The findings from the study will aid in augmenting groundwater resources by identifying artificial recharging locations. The study also would further contribute to assess the competency of the reservoirs and canals from a geotechnical viewpoint time and cost effectively.

Section – 3 (About the Study Proposal)

3.1 Origin of the Proposal & Problem Definition (Maximum 350 words)

(Describe the research proposal, the background, how the idea originated etc.)

Surface and subsurface water regimes are interlinked mechanisms in a hydrological system. During monsoon, surface water recharges subsurface storages resulting in its replenishment and during non-monsoon; the subsurface flow is an important source of water to feed the rivers (base flow).

Geology, density of lineaments, geomorphology, drainage pattern, temporal and spatial change of land use and land cover, influences th e recharging of subsurface water. A systematic study of these by incorporating river basin information such as rainfall, infiltration characteristics, hydraulic properties of the bed materials of surface water bodies (such as canals, lakes etc) would help in estimating the recharge component.

The present study, involves literature review, collection of data (hydro-metrological, geological, topographical, groundwater and surface water) analysis of remotely sensed data (to derive the information

on land use/ land cover, geology, lineament characteristics and geomorphology) and conducting geophysical investigations, hydrogeological studies and infiltration tests at selected locations (for mapping geometry of the subsurface structure and its hydraulic properties). Geophysical surveys using electrical imaging and ground penetrating radar would be carried out at representative locations based on results geological, hydrogeological, geomorphological analysis along with remotely sensed data, to decipher the subsurface structures which control groundwater occurrence and its movement.

Infiltration and pumping tests along with geoelectrical studies will be carried out to establish relationship between geoelectric and hydraulic parameters for estimating the spatial distribution of hydraulic conductivity of the subsurface. In addition, underwater single channel seismic reflection survey and underwater electrical imaging survey would be conducted to map the thickness of lake bottom sediments and to evaluate their longitudinal conductance, for establishing leakance factor.

The thematic maps of land use/land cover, geomorphology, slope map, drainage map, lineaments, geo-electrical and infiltration would be integrated into GIS environment using ArcGIS software for a systematic study of aquifer regime.

Surface and subsurface flow components would be evaluated by modeling of catchment runoff with models such as Soil and Water Assessment Tool (SWAT).

SWAT is a hydrogeological watershed [11] model. It quantifies the impact of long term land management practices in large and complex watersheds. SWAT uses a two-level disaggregation scheme; the primary being the sub-basin identification based on topographic criteria followed by further discretisation using land use/ land cover and soil type considerations. The model adopts the concept of 'Hydrologic Response Unit (HRU). SWAT accounts for the subsurface component of water cycle only.

Midlands and plains of the Bhima basin which includes Ghod, Kukdi and Mina rivers and the command area of the Ghod reservoir is selected as the present study area. A map of study area (approximately 1778.16 km^2) is depicted in Figure 1. The study area falls under rainfall variability index of more than 30%, with extreme temperature variation [7], [8]. The upper part of the study area falls under "Assured rainfall zone" to "Very high rainfall zone" with lateritic soils, but due to higher surface slopes (10-20%) and black soil the percolations are very low on an average. The area is predominantly covered with multilayer Deccan trap while in the hilly part weathered lateritic patches are observed.

In this region the surface water resources are exploited faster forcing excess withdrawal of groundwater resulting in its depletion. Added to this, the geological conditions of the region i.e. hard rock make the occurrence and movement of groundwater more complex. In view of the above, the present study proposal would be useful in mapping the subsurface flow regime and evaluating spatial interaction of surface water and subsurface water.

