GOVERNMENT OF TAMIL NADU
WATER RESOURCES DEPARTMENT

Tender Schedule
(TWO COVER SYSTEM)

Tender Notice No. : TNWRIMS/ IWSH&QC/2022-1

Name of Work:-

Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS)

Last date and time for receipt of Tender Schedule	**:**	**17-08-2022 3.00 PM**
E.M.D. Amount	**:**	**Rs.15,00,000/-**

OFFICE OF THE CHIEF ENGINEER & DIRECTOR
WATER RESOURCES DEPARTMENT
INSTITUTE FOR WATER STUDIES
HYDROLOGY & QUALITY CONTROL
THARAMANI, CHENNAI - 600113.

Sd/-14-07-2022
Chief Engineer & Director,
IWS, H & QC, Chennai-113.

GOVERNMENT OF TAMILNADU
WATER RESOURCES DEPARTMENT

OFFICE OF THE
CHIEF ENGINEER & DIRECTOR, WRD,
INSTITUTE FOR WATER STUDIES,
HYDROLOGY & QUALITY CONTROL,
THARAMANI, CHENNAI – 600 113.

NAME OF WORK : Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS)

E.M.D. Rs. **: Rs.15,00,000/-**
(Rupees fifteen lakh only)

TENDER DATE **: 17-08-2022**

TENDER TIME **: 3.00 PM**

TENDER SCHEDULE ISSUED : 15-07-2022 to 16-08-2022

TO

M/S.

Sd/-14-07-2022
Chief Engineer & Director,
IWS, H & QC, Chennai-113.

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SECTION I - TENDER NOTICE

For and on behalf of the Hon'ble Governor of Tamil Nadu, Priced Tenders will be received by the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai - 600 113 at his office upto 3.00 P.M. on 17-08-2022 for the work of Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS).

1.1. The tenders of the qualified tenderers who have satisfied the tender conditions will be opened by the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control Tharamani, Chennai - 600 113 at 3.30 P.M. at the place afore mentioned. The date of opening will be intimated to the qualified Tenderers well in advance. Hereafter the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control Tharamani, Chennai - 600 113 is referred as the 'Purchaser' in the entire document.

1.2. The qualified tenderers or their agents are expected to be present at the time of opening of tenders. The tender receiving officer will be opening each tender, prepare a statement of the attested and unattested corrections therein and hand it over to the tenderer concerned and initial all such corrections in the presence of the tenderer. If any of the tenderers or their agents finds it inconvenient to be present at the time, then in such a case, the tender receiving officer will on opening the tender of the absentee tenderer, make out a statement of the unattested corrections and communicate it to him. The absentee tenderer shall then accept the statement of the corrections without any question what so ever

2. One cover must be having technical details as in Commercial Proposal in 6.5 of Section VI for the proposed work and another cover having the financial

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details as in Commercial Proposal in 6.5 of Section VI. These two covers should be sealed separately and put in a single cover with EMD, Covering letter etc. with seal. Tenders must be submitted in sealed covers, and should be addressed to the Chief Engineer & Director, WRD Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai - 600 113 the name of the tenderer and name of the work being noted on the each and every cover.

3. The Earnest money will be retained in the case of successful tenderer and will not carry any interest. It will be dealt with as provided in the tender.

3.1. The Earnest money will be refunded to the un-successful tenderers on application, after intimation is sent of rejection of the tender or at the expiration of 3 months from the date of tender whichever is earlier.

3.2 Postal Tenders

i. The contractors may have option to present the tender directly or to send it by registered post acknowledgement due on or before the last date for receipt of tenders.

ii. In case of sending tenders by registered post acknowledgement due it is the responsibility of the tenderer himself to despatch the tender sufficiently early so as to reach the tender opening authority before the date notified in the tender notice for opening of tenders.

iii. No representation / appeal of any kind will be allowed against belated receipt of tenders by post beyond the notified date or loss in transit etc.,

iv. Tenders offered in person, before the last date and postal tenders received will be opened in a consolidated manner, as usual on the notified date for opening of tenders.

4. The tender will remain valid for a period of **ninety days** from the date of opening of tender. The validity period can be extended further, if the

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contractor gives his consent in writing, specifying the period of extension

5. The tenderer whose tender is under consideration shall attend the office of the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control Tharamani, Chennai - 600 113 before the end of the period specified by written intimation to him. If the tenderer fails to attend the office before the end of the specified period his tender will not be considered. He shall fourth with and intimation being given to him of acceptance of his tender, by the officer duly authorised in this behalf under article 299(1) of the constitution, herein after called the " accepting authority " make security deposit of 5% of the value of contract in one of the forms prescribed in Tamil Nadu P.W(A)code (i.e) by taking into account of the amount of EMD already deposited with the tender, it would be sufficient to pay the balance amount to make up the 5% of the value of contract for the purpose of security deposit) irrevocable bank Guarantee obtained from the Nationalised Bank or Schedule Banks valid upto **six months** in favour of the "**Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai - 600 113"** will also be accepted for Security deposit.

5.1 On evaluation of tender, if it is found that if the overall quoted amount of the tender is less than 5% to 15% of the value put to tender, the Contractor shall pay an additional Security at 2% of the estimated value. If the tender discount exceeds 15% to 20%, the Contractor shall pay an additional Security Deposit of 50% of the difference between the quoted amount and estimate amount. Failure to furnish the Additional Security Deposit within 15 days from the date of receipt of acceptance order and execute the agreement shall entail cancellation of award of contract and forfeiture of E.M.D. furnished.

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5.2. The security deposit together with EMD and the amount withheld shall be retained as security for the due fulfillment of contract.

5.3. The withheld amount equal to 2.5% of the total value of work done will be retained under "Deposits" and paid to the contractor after one year reckoned from the date of completion of work or as soon after the expiration of such period of two years as all defects shall have been made good according to the true intent and meaning hereof whichever shall last.

5.4. On receipt of written communication of acceptance of tender, if the tenderer fails to pay requisite security deposit within the period specified in the written communication or backs out from the tender or withdraw his tender the EMD shall be forfeited to the Government.

5.5 If the contractor fails to carry out the contract after paying the requisite deposits, then the contractor will be liable for the excess expenditure if any incurred to complete the work as contemplated in the General Conditions to the Contract.

5.6 It shall be expressly understood by the tenderer that on receipt of written communication of acceptance of tender from the accepting authority, there emerges a valid contract between the Governor of Tamil Nadu and the tenderer, for execution of the work without any separate written agreement. Hence for this purpose the tender documents (i.e.) tender notice, tender offered by the contractor, General Conditions to the Contract, special conditions of the contract, negotiation correspondences, written communication of acceptance of tender etc., shall constitute a valid contract and that will be the foundation of the rights of both the parties to the contract. Provided that it shall be open to the accepting authority to insist execution of any written agreement by the tenderer, if administratively considered necessary or expedient.

6. The tenderer shall examine closely the General Conditions to the Contract

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contained therein, before submitting his tender unit rates, which shall be for finished work. He shall also carefully study the drawings and additional specifications and all the documents connected with the tenderer.

7. The tenderer's attention is directed to the requirements as in Commercial Proposal in 6.5 of Section VI and the tenderer shall quote his rates accordingly.

8 The contractor should closely pursue all the specification clauses, which govern the rates, which he is tendering.

9. A schedule of quantities accompanies this tender notice. It shall be definitely understood that the Government does not accept any responsibility for the correctness or completeness of this schedule and that this schedule is liable to alterations by omissions, deductions, or additions at the discretion of the purchaser or as to set-forth in the Conditions of Contract. He should quote specific rates for each item in schedule, and the rates should be in rupees and in sums of five paise. The rates should be written both in words and figures and the units in words.

9.1 The tenderer should also show the totals of each item and the grant total of the whole contract and quote in the tender. This schedule accompanying the tender shall be written legibly and free from erasures, overwriting of conversion of figures. Corrections where unavoidable should be made by crossing out, initialing, dating and writing.

10. Tenderers offering a percentage deductions from or increase on the estimate amount and those not submitted in proper form or in due time will be rejected. Rates or lump sum amounts for items not called for shall not be included in the tender. No alteration which is made by the tenderer, in the contract form, the conditions of contract, the drawings, specifications or

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quantities accompanying same will be recognized and if any such alterations are made, the tender will be void.

11. The tenderer should work out his own rates, without reference being made to the Water Resource Department current schedule of rates or the Water Resource Department estimate, which are not upon for inspection by tenderers.

12. Not withstanding any subsequent change in the market value for those materials, the charge to the contractor will remain as originally entered in the written contract. No centage or incidental charges will be borne by Government in connection with this supply.

13. No part of the contract shall be sublet without written permission of the Chief Engineer & Director, nor shall transfer be made by power of attorney, authorising others to receive payment on the contractor's behalf.

14. If further necessary information is required, Chief Engineer & Director will furnish such, but it must be clearly understood that the tenders must be received in order and according to instructions.

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PARTICULARS TO BE FURNISHED BY TENDERER

1.	Name of Tenderer	:	
2.	Name of Work	:	Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS)
3.	Date of Price Tender	:	17-08-2022
4.	Details of EMD enclosed for the tender and its validity	:	
5.	Recent works executed (details) about name and place of work value of work etc.. should be given)	:	
6.	Work under execution (Details about name and place of work value of work etc.. should be given)	:	
7.	Turnover of previous years (particulars for a period of three consecutive years to be furnished.	:	
8.	Whether income tax clearance certificates is enclosed if not when it will be produced	:	
9.	Whether GST/SGST clearance certificate is enclosed if not when it will be produced.	:	
10.	List of infrastructures available with the tenderer	:	

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SECTION II. INSTRUCTION TO TENDERER

1. GENERAL

1.1 Tenderers are requested to comply with the below instructions without fail

1.2 The tenderers are requested to examine the instructions, terms and conditions and specifications given in the Tender. Failure to furnish all required information in every aspect will be at the Tenderer's risk and may result in the rejection of tender.

1.3 Any tenderer who has registered in India under the Companies Act 1956 is eligible to participate in this tender.

1.4 It will be imperative for each Tenderer(s) to familiarize itself with the prevailing legal situations for the execution of contract. Purchaser shall not entertain any request for clarification from the Tenderer regarding such legal aspects of submission of the Tender.

1.5 The Proposal and all related correspondence including the documents shall be written in English only.

1.6 It will be the responsibility of the Tenderer that all factors have been investigated and considered while submitting the Tenders and no claim whatsoever including those of financial adjustments to the contract awarded under this tender will be entertained by Purchaser.

1.7 Neither any time schedule nor financial adjustments arising thereof shall be permitted on account of failure by the Tenderer to appraise themselves.

1.8 The tenderer shall be deemed to have satisfied itself fully before tendering as to the correctness and sufficiency of its Bids for the contract and price quoted in the tender to cover all obligations under this tender.

1.9 Purchaser shall respond to the accepted queries and the same will be released

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as corrigendum to the Tender

1.10 Cost of Tender: The tenderer shall bear all costs associated with the preparation and submission of his Tender, and the Employer shall in no case be responsible or liable for those costs

1.11 Clarification of Tender Documents: A prospective tenderer requiring any clarification in the tender document may notified by e-mail to ceiwshqc@gmail.com.