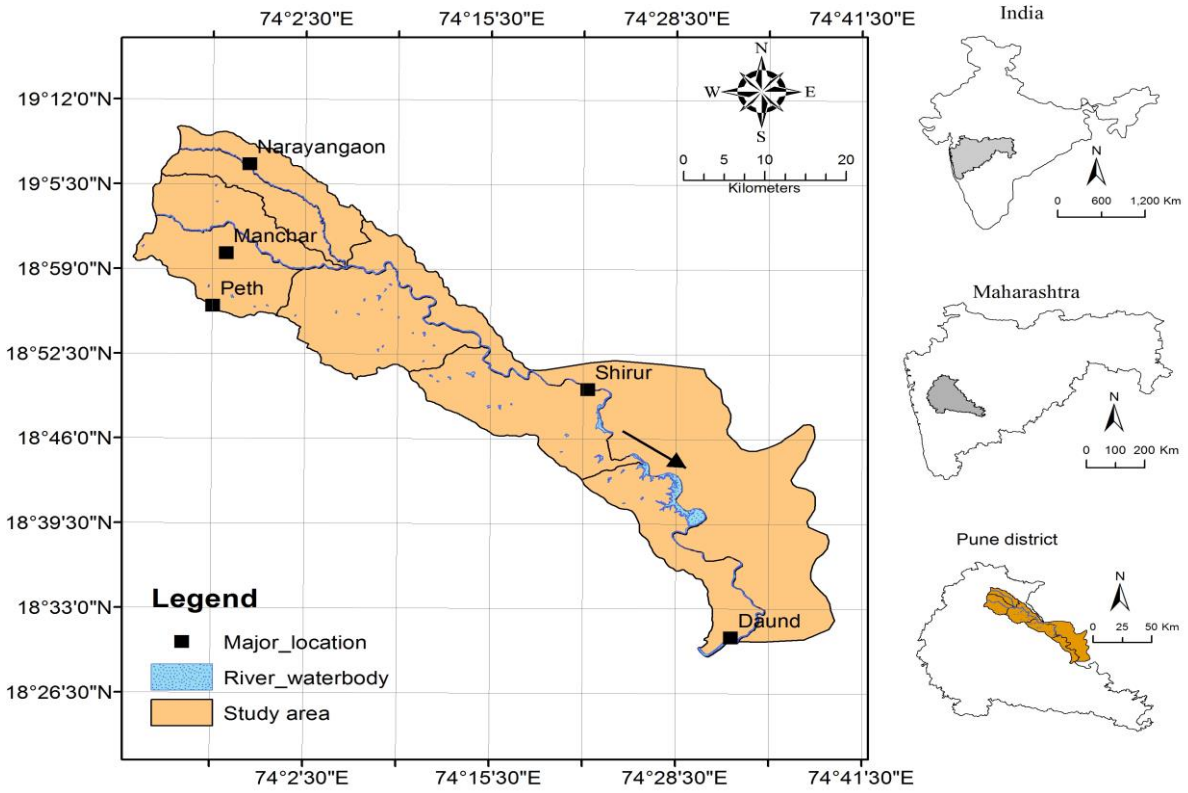

Figure 1: Map of Study area.

The outcome of this study would help in locating groundwater recharge areas to improve groundwater resources. The study also would further contribute to assess the competency of the reservoirs and canals from a geotechnical viewpoint time and cost effectively.

3.2 Specify Objectives of the Study

[Briefly list the objectives (not exceeding five)]

1. To map geology and identify lineaments of the area by using remotely sensed data.
2. To map subsurface structures by geophysical methods.
3. Establishing relationship between geoelectric and hydraulic parameters for estimating the spatial distribution of hydraulic conductivity of the subsurface by conducting infiltration and pumping tests along with geoelectrical studies.
4. Establishing leakance factor of the surface waters by conducting underwater single channel seismic reflection survey and underwater electrical imaging survey.
5. To evaluate impact of Land use/ Land cover change on groundwater recharge in the area.
6. To estimate surface and subsurface water interaction by hydrological modeling of catchment.
7. To propose recharge sites based on remote sensing, geophysical and geohydrological results.

3.2.1 Brief Description of the Objectives

(Classify the objectives of proposed research under one or more of the following and explain the objectives)

a. Finding answers to as yet un-answered questions.
b. Development of a new computational procedure.
c. Development of software/application.
d. Development of new field technique.

e. Design and/or develop a new device.
f. Investigation of the behavior of a natural process **Yes**
g. Any other **Integration and correlation of techniques**

3.3 Present State-of-Art

a. Describe the work that has already been done at International Level.

b. Describe The Work That has already been done at National Level

1. Experience of CWPRS

i. Remote Sensing Technique was combined with geophysical methods comprising of Magnetic, Electrical Resistivity Profiling, Soundings (Vertical Electrical Soundings (VES) and Radial Vertical Electrical Soundings (RVES)) for locating potential groundwater zones for Usha Ispat Ltd., Sindhdurg Dist., Maharashtra (India) by CWPRS[3], [14]. Lineaments were identified analyzing Remote Sensing imageries. Magnetic and Electrical profiling were used to confirm the exact position of lineaments on the ground.

ii. Established relationship between geoelectric and hydraulic parameters for a basaltic aquifer, Ahmednagar district, Maharashtra, India [9], where borehole information was very sparse. The calibrated relationship was helpful for estimating the spatial distribution of hydraulic conductivity value as an input in the construction of pragmatic numerical model that can improve the understanding of hydrodynamics of pollution spreading in the porous media of the area under study.

iii. The institution has experience in field investigations to access infiltration / soil moisture and hydraulic modeling.

2. **State of art at National level**

i. A study was conducted to map the Ground Water Prospect using Remote Sensing, GIS and Geoelectrical resistivity techniques in Dhanbad District [16] as groundwater resource in the region is limited and confined to fractured and weathered zone. Also the area faces shortage of water in dry seasons. The study finding indicated classification of different morphological units according to different groundwater potential zones. It also indicated that the high groundwater potential zones were confined along lineaments and in pediment areas.

ii. The Groundwater Potential Zones in the coastal part of Ganjam district, Orissa were delineated using Satellite Remote Sensing and GIS techniques[1]. Satellite IRS-IC LISS III, Landsat TM digital and SRTM data were used in the study to prepare various thematic maps such as, geomorphological, geological, slope, drainage density, lineament density map. Thematic maps were registered with one another through ground control points and integrated step by step using the normalized aggregation method in GIS for computing groundwater potential index. On the basis of this final weight and ranking, the ground water potential zones were delineated.

c. The idea was originated from the section 3.3 b1

d. Explain how the work proposed to be done by you will be different from the work already done by others at National and International levels.

1) Use of correlation techniques for estimating interaction of surface and subsurface waters.
2) To study the impact of land-use/land cover change on the groundwater recharge.
3) Hydrological modeling of catchment using SWAT for estimating surface and subsurface water component and integration of the results with the help of other techniques envisaged.