1.12 Amendment of Tender Document

(a) A Pre-tender meeting will be held on 28-07-2022, 11.00 AM at Institute for Water Studies, Hydrology & Quality Control, Chennai, Tharamani-113 for addressing the clarifications on the date and time mentioned in the Tender Data Sheet or any other date to be decided by Purchaser. The tenderers are requested to participate in the Pre-tender meeting and get the clarifications.

(b) Before closing of the Tender, clarifications and corrigendum (if any) will be notified in the Tender Schedule. The tenderer shall periodically check for the amendments or corrigendum or information till the closing date of this Tender. No clarifications would be offered by Purchaser within 48 hours prior to the due date and time for opening of the Tender.

(c) Before the closing of the Tender, Purchaser may amend the Tender document as per requirements or wherever Purchaser feels that such amendments are absolutely necessary. Purchaser at its discretion may or may not extend the due date and time for the submission of tender on account of amendments.

(d) Purchaser is not responsible for any misinterpretation of the provisions of this tender document on account of the tenderers failure to update the proposals on changes announced through the website.

1.13 Language of Tender : The tender prepared by the tenderer and all correspondence and documents relating to the tender, shall be written in the English language only. The supporting documents and printed literature

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furnished by the tenderer may be in another language provided they are accompanied by an accurate translation in English duly notarized, in which case, for all purposes of the tender, the translation shall govern. Tenders received without such translation copy are liable to be rejected.

1.14 Tender Currency : Prices should be quoted in Indian Rupees only.

1.15 Contacting Tender Inviting Authority

(a) Tenderer shall not make attempts to establish unsolicited and unauthorized contact with the Tender Accepting Authority, Tender Inviting Authority or Tender Scrutiny Committee after the opening of the Tender and prior to the notification of the Award and any attempt by any tenderer to bring to bear extraneous pressures on the Tender Accepting Authority shall be sufficient reason to disqualify the tenderer

(b) Notwithstanding anything mentioned above, the Tender Inviting Authority or the Tender Accepting Authority may seek bonafide clarifications from tenderers relating to the tenders submitted by them during the evaluation of tenders.

1.16 Force Majeure

(a) Neither the Purchaser / nor the Successful tenderer shall be liable to the other for any delay or failure in the performance of their respective obligations due to causes or contingencies beyond their reasonable control such as:

i. Natural phenomena including but not limited to earthquakes, floods and epidemics.

ii. Acts of any Government authority domestic or foreign including but not limited to war declared or undeclared, priorities and quarantine restrictions.

iii. Accidents or disruptions including, but not limited to fire, explosions, breakdown of essential machinery or equipment, power and water shortages.

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(b) A party affected by an event of force majeure should give a written notice with full details as soon as possible and in any event not later than **seven calendar days** of the occurrence of the cause relief upon. The other party to respond within a reasonable time of not later than **fifteen days** and issue an acknowledgement on the claim or force majeure applies then dates (period) by which performance obligations are schedule to be met, with extended for that period of time equal to the time lost due to any delay so caused

1.17 Arbitration and Dispute Resolution : Any dispute or difference, whatsoever, arising between the parties to this contract arising out of or in relation to the terms of this contract shall be resolved by the parties mutually by acting in good faith towards fulfilling the contract and for this purpose the parties mutually agree to furnish or exchange all relevant documents, information and any other material within their special knowledge and thereby conclude their discussions between them / their representatives or officers within a period of time as may be mutually agreed to say the time of commencement of the move to resolve the dispute.

In case, the parties failed to resolve the disputes amicably within the time frame agreed and, in the manner, stated supra, the aggrieved party shall approach the Courts in Chennai City alone to the exclusion of all other Courts to adjudicate the unresolved dispute.

1.18 Joint Venture/Consortium Tenders : Tenders submitted by a joint venture (JV) of two firms as partners shall comply with the following requirements:

a. One of the partners shall be nominated as being in charge, and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners.

b. The partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture and

the entire execution of the contract, including payment, shall be done exclusively with the partner in charge.

c. The joint venture agreement should define precisely the division of assignments to each partner. All members of JV should have active participation in providing services during the currency of the contract. This should not be varied/modified subsequently without prior approval of the Purchaser.

d. A copy of the Joint Venture Agreement entered into by the partners shall be submitted with the Tender

1.19 Prices quoted in the tender shall be inclusive of all charges and for free delivery at Chennai

1.20 If any levies such as GST, etc., are chargeable as extra, these shall be specified clearly in the tender.

1.21 The prices quoted shall be firm and fixed and no variation in prices will be allowed on any account.

1.22 The rate quoted by the tenderer, for the work should strictly be adhere to the specification mentioned in the schedule. The rate shall not be quoted for other specifications. The Tender containing rate for other specifications which are inferior to the specification stipulated in the sub class 6.5 'Commercial Proposal' in Section VI shall liable to be rejected. Tenders with such quoting shall not be taken in to consideration to comparison of Tenders.

1.23 Tenderers shall quote the 'Net' rate of the items specified in the sub class 6.5 'Commercial Proposal' in Section VI inclusive of all taxes, freight, packing and forwarding etc., and shall be free from any hidden costs. The items specified in the sub class 6.5 'Commercial Proposal' in Section 6 are to be delivered at the place of consignee to whom it is allotted. The rate quoted in the sub class 6.5 'Commercial Proposal' in Section VI alone shall be taken for comparison of Tenders and any other type of charges quoted in covering letter,

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extra quotation (or) any other page of Tender document shall not be taken in to account. Any such quoting other than 'Net' rate shall be considered as violation of 'Tender' condition and the tender shall be liable to be rejected summarily.

2. PERIOD OF DELIVERY

2.1 Delivery period will be the essence of the contract and shall therefore be clearly stated in the tender. Other factors being more or less equally favourable, offers for quicker delivery will be preferred.

2.2 Conditions such as strike, lockout, power cut etc., may not be generally accepted as valid reasons for delay in the completion of works.

2.3 Belated work is liable to be penalized as per Clause 11.

2.4 If a contract is awarded for higher tendered rate in preference to the lowest acceptable offer in consideration of earlier delivery, and in case of failure of the contractor to complete the supplies in terms of such contract within the period of delivery specified in the tender and incorporated in the contract the contractor shall be liable to pay to the Government the difference between the contract rate and that of the lowest acceptable tender. This will also be without prejudice to other right under the terms and conditions of the contract.

2.5 The purchaser reserves the right to cancel the order if the supplies are not completed within the stipulated period of delivery, notwithstanding the penalty applicable to the belated supply. The decision of the Purchaser in this regard shall be final.

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3. CERTIFICATES

GUARANTEE CERTIFICATES

3.1 The tenderer / contract shall warrant the materials and workmanship of the items offered to be free from any manufacturing defects. Any defective materials and / or bad workmanship discovered either at the time of the receipt of the items or in the course of the actual use / operation of the materials / equipment shall be duly repaired or replaced by the contractor free of cost for a minimum period of 36 (Thirty six) months from the date of installation or 42 months from the date of delivery, whichever is earlier.

3.2 In case where imported materials are offered, the tenderer shall furnish in the tender itself the following particulars.

a. Country of origin
b. Overseas Manufacturers name and address
c. Import license number and date
d. Name of the company to whom the Import license was issued
e. Port through which the materials were cleared

3.3 In the case of offers for imported materials irrespective of the fact whether the overseas Manufacturer / Agents have furnished guarantee or not, the tenderer shall furnish a separate guarantee in accordance with clause 3.1 above

3.4 Test Certificate : In the event of an order being placed, the tenderer / contractor shall produce along with the supply appropriate manufacturer's own test certificate /I.S.I. Certificate for the materials / equipments.

4. Software & Hardware Details

4.1 The details of software, version, source (open source /commercial), etc. and hardware details such as name of hardware, make, model No. type, capacity etc. should be furnished.

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4.2 The materials offered should confirm to the relevant I.S. Specifications Materials bearing I.S.I. marks are preferred. In such offers, a Photostat copy of the I.S. License would be called for, if found necessary.

4.3 Illustrated pamphlets containing all the technical details specifications, construction features for the materials / equipments tendered for should be sent along with the tender. Failure to send detailed pamphlet brochure, drawing may result in the rejection of tenders.

5. STANDARD ACCESSORIES FOR REQUIREMENTS

In case of equipments to be supplied, all minor accessories which are necessary for the satisfactory and efficient operation of the equipment, shall be supplied by the supplier along with the equipments, irrespective of the fact whether or not such minor accessories are specifically indicated in the tender schedule or purchase order. The details of the standard accessories and tools should invariably be furnished in the tender.

6. SAMPLE

If called upon, the tenderer should demonstrate the methodology and work flow to show the capability of the completion of entire works.

7. EARNEST MONEY DEPOSIT

An Earnest Money Deposit of Rs.15,00,000/- (Rupees fifteen lakhs only) shall be sent with the tender by means of a MICR crossed Demand Draft drawn in favour of The Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai – 600 113.

7.1 Bank guarantee to a validity of 135 days, Indira Vikas Patra, National Savings Certificate duly pledged to the under signed will be accepted, cash, cheque will not be accepted towards Earnest Money Deposit.

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7.2 If the Demand Draft towards Earnest Money Deposit is not sent along with the tender, but sent separately, the tenderer shall ensure that the demand draft along with reference of particulars reaches this office within the time limit specified for the receipt of the tenders. The time of receipt at this office alone will be the criterion and no reasons such as posted before the due date Draft taken before the Date of TENDER etc., will not be accepted.

7.3 The Earnest Money Deposit deposited by a tenderer towards a previous tender will not be counted as Earnest Money Deposit towards any subsequent tender. The Earnest Money Deposit will not bear any interest.

7.3.1 No firm is normally exempted from the payment of Earnest Money Deposit / Security - Deposit.

7.3.2 The tenders received without Earnest Money Deposit within the time specified for the receipt of the tenders will not be considered. The decision of the purchaser shall be final in this regard.

8. REFUND OF EARNEST MONEY DEPOSIT

After the tenders are finalized, the Earnest Money Deposit amount will be refunded to the unsuccessful tenderers. For this purpose, the tenderer is advised to send along with original tender itself, an advance stamped receipt for the Earnest Money Deposit amount, so as to enable the amount to be refunded without delay. The advance stamped receipt shall be made out in favour of the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai - 600 113.

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9. SECURITY DEPOSIT

9.1 The successful tenderer, upon advice being to him by the purchaser regarding the acceptance of his tender, shall arrange to pay immediately a Security Deposit to a value of 5 (five) percent of the value of the order less the amount already be paid as Earnest Money Deposit, before effecting the supply within 7 days of receipt of the order. This additional amount along with the Earnest Money Deposit amount will be retained as Security Deposit for the due fulfillment of the contract. This deposit also will not bear any interest. Failure to pay the Security Deposit will entail forfeiture of the Earnest Money Deposit, together with the cancellation of the supply order.

9.2 The above security deposit will be refunded on application after the expiry of guarantee period only.

9.3 Such of the tenderers who are specifically exempt from payment of Earnest Money Deposit, will also be exempt from payment of Security Deposit. However they shall execute proper agreement including a clause among others to the effect that in the event of non-fulfillment of the contract or non-observance of any of the terms and conditions stipulated in the contract, they shall pay on demand, the Security Deposit.

10. VARIATION IN QUANTITIES

The purchaser reserves the right to accept the tender either in full or in part and either to increase or to decrease the quantities indicated in the tender schedule, unless qualified by the specific limitations of the tender.