e. List the References Examined

1. Biswas, A., Jana, A., Sharma, S. P., 2012. Delineation of groundwater potential zones using satellite remote sensing and geographic information system techniques: A case study from Ganjam district, Orissa, India. Research Journal of Recent Sciences. 1(9), 59-66.
2. Bradbury, K. R., 1982. Hydrogeologic relationships between Green Bay of Lake Michigan and onshore aquifers in Door County, Wisconsin. Ph. D thesis, University of Wisconsin-Madison, W1, 287.
3. Central Water & Power Research station, 1997. An interim note on groundwater investigations carried out for Usha Ispat Private Limited, Satarda, Maharashtra. Technical Report no. 3430.
4. Cooley, R. L., 1977, A method of estimating parameters and assessing reliability for models of steady-state ground water flow. I. Theory and numerical properties. Water Resour. Res. 13, 2, 318-324.
5. Gassman, P. W., Reyes, M., Green, C., Arnold, J. G., 2007. The soil and water assessment tool: Historical development, applications and future research directions. Trans ASABE. 50, 4, 1211-50.
6. Gassman, P. W., Sadeghi, A. M., Srinivasan, R., 2014, Application of the SWAT model special section: overview and insights. Journal of Environmental Qual. 43, 1, 1-8. doi:10.2134/jeq2013.11.0466.
7. Government of Maharashtra, 1999. Approach. Report of Maharashtra Water & Irrigation Commission, Volume –I.
8. Government of Maharashtra, 1999. Maps of Maharashtra. Report of Maharashtra Water & Irrigation Commission, Volume –IV.
9. Krishnaiah. C., 2015. Establishing hydrogeophysical relationship between geoelectric and hydraulic parameters for a basaltic aquifer, Ahmednagar district, Maharashtra, India. J. Ind. Geophys. Union. 19, 3, 282-289.
10. Mishra, N., Khare, D., Gupta, K. K., Shukla, R., 2014. Impact of Land Use Change on Groundwater - A Review. Advances in Water Resource and Protection (AWRP). 2, 28-41.
11. Neitsch, S. L., Arnold, J. G., Kiniry, J. R., Srinivasan, R., Williams, J. R., 2005. Soil and water assessment tool theoretical documentation: Version 2005. Temple. TX: Grassland, Soil and Water Research Laboratory, Agriculture Research Service. Available: www.brc.tamus.edu/swat/doc.html.
12. Omran, A. A. K. A., 2008. Integration of Remote Sensing, Geophysics and Gis to Evaluate Groundwater Potentiality – A Case Study In Sohag region, Egypt. The 3rd International Conference on Water Resources and Arid Environments (2008) and the 1st Arab Water Forum.
13. Patil, S. G., Mohite, N. M., 2014. Identification of ground water recharge potential zones for a watershed using remote sensing and GIS. International journal of geomatics and geosciences. 4, 3, 485-498.
14. Ramteke, R. S., Venugopal, K., Ghosh, N., Krishnaiah, C., Panvalkar, G. A., Vaidya, S. D., 2001. Remote sensing and surface geophysical techniques in the exploration of ground water at Usha Ispat Ltd., Sindhugad district, Maharashtra, India. Journal of Indian Geophysical Union. 5, 1, 41-50
15. Rugel, K., Golladay, S. W., Jackson. C. R., 2011. Identifying groundwater/stream interaction in the lower flint river basin using multiple stream parameters and remote sensing data sets. Proceedings of the 2011 Georgia Water Resources Conference, held April 11–13 at the University of Georgia.
16. Srivastava, V.K., Giri, D. N., Bharadwaj, P., 2012. Study and Mapping of Ground Water Prospect using Remote Sensing, GIS and Geoelectrical resistivity techniques – a case study of Dhanbad district, Jharkhand, India. J. Ind. Geophys. Union. 16, 2, 55-63.
17. Urish, D. W., 1981. Electrical resistivity-hydraulic conductivity relationships in glacial outwash aquifers. Water Resour. Res. 17, 5, 1401-1408.

18. Vazquez-Amabile, G. G., Engle, B. A., 2005. Use of SWAT to compute groundwater table depth and streamflow in the Muscatatuck river watershed. Transactions of the ASAE, 48(3), 991-1003.
19. Winter T. C., 1981. Uncertainities in estimating the water balance of lakes. Water Resour. Bull. 17, 1, 82-115.
20. Worthington P. F., 1977. Influence of matrix conduction upon hydro geophysical relationships in arenaceous aquifers. Water Resour. Res. 13, 87-92.

3.4 Methodology to be adopted

(*Describe clearly the proposed methodology for the study*)

The present study involves literature review, collection of data (hydro-metrological, geological, topographical, groundwater and surface water) analysis of remotely sensed data (to derive the information on land use/ land cover, geology and lineament characteristics) and conducting experiments at selected locations (geophysical investigations, hydrogeological studies and infiltration tests). Geophysical surveys using electrical imaging and ground penetrating radar would be carried out to decipher the subsurface structures which control groundwater occurrence and its movement. Infiltration and pumping tests along with geoelectrical studies will be carried out to establish relationship between geoelectric and hydraulic parameters for estimating the spatial distribution of hydraulic conductivity of the subsurface. In addition, underwater single channel seismic reflection survey and underwater electrical imaging survey would be conducted to map the thickness of lake bottom sediments and to evaluate their longitudinal conductance, for establishing leakance factor. Different thematic maps viz, land use/ land cover, geomorphology, slope map, drainage map and lineaments, geo-electrical and hydrogeology would be integrated into GIS environment using ArcGIS software for a systematic scenario study on aquifer regime. Surface and subsurface flow components would be evaluated by modeling of catchment runoff with models such as Soil and Water Assessment Tool (SWAT).

3.4.1 List new data to be generated under the project, if any

- Hydrogeological inventory such as groundwater levels at various location.
- Aquifer mapping based on results of remote sensing data and geophysical studies.
- Pumping test to find aquifer parameters/ characteristics at representative places.
- Infiltration tests at selected sites on land.
- Estimating the spatial distribution of hydraulic conductivity of the subsurface by hydrogeophysical correlation study.
- Estimating the distributive leakence factor of the lake or river bed.
- Locating groundwater recharges points.

3.5 Envisaged Contribution of the Proposal

(*Describe briefly the contribution envisaged to be made by the proposed PDS to the Water Resources Sector)*

The present study proposal would be useful in mapping the subsurface flow regime and evaluating its spatial interaction with surface water. The outcome would also aid in locating artificial recharge areas based on infiltration, geomorphology and subsurface structural geology. The study would further contribute to assess the competency of the reservoirs and canals from a geotechnical viewpoint time and cost

effectively. Surface and subsurface flow components would be evaluated by modeling of catchment runoff with models such as Soil and Water Assessment Tool (SWAT).

3.6 How Research Outcome will benefit the Scientific Community and Society

(*Describe how the research outcome will be useful to scientific community and society)*

The study aimed at mapping the subsurface flow regime and evaluating its spatial interaction with surface water hydrogeologically. It will be helpful in proposing recharge sites. Surface and subsurface flow components would be evaluated by modeling of catchment runoff with models such as Soil and Water Assessment Tool (SWAT). The study further contributes to assess the competency of the reservoir and canals in geotechnical point of view.

3.7 End-of-project Deliverables

(*Describe the envisaged deliverables of the study)*

- Geological, geomorphological and lineament characteristics of terrain.
- Land use land cover mapping.
- Hydrogeological inventory.
- Distributive infiltration characteristic of the area.
- Hydrological modeling of catchment for estimating interaction between surface and subsurface water using SWAT.
- Identification of recharge sites.

3.8 Work Plan & Activity Chart

(Describe various work elements of the study and give a 3-monthly activity chart for all the activities planned in the study)

Item	Activity	Event								
		2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
1	Literature Survey			←	→					
2	Procurement			←	→					
3	Field studies				←	→				
4	Desk Studies				←	→				
4	Data processing and Report				←	→				

3.9 Details of Earlier Research Projects completed by PI/Co-PI funded under Hydrology Projects, if any

Name of the project: *Estimation of Irrigation return flow under HP-I*

Dr. C. Ramesh (Co-PI) played a key role in developing the process based model for irrigation return flow from a Kukadi left bank command area under the basic R&D (HP-I) studies.

Section – 4 (About the Budget)

4.1 Total Cost of Project 28.8 lakhs

4.2 Head-wise Abstract

S. No.	Head	Amount (Rs.)
Lead Organization		
1	Remuneration/Emoluments for Manpower	-----
2	Travelling Expenditure	-----
3	Infrastructure/Equipments (Appendix I)	7.25 Lakhs
4	Experimental Charges/Field work/Consumables including TA, DA of field work and lab work. (Appendix II)	7.55 Lakhs
	Lead organization Sub Total	**14.8 Lakhs**
5	Partner organization i. Emoulments / Incentives for the manpower, Travelling Expenditure, TA, DA, Data Charges, Consumables, Contingency (Appendix II).	2 Lakhs
	Partner organization Sub Total	**2.00 Lakhs**
6	Consultancy i. Remuneration/Emoluments for Manpower (Appendix III) ii. Travelling Expenditure iii. Infrastructure/Equipments iv. Experimental Charges/Field work/Consumables	9.00Lakhs (1 Project Assistant + 1 Faculty) 1.00 Lakhs 1.00 Lakhs 1.00 Lakhs
	Consultancy Sub Total	**12.00 Lakhs**
	Grand Total	**28.8 Lakhs**

(***Note****: Provide year-wise details with justifications of each head in separate table.*)

4.3 Head wise Details

4.3.1 Remuneration / Emoluments for man power ***NIL***
(Rates for different positions as per DST/NIH norms) ***Justification – NA-***

4.3.2 Travel Expenditure (TE)

(Give the break-up for the TE indicating the places to be visited, purpose, number of visits to each place by air/ rail/ road with approximate cost for each visit)