11. PENALTY

If the work is not completed within the stipulated scheduled completion period the belated work may be penalized at the rate of 0.5 % of the value of the undelivered goods per week upto a maximum of five percent for the work

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beyond the completion period. Thereafter, the work order will be cancelled. The penalty clause will be strictly adhered to.

12. PAYMENT

12.1 Payment will be made as per payment condition clause 5.17 in Section V after development of modules in satisfactory conditions and proper verification, installation and acceptance of the Chief Engineer & Director, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai-113 or an officer authorized by him. No payment will be made against proof of dispatch since advance payment before the receipt of the material is not permissible.

12.2 Payment will be made only for complete unit or assembly and part payment will not be made for part work of component parts. Payment will be made only for the actual quantities accepted

13. JURISDICTION FOR LEGAL PROCEEDINGS

No suit or any proceedings in regard to matter arising in any respect under this contract shall be instituted in any court in the City Civil Court at Chennai the Court of Small causes at Chennai. It is agreed that no other Court shall have jurisdiction to entertain any suit or proceedings even though part of the cause of action might arise within the jurisdiction. IN CASE ANY PART OF CAUSE OF ACTION ARISES WITHIN THE JURISDICTION OF ANY COURTS OF Tamil Nadu and not in the Courts in Chennai, then it is agreed that such suits or proceedings may be instituted in a Court within Tamil Nadu and not in the Courts in Chennai, then it is agreed that such suits or proceedings may be instituted in a Court within Tamil Nadu and no other Court outside Tamil Nadu shall have jurisdiction even though any part of the cause of action might arise within the jurisdiction of such courts.

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14. SUBMISSION OF TENDERS

The procedure for submission of tender document is Two Cover System and the details are as follows:

I. Technical Proposal.

It comprises:

(i) Pre-qualification Criteria

(ii) Technical Qualification Criteria

II. Commercial Proposal

All the documents submitted by the Tenderee should have page number and should be indexed in the prescribed format.

I. Technical Proposal Form (Pre-qualification Criteria and Technical Qualification Criteria):

Both Technical and Financial proposals, should be sealed and submitted to the Chief Engineer & Director, WRD, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai – 600 113.

(a) The content format of the Technical Proposal will be presented in the tender and the tenderer has to give the relevant documents in the format, as asked in the tender against each item. The Tenderer has to verify each document and then sign the same before final submission.

(b) The Technical Proposal Form should not be changed or altered or tampered. If the Proposal form is tampered, the bids will be summarily rejected.

(c) The Technical Proposal Form should not contain any Price indications strictly; otherwise the Proposals will be summarily rejected.

(d) The Technical Proposal format as given in the tender document shall be filled and signed shall be submitted.

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(e) The supporting documents and other documents should be submitted in the Technical Proposal as indicated in sub clause 6.4 of Section 6.

II. Commercial Proposal Form

(a) The Commercial Proposal Form called Bill of Quantity (BOQ) should be filled in at the appropriate places indicated. The Commercial Proposal Form should not be changed or altered or tampered. If the Commercial Proposal form is tampered, the Proposals will be summarily rejected.

(b) The Commercial Proposal Form should not contain any conditional offers or variation clauses; otherwise the Proposals will be summarily rejected.

(c) The Prices quoted shall be in INDIAN RUPEES (INR) only. The tender is liable for rejection if Commercial Proposal contains conditional offers.

(d) The cost quoted by the tenderer shall include cost and expenses on all counts viz., cost of equipments, materials, tools, techniques, methodologies, manpower, supervision, administration, overheads, travel, lodging, boarding, in-station & outstation expenses, etc., and any other cost involved in the work and all applicable taxes.

(e) In cases of discrepancy between the prices quoted in words and in figures, lower of the amount in words shall prevail.

(f) The cost quoted by the tenderer shall be kept firm for a period of 90 days from the date of opening of the Tender. The tenderer should keep the Price firm during the period of Contract including during the period of extension of the time if any. Escalation of cost will not be permitted during the said periods or during any period while providing services whether extended or not for reasons other than taxes payable to the Government of India within the stipulated delivery period. The tenderer should particularly take note of this factor before submitting the tenders.

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14.1 Period of Validity : The tenders shall be kept open for acceptance for a period of not less than 90 (Ninety) days from the date of opening of the tenders. If no specific mention is made in the Tender regarding period of validity, it will be taken as 90 (Ninety) days from the date of opening of the tenders and the supplier is bound to supply the materials at the rates quoted in the tender, if the purchase order is placed within 90 (Ninety) days from the date of opening of the tenders.

14.3 Withdrawal of Tender Before Openning: No tenderer shall be allowed to withdraw the tenders submitting the tender.

14.4 Resubmission of Tender : Tenderer can modify/resubmit the tenders at any point of time either in technical proposal or in commercial proposal or both, before the tender submission end date and time.

14.5 Modification and Withdrawal of Proposals : No proposal shall be withdrawn during the tender validity period. Entire EMD shall be forfeited if any of the tenderer withdraw their bid during the validity period.

14.6 Non – Conforming Proposals : A Proposal may be construed as a non – conforming proposal and ineligible for consideration;

(i) If it does not comply with the requirement of this tender.

(ii) If the proposal does not follow the formats requested in this tender

14.7 Disqualification/ Rejection of Proposal(s) : The proposal is liable to be disqualified in the following cases or in case tendere fails to meet the tendering requirements as indicated in this tender:

i. Proposal not submitted in accordance with the procedure and formats prescribed in this document is treated as non-conforming proposal

ii. During validity of the proposal, or its extended period, if any, the

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tenderer increases his quoted prices

iii. Proposals with Conditional Offers.

iv. The tenderer not confirming to unconditional acceptance of full responsibility of providing services in accordance with the scope of work.

v. Proposal is received with suppression of information or incomplete information

vi. Proposal is not accompanied by all the requisite documents

vii. Proposal is not accompanied by the EMD

viii. If tenderer provides quotation only for a part of the project

ix. Information submitted in the Proposal is found to be suppressed, misrepresented, incorrect or false, accidentally, unwittingly or otherwise, at any time during the processing of the contract (no matter at what stage) or during the tenure of the contract including the extension period, if any.

x. Tenderer tries to influence the proposal evaluation process by unlawful/ corrupt/ fraudulent means at any point of time.

xi. In case any one tenderer submits multiple proposals or if common interests are found in two or more tenders, the lowest eligible financial tender shall be considered for evaluation.

xii. Tenderer fails to deposit the Performance Bank Guarantee (PBG) or fails to enter into a contract within 21 working days from the date of Issuance of Letter of Acceptance.

xiii. While evaluating the proposals, if it comes to Purchaser's knowledge expressly or implied, that some tenderers may have colluded in any manner whatsoever or otherwise joined to form an alliance resulting in

delaying the processing of proposal then the tenderers so involved are liable to be disqualified for this contract as well as blacklisted for the period of **three years** from participation in any of the tenders floated by Purchaser

xiv. If the information on price, pricing policy, pricing mechanism or any information indicative of the commercial aspects of the tender is mentioned anywhere other than the commercial proposal.

14.8 Right to Terminate the Process

i. Purchaser may cancel the tender process at any time and without assigning any reason. Purchaser makes no commitments, expressed or implied, explicit or implicit, that this process will result in a business transaction with anyone.

ii. This tender does not constitute an offer by Purchaser

14.9 The Tender does not commit Purchaser to enter into a tender agreement in respect of the Project with the shortlisted tenderer

14.10 Income tax certificate : The tenderer shall send a copy of latest certificate of Income tax verification from the appropriate Income tax Authority in the Form prescribed there-for.

14.11 A pre Tender meeting will be held on 28-07-2022, 11 AM for technical clarification of the works at Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai-113

14.12 Address : The tender shall be sent in a sealed envelope addressed to the Chief Engineer & Director, Institute for Water Studies, Hydrology & Quality Control, Tharamani, Chennai-113 and super scribed with the words Tender for implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS) by designation only and not by name. The fact of E.M.D. paid shall also be indicated on the cover.

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14.13 Last date of receipt : The sealed tender shall be sent so as to reach this office not later than 17-08-2022, 3 PM in case the above date happens to be a holiday, for any reason the tenders will be received upto the same time on the following working day.

14.14 The tenders shall be sent by registered post with acknowledgement due or alternatively dropped inside the tender box kept in this office on all working days. The time of receipt of tender at this office alone will be the criterion and no reasons for the delay such as postal delay etc., will be accepted.

14.15 Tender Schedule terms and condition, should be signed by tenderer in each page in token of their acceptance of the terms and sent along with their offers. No deletion or alteration of terms and conditions is permissible. Tenders received without department schedule and conditions duly signed by tenderer may not be considered.

14.16 Opening of tenders : The tenders will be opened on the same day i.e 17-08-2022 at 03.30 p.m. by the Purchaser or the officer authorized by him at his office in the presence of such of those tenderers present.

14.17 The tenderers are advised to go through all the terms and conditions carefully and bring to the immediate notice of the purchaser, if there are any corrections or omissions in the tender schedule. Reporting of any corrections or alternations after submitting the tender, will not be entertained.

14.18 The Purchaser reserves the right to accept the whole tender or any part there of or reject all the tenders if the interest of the Government so require, without assigning any reasons what ever and to waive any minor irregularities in the tenders received.

14.19. Income Tax:- Income Tax has to be deducted from the contractors bill at the rate of 2% in respect of other contracts, if the value of the contract exceeds Rs.20,000/- In addition to the above, applicable surcharge should also be deducted, if the contractor is a company.

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SECTION III: QUALIFICATION REQUIREMENTS

3.1 Pre- Qualification (PQ)

Keeping in view of the complexity and volume of the work involved, following criteria are prescribed as pre qualification criteria for the tenderer interested in under taking the project.

Technical Tenders of only the successful pre-qualifiers will be opened for evaluation.

Sr.No	Criteria	Supporting Documents
PQ-1	**Legal Entity:** The tenderer (including consortium/ JV member) should be a company registered under Indian Companies Act, 1956/2013.	Copy of Certificate of Incorporation signed by Authorized Signatory of the Tenderer or A copy of the partnership deed/ instrument of partnership or a Copy of LLP agreement or any other relevant document. Copy of Article of Association/Memorandum of Understanding
PQ-2	The tenderer (including consortium/JV member) should have in its name PAN (Permanent Account Number) with Income Tax authority in India.	Copy of the PAN Card signed by Authorized Signatory of the tenderer
PQ-3	The tenderer (including consortium/JV member) should have in its name GST Registration number in India.	Copy of GST Registration Certificate signed by Authorized Signatory of the tenderer.

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Sr.No	Criteria	Supporting Documents
PQ-4	**Financial: Turnover** The tenderer (Prime tenderer) should have minimum average turnover of INR 15 (Fifteen) Crores in the last three years	CA Certificate with CA's Registration Number/ Seal clearing mentioning the Turnover, Net worth and Copies of Audited Balance Sheets and PL Statement
PQ-5	**Financial: Net Worth** The tenderer (including consortium/JV member) should have a positive net worth as on 31-03-2021	CA Certificate with CA's Registration Number/ Seal
PQ-6	**Tenderer Experience:** The tenderer (Prime or consortium/JV member) must have experience of working experience of similar work with governments/ state owned enterprises. The tenderer's scope of work in the Projects should include following: Design, development and implementation of open source based digital platform on Cloud with below features a) Mobile applications b) Big Data &Analytics c) Web-GIS Portal d) Scientific Models	Work Orders / Service Agreement or Completion Certificate from the client /Work order of the ongoing projects will be accepted along with certificate of work report from client incase at least 60% of work has been accomplished satisfactorily.

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Sr.No	Criteria	Supporting Documents
PQ-7	**Tenderer Experience:** The Tenderer /Consortium/JV should have experience in development & operationalization of real-time Decision Support Systems involving: • Inflow Forecasting • Reservoir Optimization • Hydrological Modelling • Crop Modelling (Stress/Crop Phenology/water Requirement)	Work Orders / Service Agreement or Completion Certificate from the client /Work order of the ongoing projects will be accepted along with certificate of work report from client incase at least 60% of work has been accomplished satisfactorily.
PQ-8	**Quality Certificate:** The Tenderer consortium/JV member must possess a) valid: ISO certificate 27001:2013 **b)** Certificate of Capability Maturity Model (CMMI) at Level 5	Copies of relevant certificates validation date of tender submission
PQ-9	**Undertaking:** Tenderer & the Partner(in case of JV or Consortium) should not be debarred / black- listed by Central / State Government in India, at the time of submission of the Tender, shall not be allowed to participate in this tender. Tenderers need to submit a self-declaration in this regard.	Self-Attested Letter by Company / Firm / Agency

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Sr.No	Criteria	Supporting Documents
PQ-12	**Consortium /JV** The tenderer must have experience of working with governments/ state owned enterprises and to meet the eligibility requirements intending to apply with JV/Consortium is allowed. (Maximum JV/ Consortium members to a maximum of 2 including Prime tenderer)	JV/Consortium Agreement

3.2 Technical Evaluation Matrix

The Purchaser shall assess each Tender against the following Technical Qualification Criteria. All the tenderers who secure a Technical Score of 75% or more will be declared as technically qualified.

Sl. No.	Evaluation Criteria	Total Marks	Overall cut-off for opening Financial Proposal
1	Tenderer Experience	40	75
2	Technical Presentation & Demonstration of Live System	40	
3	Proposed Solution	10	
4	Resource Planning and Key Resources Proposed	10	
Total		100	

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3.2.1 Tenderers Experience

Sl. No.	Citation	Documentary Evidence	Maximum Marks Allotted
1	The tenderer or any member (in case of JV/Consortium) should have experience in development and completion of cloud-based web-GIS projects/systems in the water resources domain during the last five (5) years for State or Central Government departments of minimum value of Rs. 50 Lakhs Above 5 citations = 6 marks, 3-5 citations = 3 marks, 1-2 citations = 1 mark 4 additional marks if the above all the citations are developed on Open source-based tools	Copy of work order + Completion Certificates from the client.	10 Marks
2	Experience in development and handling of IT projects in the water resources domain during in the last five (5) years with an aggregate project value of	Copy of work order + Completion Certificates from the client. (For ongoing projects minimum completion	10 Marks

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	minimum INR 20 crores (not inclusive of Hardware supply and any License Software) for State or Central Government departments. (Out of aggregate value one Project should have minimum value of 7.5 Crores) Aggregate Value of the Projects of Rs. 20 Crores (One Project should be at least 7.5 Crores) =10 marks	should be 60% and commercial consideration will be based on the completion Percentage)	
3.	Quality Certification : (Consulting and Implementation services in the field of GIS, Remote sensing, Software, Application Development, Cloud Software Development) A. ISO certificate 9001:2015: 1 Marks B. ISO certificate ISO 27001:2013: 2 Marks C. CMMI Maturity Level 5: 2 Marks	Relevant Copies of certificates highlighting validity	5 Marks
4.	Experience in developing Flood Warning System with GIS and MIS views to monitor extreme	Copy of work order + Completion Certificates from the client. (For	10 Marks

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	weather forecast, inflow forecast.	ongoing projects minimum completion should be 60% and commercial consideration will be based on the completion Percentage)	
5.	Experience in developing MIS/GIS based Mobile Applications for any State or Central Government 1 applications = 2 Marks 2 applications = 4 marks more than 2 applications = 5 marks	Copy of work order + Completion Certificates from the client. (For ongoing projects minimum completion should be 60% and commercial consideration will be based on the completion Percentage)	5 Marks

3.2.2 Technical Presentation and Demonstration of Live System

Sl.No.	Citation	Documentary Evidence	Marks Allotted
1	Technical presentation Understanding of Solution and Scope of work and all aspect of the Project	Demonstrated level of understanding of the project purpose and scope of work.	15
2	Demonstration of Live System and	Tenderer has to provide	25

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	Submission of use cases (atleast 10 Modules mentioned under 2.2.1) Each module demonstrated will get 2.5 Marks to a maximum of 25 marks	the detailed demonstration on the solution technology landscape, with the details of the client and project implemented and work order under which these modules are developed or ongoing (in case the project is ongoing development, module under demonstration should have been completed) Live URL of each of the Use cases.	

3.2.2.1 Live Demonstration of Modules like as detailed in the Scope of Work

Sr. No.	List Live Modules to be Demonstrated
Module 1	Realtime Dashboards of Water Sources • Rainfall • Reservoirs • Soil Moisture • Minor/Major Irrigation Tanks • Pump Houses
Module 2	Either Village or Urban Water Budget
Module 3	Groundwater Information Management • Realtime Groundwater levels • Village Groundwater Yield information

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Module 4	Project Monitoring and Management • Monthly Work Progress Report
Module 5	Water Conservation Planning • GIS and MIS View planning at Village level
Module 6	Satellite based Water bodies monitoring • Dashboard using Mobile Application & Satellite to estimate Water Availability in water bodies.
Module 7	Satellite based Crop Area Monitoring • Automatic detection of Crop area using Satellite Data and related Workflow
Module 8	Reservoir operation Management • Reservoir operation planning at different inflow, Water availability and Demand Scenarios
Module 9	Water Audit • Realtime inflows, availability and outflows • Water Audit report for selected time period
Module 10	Canal operations • Sub minor level Crop Sown Information • Water release information Sub-minor • Model based Advisories
Module 11	Lift & Transfer management • Advisories and DSS for water transfer based on the Inflow forecast and Demand
Module 12	Inflow Forecasting • Inflow forecasting at key reservoirs and River gauges for at least seven days in advance
Module 13	Early season drought

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	• Block level Season Drought advisory in advance
Module 14	Drinking water stress management • Block level Season Drought advisory in advance

3.2.3 Proposed Solution and Approach Methodology

Sl.No.	Citation	Documentary Evidence	Marks Allotted
1	Overall Solution & Deployment Architecture	(i) Understanding of Business and Scope of work and all aspect of the Project (ii) Functional architecture, Application architecture, Integration architecture & Infrastructure deployment architecture proposed solution covering at minimum the below key aspects: • Modularity of the system • Scalability to handle future load and no constraints on the application • Suitability of Tools & Technologies proposed • Use of Open standards	10

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		and open source products • Approach to develop the API based system • Managing the API eco system • Risk and mitigation • Plan to handle multiple stake holders	

3.2.3 Key Resources Proposed

Sl.No.	Position	Details	Marks Allotted
1	Resource Deployment Plan & Governance Structure	Tenderer would be evaluated for Resource Deployment Plan & Governance Structure	2
2	Program Manager/Project Manager/Team Lead	▪ Education: B. Tech/B.E/MBA/ MCA or Equivalent & ▪ Minimum Experience: Should possess at least 8 years of experience in IT. ▪ Should have more than 6 years of experience of handling such large projects as a project/program manager	1

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3	Solution Architect	▪ Education: B.Tech/B.E/MBA/ MCA or Equivalent ▪ Minimum Experience: At least 8years in ITdomain ▪ Should have experience of more than 5 years as Solution Architect in large projects of similar nature	1
4	GIS Expert	▪ Education: B.Tech/B.E/MBA/ MCA or Equivalent. ▪ Minimum Experience: At least 8years in IT domain & GIS technology ▪ Should have experience of more than 5years as GIS Expert in large projects of similar nature.	1
5	Remote Sensing Expert	▪ Education: Fulltime M. Tech/ M.Sc. in remote sensing/ Geomatics or equivalent ▪ Minimum Experience: :At least 5 years ▪ Should have experience of more than 5 years in satellite imaging domain in large	1

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		projects of similar nature.	
6	Water Resources Expert	▪ Education: Relevant advanced (Masters) academic degree in Hydrology, Hydraulic and / or Water Resources engineering. ▪ Minimum Experience: At least 8 years ▪ Should have experience and knowledge of hydrological and hydrodynamic modelling tools.	1
7	Agriculture Expert	▪ Education: Master's in Agriculture or equivalent ▪ Minimum Experience : 10 Yrs. of Experience, Skill Set: Experience in crop phenology, soil characteristic, modeling etc.	1
8	Database Specialist / Software Programmer/ Software Engineer	▪ Education: B. Tech/B. E/MCA ▪ Minimum Experience: 4 year experience in data base applications for Database, Web management; ▪ Extensive experience in scripting using cutting edge software development tools.	1
9	Technical Support	▪ Education: B. Tech/B. E/MCA ▪ Minimum Experience: 3 years experience in Operations and Maintenance	1

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SECTION IV: EVALUATION & AWARD OF CONTRACT

This section contains all the criteria that the Purchaser shall use to evaluate Tenders and qualify Tenderers. No other factors, methods or criteria shall be used.

The evaluation methodology adopted will be Quality cum Cost Based System (QCBS) method of evaluation where Technical proposal Score will get a weightage of 90% (denoted by ST) and Commercial proposal Score a weightage of 10% (denoted by SF)

Evaluation of tenders would be done on QCBS (Quality and Cost Based Selection) criteria as detailed. The tenderer shall have to score at least 75 marks in Technical Score as per "Technical Evaluation Criteria" for being eligible for opening of financial proposal.

4.1 Technical Proposal Qualification

i. Purchaser shall validate the "Tender Fee & Earnest Money Deposit (EMD)".

ii. Purchaser will review the Pre-Qualification Proposal of the Tenderers to determine whether the requirements as mentioned in Pre-Qualification Criteria of the tender are met. Each of the Pre-Qualification condition mentioned in the tender is MANDATORY. Incomplete or partial Proposals are liable for rejection.

iii. Technical Proposals of the pre – qualified tenderer will alone be evaluated.

iv. Purchaser will review the Technical Qualification proposals of the Pre-Qualified tenderers to determine whether their proposals are substantially responsive and to determine whether the requirements as mentioned in Technical Qualification criteria of the tender are met. Tenders that are not substantially responsive are liable for rejection.

v. Proposal Presentations: Purchaser will invite each Tender to make a

presentation to Purchaser, at a date, time and venue decided by Purchaser. The purpose of such presentations would be to allow the tenderer to present their proposed solutions to the Technical Committee formed by the Purchaser and orchestrate the key points in their proposals. The team proposed for deployment shall make the presentation.

vi. Tenderers should demonstrate the Live Modules as mentioned in the technical evaluation criteria

vii. Purchaser shall assign a technical score to the tenderers based on the Technical Qualification criteria detailed in this tender document. The tenderers are instructed to submit all relevant documents in support of the technical evaluation criteria as specified. The Technical Score (ST) is total marks obtained by the tenderer against the 100 Marks in Technical Evaluation Criteria.

viii. The Technically qualified tenderers will be selected under this tender for further process i.e. the tenderer will be selected as technically qualified tenderer.

ix. Tenderers, those who score the minimum cut-off score of 75% in each section mentioned in Technical Qualification Criteria of the Tender will alone qualify for the evaluation of the commercial proposal

4.3 Commercial Proposal

i. All the technically qualified tenderers will be informed to participate in Commercial proposal opening process.

ii. The commercial proposals for the technically qualified tenderers shall be opened on the notified date and time and reviewed to determine whether the commercial proposals are substantially responsive. Tenders that are not substantially responsive are liable for rejection.