Field investigations (by road)

i. Site Inspection for ground truth (5 to 6 locations)
ii. Geophysical (Electrical Imaging, Ground Penetrating Radar) survey based on the results of Remote sensing analysis and GPS survey.
iii. Estimating the spatial distribution of hydraulic conductivity of the subsurface.
iv. Estimating lakebed hydrogeological properties using geophysical methods at representative locations
v. Conducting Infiltration tests selected places

Justification: Field studies are required to collect data for the study

4.3.3 Infrastructure/Equipment (Purchased item of permanent nature like software/data etc.)

(*Give details indicating specifications, quantity and rate. Estimated cost for all items such as equipment, software etc.*) ---- **Copy enclosed as Appendix I**-----

Justification: Equipment is required to conduct the required tests

- Knowledge on hydrogeological properties of bed material of the surface water body is required to study the relationship between the surface and subsurface water regime. As direct measurements of these properties will be uneconomical and difficult, a correlation between longitudinal conductance and leakance of the bed of the surface water is proposed. This will provide a rapid and inexpensive method for estimating lakebed hydrogeological properties. Hence, underwater resistivity imaging equipment is required to collect required data. The equipment also required to be used in mapping subsurface structures that control groundwater movement. The equipment also can be utilized to assess the competency of the canals and reservoirs rapidly and cost effectively from geotechnical point of view.
- The information could be accurately located on the imagery and thematic maps using Global Positioning System (GPS)

4.3.4 Experimental Charges/Field work/Consumables

(List the items and estimated cost) 9.55 lakhs (7.55 lakhs + 2.00 lakhs)

I. Field investigations (by road)
   - Site Inspection for ground truth (5 to 6 locations)
   - Geophysical (Electrical Imaging, Ground Penetrating Radar) survey based on the results of Remote sensing analysis and GPS survey.
   - Estimating the spatial distribution of hydraulic conductivity of the subsurface.
   - Underwater electrical and single channel seismic reflection surveys at selected locations.
   - Conducting Infiltration tests (at selected locations)

II. Data, spares of the equipment and consumables:
   - Topo Sheets (Survey of India)
   - Soil, Geology and Hydrogeology base maps.
   - Remote Sensing Data (two data sets (pre and post monsoon) for each year for 3 – 4 years
   - Hydrometric Data (rain fall and flow)
   - Accessories for Electrical Imaging System and Hardware
   - Stationery

Justification: For conducting field studies

4.3.5 Consultancy

Please clearly mention the role of consultant. MOU has to be signed with consultant. The format of MOU will be decided on case to case basis with mutual consent between both the parties. However, MOU has to be brought to the notice of R&D Section of NIH.

Justification of consultancy:

- Familiarity with the geological and hydrogeological set up of the selected site.
- Extensive data collection in a larger area is required, which is challenging to be fulfilled with available man power of study group in lead organization. Further, the scientists of CWPRS are engaged with time bound client sponsored projects. So, the data collection will be done collectively by the study team of CWPRS and consultant team.
- Data collection and surveying in geological and hydrogeological studies along with study team of lead organization.
- Helping in the study of the imageries and their interpretation from geological point of view.

Date: 8/11/17
Place: Pune

Signature of PI 8/11/17
Name/Designation

Format for Endorsement from the Head of Institution

Project Title:

1. Certified that the Institute welcomes participation of **Dr. C. Krishnaiah, Scientist 'D'** as the Principal Investigator and **Dr. C. Ramesh, Scientist 'C', Shri M. S. Chaudhari, Scientist 'C', Mrs. Mandira Majunder, Scientist 'B'**, **Shri Ch. Subba Rao**, **Scientist 'B', Shri V. Chandrashekhar , Scientist 'B', Mrs. Namita Karki, Assistant Research Officer, Shri K. Narsayya, Assistant Research Officer and Shri Vivek Bagade, Assistant Research Officer** as the Principal Co-Investigators for the project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigators will assume the responsibility of the fruitful completion of the project (with due information to NIH) .
2. Institute undertakes to provide financial and other management responsibilities of the project.
3. Institute undertakes to provide all necessary infrastructure facilities for the execution of the project.