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iii. Partial proposal shall be liable for rejection and hence the tenderer has to quote for all the items.

iv. The Commercial Score of the tenderer shall be calculated with respect to the lowest Total Price and shall be calculated for a maximum score of 100. The methodology for calculation of Commercial Score shall be as follows;

SF = 100 x (Fmin/F) (rounded off to 2 decimal places)

Where

F = Total Financial tender amount quoted by individual Tenderer

Fmin= Lowest Total Financial tender amount quoted by individual Tenderer

SF = Financial Score obtain by the Individual Bidder

Total Tender Evaluation (Combined Evaluation of Technical and Commercial Scores)

i. The Total tender evaluation shall be based on Quality and Cost based Evaluation (QCBS). Technical Score shall have 90% weightage and Commercial Score shall have 10% weightage.

ii. **The Total Score of the Tenderer S = (ST x 0.9) + (SF x 0.1)** (rounded off to 2 decimal places)

(a) The tenderer achieving the highest Total Score shall be invited for negotiations for awarding the contract

(b) In case of a tie where two or more tenderers achieve the same highest Total Score, the tenderer with the higher Technical Score will be invited first for negotiations and for awarding the contract.

iii. The evaluation, negotiation and Award of Contract will be done as per provisions of Tamil Nadu Transparency in Tenders Act, 1998 and The Tamil Nadu Transparency in Tenders Rules, 2000 as amended from

time to time

4.4 Award of Contract

i. Award Criteria:

Post evaluation process and negotiations, Purchaser will award the Contract to the tenderer whose proposal has been determined to be technically responsive to the requirements of the tender and has obtained the high score in total bid evaluation process.

ii. Notification of Award and Letter of Acceptance

a. After the successful completion of negotiations, Purchaser will issue Letter of Acceptance (LOA) to the successful bidder.

b. The contract period will commence from the date of contract signing.

c. Upon the identification of successful tenderer and after execution of agreement, Purchaser shall notify unsuccessful tenderers and will return their EMD.

d. Upon the receipt of performance bank guarantee (PBG) from successful tenderer, Purchaser shall return the EMD of the successful tenderer

4.5 Performance Bank Guarantee (PBG)

i. The successful tenderer should submit the Performance Bank Guarantee (PBG), within 21 days from the Letter of Acceptance (LOA) received by the successful tenderer.

ii. In case the successful tenderer fails to submit PBG within the stipulated time, PURCHASER at its discretion may cancel the order placed to the successful tenderer.

iii. The PBG for a value equivalent to 5% of the total contract value shall be submitted as per the format provided in this Tender document from

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iv. The PBG shall be valid for a minimum period of 32 months.

v. Purchaser shall invoke the PBG in case the successful tenderer fails to discharge their contractual obligations during the period or Purchaser incurs any loss due to the tenders negligence in carrying out the project implementation as per the agreed terms & conditions and service level agreement

4.6 Execution of Contract

The Contract will be valid during the implementation phase and the operation & maintenance phase for One Year. In case of a delay during implementation phase for reasons attributable to the selected tenderer, the contract shall be extended accordingly without any additional cost.

4.6.1 Signing of Contract

After the Issuance of LOA by Purchaser to the successful tenderer and on submission of PBG by the Successful tenderer, the Successful tenderer shall enter into a contract with Purchaser within 14 days.

Purchaser shall have the right to award in case there is a delay of more than 14 days in signing of Contract from the date of Notification of Award/ Letter of Award by Purchaser, for reasons attributable to the successful tenderer.

4.6.2 Forfeiture of EMD and SD

i. If the successful tenderer fails to act according to the tender conditions or backs out, after the tender has been accepted, the EMD will be forfeited.

ii. If the successful tenderer fails to remit the SD, the EMD remitted

by him will be forfeited to Purchaser and the tender will be held void.

iii. If the successful tenderer fails to act up on to the Agreement conditions or backs out from the contract, the SD mentioned above will also be forfeited by Purchaser.

4.7 Termination of Contract

4.7.1 Termination for default

i. Purchaser may without prejudice to any other remedy for breach of contract, by written notice of default with a notice period of 30 days, sent to the successful tenderer, terminate the contract in whole or part,

a. if the successful tenderer fails to deliver any or all of the service within the time period(s) specified in the contract, or fails to supply the items as per the delivery schedule or within any extension thereof granted by Purchaser; or

b. if the successful tenderer fails to perform any of the obligation(s) under the contract; or

c. if the successful tenderer, in the judgment of Purchaser, has engaged in fraudulent and corrupt practices in competing for or in executing the Contract.

4.7.2 Termination for Insolvency

Purchaser may at any time terminate the Contract by giving written notice with a notice period of 7 days to the successful tenderer, if the successful tenderer becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the successful tenderer, provided that such termination will not prejudice or affect any right of action or remedy that has

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accrued or will accrue thereafter to Purchaser.

4.7.3 Termination for Convenience

Purchaser may by written notice, with a notice period of 30 days sent to the successful tenderer to terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for Purchaser's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective. Services rendered by the tenderer, as assessed by Purchaser, would be paid.

4.7.4 Liquidated Damages

The successful tenderer must strictly adhere to the implementation schedule, specified in the Tender & Contract / Work Order and any delay attributable to the successful tenderer will enable Purchaser to resort to any or both of the following:

(a) Claim liquidated damages at 0.5% of the value of work as per Clause 11 of Section II for delayed deliverable per week and the maximum LD applicable is 5% of the value of affected deliverable. However, LD shall not be levied if the delay is not attributable to the successful tenderer.

(b) Purchaser may terminate the contract due to the non-performance of the successful tenderer. In the case of termination Security Deposit will be forfeited.

4.7.5 Service Level Penalties

Type of Bug	Bug/problem resolution time	Penalty Amount
Critical (Having bearing on	Should be solved within 8 hours and 3 hours if the bug	Rs. 500/- (per hour) beyond 8

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the day-to-day functioning of the respective system /availability of application (full functionality or part functionality)	/ problem has reoccurred within 7 days of the earlier resolution	hours/3 hours
Non-critical (Not-having bearing on the day-to-day functioning of the respective system)	4 working days 1 working day if the bug / problem has re-occurred within 15 days of the earlier resolution	Rs.500/-(per day) Beyond 4 working days Rs. 600/- per day beyond 7 Days Rs. 700/- per day beyond 10 days

4.8 Change Management

Any requirement beyond the scope of work mentioned above will be treated as Change Request.

The activities that will be treated as changes request is mentioned below:

a) Functional changes in the application
b) Development of new module/ in the developed system
c) core application framework
d) Additional resources in the project operation
e) Any addition to the list of BoQ
f) Development of New Models

However, the following are not considered as change request to be executed by the tenderer Software Maintenance and Project operation support team

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a. New sub-module/new Form/ New Report
b. Changes in the workflow
c. Addition of new data sources
d. Enhancement recalibration of Modules

The procedure for executing the change request is as follows:

- **Analysis:** Consultant will analyse the changes suggested and submit an estimation/cost including timeline to the Purchaser.
- **Approval:** Purchaser shall do the due diligence and provide approval on the effort and timeline suggested

4.8.1 Incorporation: After receiving the approval from Purchaser, Consultant team will incorporate the changes in the application as per the quoted rate for software enhancement.

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SECTION V: SCOPE OF WORK

TN-WRIMS should be developed using Open source and Open standards-based technologies with features of standardizations, openness, scalability and security inbuilt for all the applications hosted on the platform. This Integrated Digital Platform shall be an integrated back-end platform that provides domain specific & common services using standard interfaces (APIs) that can be used for rapid application development in a mash-up form. The platform should be capable of advanced hydrometeorological monitoring and hydrologic forecasting to provide actionable information for flood warning, hydropower operations, water allocation, agriculture operations and other areas. This makes critical water resources decisions, possible based on real-time conditions. Followings are the key modules that should be developed to meet the objective of **TN-WRIMS**.

5.1 Development of Digital Platform & Unified Database, Satellite processing and admin module Data Collation, Digitization, Cleaning, and Integration work

5.1.1 Data collation analysis and Cleaning

As a part of project execution lots of data is required to be collected, cleaned, and processed.

- All historical data stored in the different applications should be integrated into the Big data database and unified platform.
- All the data including historical data that is being integrated should be pre-processed by data cleansing modules. Any outliers and incorrect data should be corrected or eliminated in the data that is uploaded to the Big data database.

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- Some of the historical data that is not in digital form is collected in paper form where practically possible and is digitized. This data should be uploaded to the same unified database.

- The real time data that is received from the sensors should be configured to be sent every hour, every day or at a frequency that is appropriate for the type of the data coming. The data should be processed real time and is displayed in the dashboards and also stored for analytics
- All the mobile input data should be collated from the users entering different types of data from across the state and is assimilated in the appropriate database. The mobile applications are designed to enter minimal, but all the required data even when the mobile application is offline so that the data can be uploaded when the user comes online. The frequency of updating the data input from the mobile can be anything from every few minutes to once every month depending on the source and type of the data. The system should be designed to accommodate any frequency of data submissions and inputs.
- All the data integrated from web sources, central government databases and other sources is also stored in a unified database so that there is one unified database for all the data.
- The data input modules should be designed to be web and mobile ready so that it facilitates the collaboration among the users.
- The database should be designed to scale so that it cannot only hold all the historical and real time data but can also scale as the data grows in the coming years.
- The Unified Database should be a core layer of the platform that must have different data types corresponding to various entities like Groundwater, Rainfall, Reservoirs/Barrages, River Gauge Stations, Rivers

and Streams. It would be hybrid database architecture with multiple clusters that store spatial and non-spatial data that combines Static/Semi-Static alphanumeric data, Time Series Operational Data (Big Database), Static/Semi-Static Spatial data all knit together by a unified schema.

5.1.2 Data Digitization and Generation

Towards enablement of the models, dashboards and advisories, various dashboards and modules of the TN-WRIMS will require exhaustive and correct meta data to be generated. Agency is expected to deploy appropriate data digitization and support staff to achieve these activities. Following are the few identified activities for this project

- Digitization of various time series historical data sets: Gage, ground water levels, rainfall, reservoir release and storages etc
- Generation of canal network, and its sub-command area shape files, the upcoming Canal and its minor/sub minor details will be digitized or integrated as and when available
- Creation of minor/major irrigation Tank water spread area
- Generation of river polygon, cross section maps, flood vulnerable zones etc
- Digitization of Area Elevation and Capacity tables
- Crop related information in the command area
- Demand and consumption side information
- Spatial data sets like soil maps, Geological maps etc.

The data collection, cleaning and upload to the system will further be required for the below components:

Weather: Rainfall, Temperature, Wind speed, Humidity

Reservoirs: Details of Geo-tagged location of the reservoir, Full reservoir level, Dead storage level, Storage at FRL, Storage at dead storage, Reservoir rating table, Reservoir water body shape file, Different Water User Drawls & Capacities, Catchment Area, Command Area, Canal shape file etc.

Canals: Hydraulic particulars shape file of the canal network, Geo-tagged location of the off-take points, design capacity of each off-take point, command area delineation of each off-take point, localised ayacut of each off-take point etc.

River and stream flows: Geo-tagged locations of the gauge points, Rating table of the gauge points, Upstream gauge points that drain into a particular gauge point, Time travel for water to flow from upstream gauge points to a particular gauge point, Stream network shape file, Highest flood level, flow & date, Warning level & flow, Danger level & flow etc.

Minor/Major Irrigation Tanks : Geo-tagged location, Storage Capacity, Full Tank Level, Maximum water spread area, Catchment area, Command area, Cascades, Etc. It should have integration with satellite data.

Ground water: Historical data, recharge and draft.

5.1.3 Integration of existing water resources data

Key entities and their attributes stored should be:

- Supply: Rainfall, River Inflow
- Surface Water resources like Reservoirs, Tanks, Dams, Satellite based Water spread area, Rivers, Rivulets, Canal Releases.
- Ground Water resources like: Aquifer, Borewells, wells etc.
- Water Demand: Agriculture, Drinking, Industrial, Livestock and Domestic: Population based, Urban water supply bodies, Commercial and Industrial, Non-Human and environmental needs etc.,

- Geo-Spatial Data integration: Admin Boundaries, Geo-Tagged Data, Tanks, Borewells, and any other water conservation structure
- Satellite data integration and its derived themes (Water spread areas, NDVI, NDWI etc)
- Forecast Weather Data Integration: IMD, ISRO, Global Data set, State Data
- Telemetry and IoT Data Integration from sensors, data center and 3rd party sources
- Integration with other Time series Data like River, Reservoir, and Piezometers
- Integration with existing systems like:
    - TN Smart
    - TNGIS
    - AGRISNET
    - Municipal Administration and Water Supply Department,
    - Water Resource Department.
    - TN WRIS (SWARMA) – TN WRIS is having various spatial and non-spatial data related to water resources components. These layers of data will be used in development of TN WRIMS.
    - State Ground and Surface Water Resources Data Center
    - Tamil Nadu Water Supply & Drainage Board
    - TN Electricity Board (Hydropower)
    - TN Agriculture Department
    - TN Revenue and Disaster Management Department, and any other relevant government or third-party systems.

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5.1.4 Data sanitization and processing

All historical data stored in the different applications should be integrated into the Bigdata database and unified platform. All the data including historical data that is being integrated should be pre-processed by data cleansing modules. Any outliers and incorrect data should be corrected or eliminated in the data that is uploaded to the Bigdata database. Some of the historical data that is not in digital form is collected in paper form where practically possible and is digitized. This data should be uploaded to the same unified database.

5.1.5 Satellite Data Integration

With advancement in remote sensing, it has become possible to capture information remotely and quickly on various parameters like water spread area, crop health, soil moisture, Evapo-transpiration etc. It is also possible to do time series analysis on change in water areas, area under cultivation, crop intensity, productivity etc.

This platform is expected to automatically download, process and store satellite data and its derived results without any need of manual intervention. Platform is further expected to run both scientific algorithms and machine learning based models to make use of both optical and microwave-based freely available satellite data like

- Sentinel 1
- Sentinel 2
- MODIS
- Indian Satellites
- Any other satellite data that State may procure

System should be capable to make use of the above satellite Data along with ML or Scientific algorithms to fill the data gaps for the below area:

- Regularly estimate surface water availability through estimating water spread area.
- Crop health using NDVI and NDWI parameters
- Change in Water Bodies number and size
- Crop Acreage estimation and Paddy Vs non-Paddy classification

5.1.6 Geoportal & Dashboard

The geoportal with integrated GIS/MIS should serve the purpose of one Authoritative System for all water-related data Supply, Demand, Operational, Environmental factors, etc with near real-time Information of all available water such as Ground Water, Surface Water components such as Reservoirs, Canals, Irrigation Tanks, etc. The key features of dashboard should be:

- Show a schematic mimic view of the different indices inside a basin or of a watershed
- Show the real time data on water availability, demand, forecast water flows, and various other components in both GIS and MIS
- On single click, a brief detail is to be shown in the information panel. These panels are customized to suit the type of details and users.
- Drill down MIS/GIS view to the lowest unit

The Geoportal should consist of an integrated, user-friendly dashboard that enable the outlook at the GIS map view of various layers. Some key layers are illustrated below, which should combine to form desired reports.

- Administrative boundaries
- Hydrological boundaries
- Cadastral boundaries
- Catchment areas
- Command areas
- River network

- Drain network
- Canal network
- SRTM 30 digital elevation model
- Geology
- Geomorphology
- LULC

5.1.7 Geospatial analytics capabilities

Geoportal must have the capabilities to understand the data available in different formats, point level information etc. It should be able to interpret and understand change and detect important patterns hidden in the information. Various layers containing different types of data should be stacked and compared with each other based on where things are in a spatial decision support platform. The layers interlock in the sense that they are all geo referenced to true geographic space. Spatial analysis should be used to model the attributes geographically and derive results by using spatial associations and mathematical modelling and the results are aggregated in estimating and predicting outcomes, interpreting and understanding change and detecting important patterns hidden in the information.

These are listed below:

- Interpolations: Spatial interpolation process of using points with known values to estimate values at other unknown points.
- Intersections / Unions: The Intersect Tool should be used to perform a geometric overlap. The overlapped layers with all the features should be part of the output with attributes preserved.

- Associations / Aggregations: Spatial association are done to identify similar spatial data and the degree to which they are similarly arranged in space and to perform analysis of the distribution patterns.
- Spatial Density Analysis: This feature will enable user to select a particular parameter and create density polygons, and density heat maps.
- Heat maps / Choropleths: A choropleth maps are enabled to show changes across a geographic landscape within enumeration units such as States, Districts, Basins and Sub-Basins or watersheds.

5.1.8 Machine Learning

Machine learning and Artificial Intelligence should be an integral part of the platform for the platform to parse, comprehend and understand the data generated. The platform should be able to provide intelligent actionable decisions and advisory based on its learning. The platform should be able to host deep learning bases neural network algorithms for application such as crop acreage, water spread area and various other modules.

The system integrator must use the artificial neural networks to solve challenging problems that would part of the scope of work. The system must use of large amounts of available data to train a neural network to generalize to a particular problem, Deep Learning employs the power of neural networks. The system Integrator must leverage on modelling techniques& algorithms that are specific to the problem to be solved. The system Integrator must be able to architect, host and run various machine learning algorithms including deep learning neural networks like CNN, RNN, LSTM and DNN in their solution to provide automatic identification of various components where required.

The Platform must use all the sets such as Training set, Validation set and Test set while training the system. The Platform must ensure that the model

is not over-fit or under-fit. For this purpose, the Platform must understand how the accuracy and loss of the model varies per epoch. The validation accuracy must be monitored to gauge the number of epochs required to train a model without over-fitting it. This system should be progressive in nature, as the system keeps getting more data the model should be able to use it automatically and enhance its accuracy.

- Agency should automate self-training of these machine learning models: The agency must leverage on the data available from the department to automate the self-training component of the solution. This would generally include the agency to add as many sets of data that can be labeled to provide the system with the initial information required to classify. This should be followed by an automation process for the solution to get trained by itself.
- Agency to use ML platform where models can be added modified or deleted at a later stage by the department.
    - The agency should ensure that there are pre-defined models available in the ML platform and is provided with the capability for the department to
        - Add
        - Modify
        - Delete
    - This would ensure that the department is able to get desired outputs from the pre-defined or the new model that is being created
- Agency to provide facility where department officials can keep adding the training data for increasing the accuracy.

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- The agency should ensure that the training data of the ML platform is provided with the capability for the department to add more training sets
- This would ensure that the department can control the quality of the output being controlled via the updated training set

5.1.9 User Specific Views

- This should allow Block level Water Resource, Agricultural & Irrigation officers to log-in and view various details pertaining to their blocks in MIS & GIS views.
- This dashboard should have the ability for the Agricultural & Irrigation officials to work collaboratively and use the Decision Support System to simulate scenarios, observe the results and update block level planning & set targets
- The Decision Support System should also be accessible to the District level planners and Decision makers by aggregating the block level values to a District level.
- This should have a functionality to keep re-running various scenarios and the system should enable users with the outputs of specific scenarios
- The system should enable the administrators with these simulated results to take a holistic decision
- The GIS based dashboard should also be able show the decision makers the alternative sources for irrigation in deficit areas.
- Water surplus/Deficit areas as the rainfall varies
- The various scenario-based GIS views of blocks being water surplus/deficit based on various scenarios of rainfall (Normal Rainfall, +/- 20% , +/- 40% etc.

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- Water demand for various sectors such as Agriculture, Horticulture, Domestic, Livestock etc. (GIS view of areas that can be under Micro Irrigation)

5.1.10 Data Entry Workflow

Data entry module will allow representatives of the stakeholder to upload the relevant data at the designated geography area. Data entry will go through the primarily data capturing, secondary level validation and third level data authentication to ensure the quality of the data. Below model describes the proposed model.

The below modules cover the scope of entering all relevant data through Web forms and Mobile apps. The System will be enabled to capture dynamic data entry for users using:

- Web-Forms: Web-Forms allowing user to enter data that is sent to a server for processing
- Mobile apps: The mobile Application that is to be developed should act as an interface between the field information and aimed at providing the information that can be shared easily by the field officials. The Designing and developing of mobile applications (android based) that helps with the geo-tagged images and other data that can be loaded on to server.
- Data Validation & Authentication forms: All Data validation and authentication forms shall be in Web/mobile app forms mode so that the data validator or authenticator can enter verify/authenticate the data in bulk, wherever necessary and needed.

Data entry shall be performed by the users of the respective departments through web/mobile apps. Data validation and authorization shall be

performed through web forms. Unless the data is authorized by the respective departments the data will reside on the temporary database only. Once the data has been validated and authorized, the data will be moved the production system. Data entry, validation and authentications is not the scope for the consultants.

5.1.11 Mobile Application

The mobile Application should facilitate the users to capture field data. It needs to act as an interface between the field information and aim to provide the information that can be shared easily by the field officials. The mobile application should help with geo-tagging images and other data that can be loaded on to server. It should enable Department users and field staff to update data through mobile application from remote places to the geospatial server with an admin or hierarchy-based module to ensure that the data pertaining to their jurisdiction alone can be uploaded/edited.

Mobile App features and functionalities should be :

- Native app and support cross-platform (Android, IOS, etc.) with focus on simplicity, great performance, attractive design, user-friendly GUI and icons/themes
- Registration by user type and wells (Owner, GPS, Type, depth, width, contact details, etc.)
- Data Collection (observation date, time, water depth in wells, water depth in check dam/reservoir, water quality, rainfall, etc.)
- Language: English & Tamil
- Auto Sync – data sync automatically to the server and temporary data storage capacity for offline use till it gets synced
- Pull data while user change the mobile device
- Offline and Online Support

- Compatible with 2G/3G Connectivity
- Automated notifications and alerts (push and local) to the community and stakeholder
- Notification indicating the status of water depth/consumption based on historical data and forecast water availability
- Customizable to send notifications and similar nature of features
- Should enable Department users and field staff to update data through mobile application from remote places to the geospatial server with an admin or hierarchy-based module to ensure that the data pertaining to their jurisdiction alone can be uploaded/edited
    - Geo-Tagging
    - Crop Booking
    - Canal Releases
    - Water Levels
    - Pump Status
- Mobile application should be flexible to enable any input/output related features for any of the modules and should support relevant features.