Name and Signature of Head of Institution

Date:

Place:

* * *

Appendix I

Infrastructure/Equipments

Sr. No.	Item	Quantity	Rate (Rs.)/ Unit	Amount (Rs.)	Remark
1	Global Positioning System (GPS)	1	1,00.000	1,00.000	GPS is required for exact location of the testing sites.
2	Desk top computers and UPS	4	1,00,000	4,00,000	High speed PCs will be required for Processing of data.
3	Heavy duty printers	2	50000	1,00,000	Printers will be required for generating periodic reports and other day today activities.
4	A3 size colour printer	1	1,25,000	1,25,000	Colour printer is required for taking prints of various remote sensing results and the geophysical maps to be produced in the reports.
		Total	**Rs. 7,25,000/-**		

Year wise expenditure:

2016-17	2017-18	Total
Rs.6,25,000	Rs. 1,00,000	Rs. 7,25,000/-

Appendix II

Details of Experimental Charges/Field work/Consumables including TA, DA of field work and lab work (Lead Organization + partner organization).

Details of Items		Cost (Rs.)	Year wise expenditure	
			2017-18	2018-19
TA/DA of officials for field work	Lump sum	9,55,000	Rs. 6,00,000	Rs. 3,55,000
Transport of equipments to the field				
Labour charges				
Experimental charges				
Consumeable items				
Total for S.H. II =		**9,55,000**		

Appendix III

1. **Remuneration/Emoluments for Manpower Research Associate for 16 months and consultant for 23 months.**

   (Rates for different positions as per DST/NIH norms)

Designation	**2017-18**			**2018-19**		
	Rate/month (approx) in Rs.	Months (approx)	Amount (approx) (Rs.)	Rate/month (approx) in Rs.	Month (approx)	Amount (approx) (Rs.)
Consultant	Lumpsum	Rs. 2,50,000		Lumpsum	Rs. 1,25,000	
Project Assistant	25,000/- (20,000/- +HRA)	12	3,00,000 /-	25,000/- (20,000/- +HRA)	9	2,25,000 /-
Total for Project Assistant	**Rs. 5,25,000 /-**					
Grand Total for Remuneration/Emoluments for Manpower	**Rs. 9,00,000/-**					
Total: Nine Lakhs Rupees only/-						

Directorate
Ground Water Surveys and Development Agency,
Maharashtra State, Pune

Fax No. 91-020-25533108 **Ph.No. 25513715/16/18** E-mail hp2.gsda@gmail.com

Letter No. GSDA/HP/PDS/ 6009 /17 Date - 17 OCT 2017

To,
Dr. C. Krishnaiah, Scientist D,
Dy. Nodal Officer (PDS)
CWPRS, Khadakwasala,
Pune 411024

Subject: Purpose Driven Study (PDS)- Study of surface and sub surface water interaction Using Remote Sensing, Geohydrological and Geophysical techniques and its Modeling

Ref : 1. Remarks of National Hydrology Institute (NIH), Roorkee
2. Your email dated 26.09.2017

With reference to above subject NIH, Roorkee in their remarks on the above PDS mentioned to include linkage with state government with their active involvement. Accordingly, the areas of involvement of GSDA in this PDS are enclosed.

For this PDS, following team of GSDA will be working.

Sr. No.	Name	Designation	Remark
1	Dr. P.P. Reddy	District Senior Geologist, Pune District	Will work as Co-PI
2	Mrs. A. B. Kharat	Junior Geologist, Pune District	--
3	Mrs. T.U. Yewale	Junior Geologist, Pune District	--

For this PDS, cost of GSDA involvement will be as given below.

Sr. No.	Details of Items	Cost	2017-18	2018-19
1	Emoluments / Incentives for the Manpower, Travelling Expenditure, TA, DA, Data Charges, Consumables, Contingency	Lump sum	Rs. 1,00,000/-	Rs. 1,00,000/-
Total		Rs. 2.00 Lakhs		

For your information.

Encl: As above

Director,
Groundwater Surveys and Developmental Agency,
Maharashtra, Pune

Copy to:

1) Deputy Director, GSDA, Pune region, Pune for information and necessary action.
2) Senior Geologist, GSDA, Pune for information and necessary action.