5.1.12 Data Availability and Sources

Spatial Data

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Digital Elevation Model		Mostly Static in nature	Yes
Land use	WRD		Yes
Soil	TNAU		Yes
Watersheds, basins and sub basins	WRD		Yes
River network	WRD		Yes
Water bodies	WRD		Yes
Reservoirs	WRD		Yes
Irrigation Tanks	WRD		Yes
Weirs/ Barrages/	WRD		Yes

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Canal network	WRD		Yes
Ayacut areas	WRD		Yes
Command area boundaries	WRD		Yes

Meteorological Data

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Rainfall	IMD, TN-SMART	Geo-locations of rain gauges	TNSMART provides access to all available rainfall stations
Temperature, wind speed, Humidity, solar radiation	AWS stations of IMD	Geo-location of AWS stations Time series (Historic and real time)	Yes
Radar based rainfall	IMD	Hourly/ daily raster datasets	Yes
Satellite based estimates of Rainfall	GPM IMERGE	Hourly/ 3 hourly/ daily raster datasets	Freely downloadable
Rainfall	IMD	Lead time of 3 days, 7 days, 10 days, seasonal forecast	Currently TNSMART provides weather forecast and flooding potential of vulnerable areas (IMD_5day. ECMWF_10day, RIMES ensemble forecast)
	TNSMART	Risk levels, potential impacts, response planning, relief operations	Yes
	TNSMART, CFLOWS and CWC		CFLOWS Alerts focus on Chennai basin

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Hydrological – Surface water- Stream / river flows

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Geo-locations of gauge sites	WRD	Time series (Historical and real time) - daily	YES
Rating curve	WRD	Time series (Historical and real time)	YES
Details of High flood levels, corresponding flows and with time stamp	WRD	Time series (Historical and real time)	YES
Warning and Danger levels at control locations of the rivers	WRD	Time series (Historical and real time)	YES

Hydrological – Surface water- Reservoirs, barrages

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Geo-locations , Identification of multipurpose/ single purpose/ hydroelectric	WRD	Shape files	YES
Reservoir and Spillway Characteristics (Storage Capacity)	WRD	Information table	YES
FRL, MDDL, Conservation level	WRD	Information table	YES
Reservoir release details/ policies	WRD	Information table - daily	YES
Command area associated	WRD	Information table	YES
Water allocation policies of reservoirs (release, diversions under various heads)	WRD	Rule curves/ Information table	YES

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Hydrological – Surface water- Canals

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Hydraulic Particulars and Take-off points	WRD		Yes
Ayacut area associated	WRD		Yes
Design capacity	WRD		Yes

Agriculture management (AGRISNET with TNAU and Tamil Nadu Agriculture Department)

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
TANK Storage capacity	WRD		
Minor/Major Tank Water spread area, Catchment area, Details of Cascading tanks	WRD		
Command area of tanks	WRD		
Water users Association	WRD		Yes

Hydrological – Ground water

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Aquifer information – maximum capacity, recharge rates, properties etc.	WRD	Spatial along with attribute table	Yes
Geotagged locations of observation wells and irrigation bore wells	WRD	Spatial along with attribute table	Yes
Pumping information and water table fluctuations	WRD	Spatial along with attribute table	Yes
Well characteristics (depth) and well yield	WRD	Spatial along with attribute table	Yes

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Details of ground water allocation/ consumption	WRD	Information table	Yes
Average-ground water level status/ ground water potential for Tamil Nadu	WRD	Information table	Yes
Zone Categorisation based on ground water status	WRD	Spatial with attribute table	Yes
Details of Saline blocks in Tamil Nadu	WRD	Spatial with attribute table	Yes

Agriculture

Datasets	Source of Data	Frequency/ Nature of data	Status of Availability
Basin wise information Agricultural regions/ irrigated areas	AGRIS NET/ TNAU	Shape files with attribute info	Yes
Cropping pattern, crop calendar/ crop management practices/ cropping season	AGRIS NET	Information table	Yes
Soil moisture information	AGRIS NET		Yes
Soil health card	AGRIS NET		Yes
Village level fertility index	AGRIS NET		Mapped for 4500 villages across TN
Crop management – Fertilizer application, availability, Price	AGRIS NET		Mapped for 4500 villages across TN

5.2 Setting up and Automation of Hydrology, Hydraulic, Crop, and Operation Models

The solution should have hydrology models and other Rainfall Runoff models that can be used with simple input setup inbuilt. The model shall be used to estimate Surface Runoff, Soil Moisture and Evapotranspiration to be used in dashboards and Water Budget among various other modules as a key input. The model should run on a daily

basis (or at desired frequency)at a pre-defined time to estimate the Evapotranspiration, Surface Runoff and Soil Moisture parameters. This should automatically be ingested by other modules to provide real-time understanding. Platform should be capable to host various scientific models and run them in an automated fashion at regular intervals.

- Platform should be able to ingest weather forecast data in various formats like GRIB, NETCDF etc through FTP or other file transfer mechanism.
- Process and Prepare the model input dataset, at gridded or lumped space levels.
- Run models, and generate output data, and use them for estimation or prediction of parameters like Run-Off, Soil Moisture and Evapotranspiration.
- List of the models, the platform should be able to host
    - Catchment and Drainage generation
    - Rainfall – Runoff models
    - Hydrodynamic models – 1D and 2D.
    - Network Flow Optimization.
    - Reservoir Operation Optimization Model
    - Crop models – Crop Water Requirement, Soil Moisture Estimation,
    - Ground Water Assessment
    - Water budgeting and accounting
    - Other Scientific or Statistical Models

This should enable:

- Ability to view the entire stream network and click at any point and see flow values for the next couple of days
- Ability to see the actual rainfall in the self-catchment area as well as upstream over the last couple of days, that impacts the flow at that point
- Ability to select basin or region of choice to view the flow forecast

- Integrate with external system forecasts and improve the accuracy of issued forecasts
- Ability to click on any vulnerable site and view detailed flow information like site details, water level, highest water level, danger level at that particular site, level trend (rising or falling), upstream inflow, catchment inflow, outflows along with the trend chart.
- Ability to view forecasts at various granularities of the time intervals (6 hourly, daily, etc)
- Ability to view the map of the whole state and its rivers, marked with flood forecasting sites
- Ability to view locations of forecasting sites on a river clearly marked so as to get a clear overview of the flow situation across the river basin
- Ability to view the state's map with appropriate colour coding of the river network determining the flow intensity i.e., if the water level is above/below warning or danger level or High Flood level
- Ability to quickly view the sites where water level is currently on the rise or above the danger mark.
- Ability to view rainfall details like rainfall of the day, previous two days actual rainfall, next two days rainfall forecast, normal monthly rainfall and cumulative rainfall for the month, total rainfall data for the whole season.
- Ability to view water level details like water level of the day, previous day water level and projection of water level for the next few days along with name of the river, basin and site name
- Ability to import and export Data between the model and the database using the common formats like excel, text, xml, mdb, etc.

5.3 Development of Decision Support System and Dashboards

The system should consist of MIS & GIS dashboards that help the user to understand the real time & historical patterns of water related components such as Rainfall, Reservoirs, Ground Water, Minor Irrigation Tanks, Soil Moisture etc., in the Project area.

5.3.1 Realtime Dashboards for all Water supply, demand, quality, users etc.

The system should consist of MIS & GIS dashboards that help the user to understand the real time & historical patterns of water related components such as Rainfall, Reservoirs, Ground Water, Minor Irrigation Tanks, Soil Moisture etc., in the Project area.

5.3.2 Rainfall Dashboard (Including Forecast)

Rainfall is a key hydro meteorological parameter that helps in understanding many related phenomena like drought, floods, climate changes etc. Rainfall is monitored using Automatic Weather Stations of IMD, state agencies and remote sensing satellites of various space agencies globally.

This dashboard will show content of actual, merged (now cast) and forecast weather data.

Rainfall dashboard will have MIS & GIS View to provide both Statistical and Visual Understanding of Various Rainfall with GIS based heatmaps, comparisons, trends and info panel for

- Daily
- Weekly
- Monthly
- Season
- Deviation Compared to Normal
- Comparison Between Selected time frame

- Analysis - Annual Rainfall, Normal Rainfall, Count of Non-rainy days etc
- Forecast Data +24hrs, +7 Days, +30 Days,
- Ensemble Forecast with statistical parameters like Mean, 75%tile, 25%tile, 50%tile etc
- Rainfall forecast Probability heatmaps
- Source wise selection of all the above

5.3.3 Reservoirs Dashboard

Reservoirs act as key node points for water storing and balancing during the transfer of water to deficit areas in the state hence it is very important to understand the levels of water, availability of water in the reservoirs for various purposes like crop planning, flood planning etc. This Reservoir dashboard will provide information about salient features of reservoirs along with real time information like Reservoir Level ,Live Capacity at FRL Inflow, Outflow and Live Storage etc.

- Master Data: following master data for the reservoirs will be uploaded:
  - Geo-tagged location of the reservoir
  - Full reservoir level
  - Dead storage level
  - Storage at FRL
  - Storage at dead storage
  - Reservoir rating table
  - Reservoir water body shape file
  - Different Water User Drawls & Capacities
  - Catchment Area
  - Command Area
  - Canal shape file

- Current Storage, Inflows and Outflows: Current status of reservoir can be captured through a combination of data from sensors, satellite data or data entered by reservoir operator through the unified mobile APP.
- Current Level & Storage Estimation through IoT Sensors: Current water level of the reservoir can be captured through IoT sensors installed at the reservoirs by CWC, State planning department or irrigation department. IoT sensors typically measure the level and transmit data to the cloud several times during the day. Reservoir storage is computed from level based on reservoir rating table. Where there is no sensor installed data can be captured via satellite or mobile APP
- Level and Storage through Unified Mobile APP: Reservoir operator can use unified mobile APP to enter level and storage data periodically (multiple times during the day during flood season and once a day during non-flood season)
- Inflow and Outflow through Unified Mobile APP: Reservoir operator can use unified mobile APP to enter
    - Real-time inflow & outflow values can be entered by the operator several times a day during the flood season and once a day during non-flood season
    - Daily average inflow & outflow values can be entered by the operator once a day. If there are multiple sources or inflow and multiple users for outflows (power, canal releases, lift irrigation schemes, spill way, losses etc) then the data will be entered for each such source and user
- Historical Reservoir Data: Last 30 years or available data on reservoir level, storage, inflows and outflows can be uploaded into the system through file-based upload.

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5.3.4 Ground Water – Dashboard

Groundwater levels are monitored using observation wells and piezometers implanted by Central Groundwater Board and State Ground water departments. This dashboard should provide features like near real time information of Ground water levels, Level trends based on the historical data, Water level fluctuations, spatial analysis, season wise trends etc which helps in understanding the Change in Groundwater levels.

- Master Data: Following master data (whatever is available) for monitoring ground water levels will be uploaded:
  - Geo-tagged location of the observation borewells
  - Geo-tagged location of the agriculture borewells
  - Pumping motor horsepower
  - Depth of the borewell
  - Borewell yields across the region
  - Aquifer data
- Current Ground Water Levels: Current ground water levels can be captured using telemetry enabled piezometers, which transmit depth to ground water several times during the day. If telemetry sensors are not installed, then periodic ground water levels can be captured and submitted using the unified mobile APP. Typically ground water department captures this data at the observation wells once a month or pre & post monsoon. In addition to department captured data NGOs, farmers and extension workers can submit this data through unified mobile APP.
- Historical Data: Available historical data will be loaded into the system through a file-based upload

5.3.4.1 Major and Minor Irrigation Tanks and other smaller water bodies

Irrigation tanks increases the proportion of water available for agricultural practices thus increasing farmer satisfaction levels. It is very important to understand the levels of water and availability of water in the Irrigation Tanks for crop planning. This dashboard provides the information about salient features and parameters like Irrigation Tank's storage capacity, current storage and fills percentage of each Irrigation tank. This dashboard will give a GIS and MIS view of Irrigation tank statistics within the project influence area. This dashboard will make use of department data to display the water volume in Irrigation tanks.

5.3.5 Soil Moisture Dashboard

Soil Moisture gives the user the insights regarding the crops that can thrive in a location and thereby helping the planners and farmers. This dashboard provides the user with the information pertaining to the Soil Moisture for the area of interest. The soil moisture will make use of various national and global datasets available on soil moisture, and provide farm, command area, village, block, and district level soil moisture statistics.

- Master Data: Following master data for soil moisture will be uploaded:
  - Soil map (type of soil, saturation level, field capacity, wilting point etc.)
  - LULC
  - DEM
  - Normal cropping pattern
  - Crop phenology
  - LAI
  - Root depth
- Geo-tagged location of Soil moisture sensors for validation (if available)

- Current Soil Moisture Data: Mass and energy balance hydrology model uses rainfall, temperature, wind speed, humidity, LULC, LAI, Root depth and DEM as input to generate grid-based soil moisture, evapotranspiration, runoff and deep percolation. Soil moisture is computed at depth of 30 cm, 60 cm and 1 meter.
- Historical Data: Historical soil moisture is computed based on historical weather data using the hydrology model.

5.3.6 Lift Irrigation Schemes

This dashboard will provide MIS and GIS visualization of the location of these LI Schemes, pump capacity, cascade of network, canal capacity and possible new lift scheme points.

This module will also have GIS water storage and inundation simulation tool which will allow a user to select any point in the drainage network, and define the length and height of the dam, and the tool will simulate the storage volume computation and inundated water spread area, along with 3D visualization in the GIS view over-laid on the satellite map view.

5.3.7 Water Demand

Understanding the water demand forms a crucial part of the water management cycle, this module is required to capture the water demand at the right granularity of space and time.

- District>Block>Village.
- Basin>Sub-basin
- reservoirs>Canals>WUAs
- Annual> Season> Month>Week

Followings are further demand categories needs to be captured

- Agriculture demand: MIS and GIS view for seeing seasonal, and annual cropping pattern.
  - Associated crop water demand, and water availability from rainfall
  - Associated deficit indent in the season.
  - Distribution of the Agriculture demand as Surface Irrigation demand, Ground Water Irrigation Demand, tank Irrigation Demand.
- Drinking Demand: MIS / GIS view of Urban and Rural drinking needs.
  - Drill down to each individual scheme level or municipal corporation level
  - Surface and Ground Water wise data
  - This will include both domestic, drinking and livestock needs.
- Industrial and other demands: MIS / GIS view of Industrial needs.
  - Categorized by Major, Medium and Minor Industry categories.
  - Surface water vs ground water use among the industries
  - Integration of water meter readings through Mobile app or IoT sensors data ingestions.
  - Commercials demands: MIS / GIS view of Commercial needs.
  - Commercial Complexes, Theatres, Shopping Malls, Hotels and Restaurants, Marriage function halls, Amusement parks etc.
  - Integration of water meter readings through Mobile app or IoT sensors data ingestions.
- Environmental demands etc: MIS / GIS view of Environmental needs.

The Water Demand Module should be captured via combination of mobile app, satellite data, and integrating with other departmental systems in the state. The platform should be able to host the demand data into a web-GIS format, with all layers interactable to see its information spatially.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	All departments linked to water resources Planning Department Academia Water Resources Department Disaster Department
Execution Roles	Data entry, validation and operations. Planning operations and maintenance based on trends and deviations. View GIS & MIS reports
Administrative role	Understanding stress areas Year over year comparisons
Policy Making role	Framework for water conservation Transboundary water accounting Planning water allocation Defining economic value of water

5.3.8 **Village Water Budget**

Village water budget should help in micro-level planning of water management. Village water budget should identify villages that are in surplus and deficit based on available water supply and demand.

Water supply should be estimated based on:

- Water available from rainfall to cropped area during the crop life cycle
- Water available from ground water based on Ground Water
- Estimation Methodology
- Water available from canal irrigation
- Amount of runoff conserved and excess runoff

On the demand side, system should consider crop water demands, drinking water requirements from human beings as well as livestock, industrial water requirements and natural flows.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Water Resource Department PR&RD Planning Department NREGA
Execution Roles	Tool for water budgeting Village hydrological assessment Identify deficit villages with surplus runoffs
Administrative role	Identify intervention opportunity either in demand or supply Financial Planning DPR approval Unifying Watershed plans Workflow monitoring
Policy Making role	Enactment of law relating to water usage Crop pattern change Incentivizing Inter-basin transfer planning

5.4 Ground water Information & Management

Groundwater management deals with the complex interaction between human societal activities and the physical environment, which pose an extremely complex and difficult problem to solve for the benefit of all parties involved. Those using aquifer are little motivated to preserve it; any preservation may simply be exploited in future by other individuals. Consequently, there are rivalries between the exploiters without care about management programs. Such a competition might lead to inflicting damages on the third party, which is the society itself.

There's something called "safe yield" of groundwater. "Safe yield" means the amount of water that you can extract from an aquifer. If groundwater is extracted more than the safe yield, then it raises the risk of water scarcity.

Each and every stakeholder involved in groundwater usage has its own requirements and expectations. This gives obvious reasons for conflicts among themselves. One type of conflict may arise on quantity matter. Eg. In regions where more volume of groundwater can be obtained if a well is dug deeper into the ground. While another one might be concerned with the quality of groundwater extracted.

Whatever be the case, the issue is once the groundwater is depleted, it won't be replenished soon. This is one of the reasons that make the management of groundwater an important issue to be tackled with different steps and strategies.

Among the management strategies the groundwater management system should provide understanding for:

- Adjustment of the annual rates of pumping, generally, based on monthly rates,
- Adjustment of the well configuration,
- Augmentation of water supply from other sources or groundwater recharge enhancement,
- Awareness of groundwater beneficiaries,
- Limitation of exposition according to monitoring results.

Groundwater Dashboard should provide features like near real time information of Ground water levels, Level trends based on the historical data, Water level fluctuations, spatial analysis, season wise trends etc. This should help in identification of stress area, aquifer recharge status and

establish rainfall vs groundwater trends to take up ground water conservation activities.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Water Resource Department PR&RD NREGA
Execution Roles	Field Data collections & validation Identification of recharge requirements Plan for water harvesting Identify recharge opportunity(quantify)
Administrative role	Trend Analysis Recharge structure planning & Approvals Fund management Identify exploitation Field level regulatory implementation
Policy Making role	Groundwater regulations Borewell permissions Encouraging conjunctive usage

5.5 Water conservation planning

This module should help in identifying the villages in deficit and suggest appropriate intervention to ensure availability of drinking water. The system should be estimating runoff available at the required reliability level, recommending additional water conservation activity that can be taken up taking into account the deficit and available runoff including the location and type of water and soil conservation activities to be taken up.

This module should allow hydrological assessment to be run on cloud providing results in near real-time with 3D view of contours and structure yield along with water conservation structure prediction. This should be

interactive to allow even non subject matter experts to play with various what if scenarios.

This should help in getting key answers as below:

- Which villages should be prioritized for water conservation works.
- What water management strategies (supply/demand side) should be implemented
- How much additional runoff is available at the required reliability level
- What is the minimum additional capacity required to mitigate the identified water deficit or conserve available run-off in the deficit region
- How many water and soil conservation structures should be built in the village based on the village deficit and available run-off.
- Location and type of water and soil conservation that can be taken up in the village based on geology, geo-morphology, lineaments, soil type, LULC, slope and other GIS layers
- How to fill MI tanks and utilize flood water and providing mean to better rainwater harvesting by finding suitable zones
- Enable field functionaries to validate the location and type of structures or modify as required using a mobile application
- Priorities the soil and water conservation activities on a ridge to valley basis and funds available
- Track the progress of the activities

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	PR&RD Water Resource Department Planning Department Agriculture Department Funding Agencies like World Bank
Execution Roles	Field Data collection Village Hydrological Profile Identify soil and water conservation structure type and locations Site suitability survey Prepare master plan Prepare DPR
Administrative role	Master plan approval Fund management & Budget planning Workflow monitoring
Policy Making role	Incentivize watershed units Fund allocations Negotiate national and international funding agencies Promote village water independence Incentivize demand side management

5.6 Project Implementation & Support

To track the progress of key projects in the state to ensure that they have near real-time information into the project progress as wells as various critical components of the project including Financial, LA and R&R activities being take up in addition to identifying the issues that may be delaying the project progress. The Objective of this module is to develop a GIS Solution with a Mobile Data Collection System, where data collection from field level would be done through hand held smart devices (mobile/Tablets). The smart devices will be equipped with custom made software which will enable the user to collect data and would send the data directly to a central server using mobile network.

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The data would comprise of Text, Image, Videos etc. and also location (Latitude, Longitude) which would be captured by the smart device automatically during the field data collection time.

The Web based MIS & GIS application will cover the entire hierarchy of the department and will give an end-to-end solution to monitor project lifecycle post awarding of project with the project progress and various reports dashboards. The application should accommodate any number of projects to be added.

5.6.1 Project Module

This module will contain details of information & process of the following:

- Project on-boarding with details like Project Name, Location, Budget, Description, Tenure, BOQ, Estimate & Technical Detail, Schedule of rate
- There will be provision for entry of master data for a new project which has been approved. Data will be imported from various wings of the department.
- After entry of a project the data can be viewed and modified or deleted in case of incorrect entry after the approval from the approving authority.
- Schedule of Rate will maintain departmental and regional schedule. All the times of departmental and regional schedule will be registered category wise along with their units so that estimate or BOQ will be prepared smoothly.
- Both the schedules will be managed through the software by any authorized person. Both these schedules will be maintained according to financial year as every year new item may be added or category wise rate of the item may change or rate of individual item may also change
- The system will have module for EoT (Extension of time) and revising estimates

5.6.2 Monitoring Module

The main objective of this module is to monitor the progress of any particular project at any point of time. This module will enable top level officials identify bottleneck of certain project on real time analysis.

This module will contain following segments:

- Milestone of Schemes
- Video Comparison
- Video / picture uploading
- Preparation of report
- Financial Requisition
- Milestone chart of each project can be prepared. Timeline of each component of the project will be shown on the chart comparing its target and achievement.
- All features, module links