Involvement of Groundwater Surveys and Development Agency
(State Groundwater Department, Maharashtra)

Groundwater Surveys and Development Agency, Government of Maharashtra as an Implementing Agency will be actively involved in the PDS titled "Study of surface and sub surface water interaction using Remote Sensing, Geohydrological and Geophysical techniques and its modeling" in the following areas

[1] Providing the Groundwater Prospect Maps of the study area and coordinating its interpretation for various geohydrological conditions.

[2] Classification of study area into different Geomorphological and Hydrogeological units.

[3] Identification of lineaments in the area which control the groundwater occurrences.

[4] Provide the water level data of the existing Observation wells of GSDA in the study area for last 5 years (2012-2017).

[5] Interpretation of well inventory data and water level data.

[6] In selecting the locations for pump tests and VES.

[7] Validation of artificial recharge structures locations from hydrogeological point of view.

Director
GSDA, Pune

Reference-1

NATIONAL HYDROLOGY PROJECT SECRETARIAT
NATIONAL INSTITUTE OF HYDROLOGY
ROORKEE- 247667

Minutes of the Expert Committee for PDS Proposals presented during First R&D Session on 13-14 July 2017 at NIH, Roorkee

S. No.	Name of PI of the Project & Implementing Agency	PDS Title	Budget (Rs. in Lakhs)	Duration	Decision	Remarks
1	Dr. C. Krishnaiah, Scientist D, Central Water and Power Research Station, Pune	Study of Surface and Subsurface Water Interaction using Remote Sensing, Geohydrological and Geophysical Techniques and its Modeling	86.80	Three Years	revise and resubmit	In the PDS the localized problem of state government should be addressed and state IAs must be involved. So that logical conclusion of the PDS should be ensured. Thus PI should include the following points: i) Linkage with state government with their active involvement. ii) High cost wuipment should be removed and shifted in Component A of NHP. iii) What will be role of consultant.
2	Dr. Shanti Vaidya, Scientist D, CWPRS, Pune	River Rejuvenation of Mutha River Reach Flowing through Pune City and Suburbs, Maharashtra	70.00	Three Years	revise and resubmit	i) Details of Infrastructure equipment need to be provided. ii) Proposal include for training of 2 personnel from DHI amounting to Rs8.8 Lakh. Justification for same may be provided.
3	Dr. Binoy Tomy George, Irrigation Deptt, Kerala	Measurement of Discharge of the Flowing Stream using Image Processing Techniques in Muvattupuzha Basin	40.00	Two Years	Recommended	Examine the velocity measurement aspect.
4	Dr. Udaya Kumar, Director, Kerala Engineering Research Institute(KERI), Peechi, Kerala	Sediment Assessment of Reservoirs	58.00	Three Years	Not Recommended as PDS	Submit under component A of NHP.

Reference - 2

Project Name
NHP
Document Type :
Doc 1st Tier :
PDS Proposals
Document Title / Name :
Study of surface and subsurface water interaction using remote sensing, geohydrological and geophysical techniques and its modeling.
Document Description (More Detail) :
As per the recommendation of review committee meeting at NIH it is revised proposal for said titled PDS.
Document Author :
Doc Owner :
Central Water & Power Research Station (CWPRS)
Created :

Uploaded Document :
Study of surface and subsurface water interaction using remote sensing, geohydrological and geophysical techniques and its modeling.
Document Web link :
Access to Public :
Reveiw
Ministry Review :
YES
Ministry Review Date :
26/10/2017
Suggestions for Improvement :
It was suggested in First R&D Session on 13-14 July 2017 at NIH, Roorkee that high cost equipment should be removed and shifted in Component A of NHP. However, it has still not been done and the revised PDS proposal still contains equipment for Rs. 67.25 lacs in the total budget of 88.80 lacs. Please remove 60.00 lacs (for Underwater Electrical Resistivity Imaging System) from the budget and re-submit the revised PDS proposal.
Other Files :

Major Action :
Published Date:
22/10/2017
Remarks/Suggestion/Query: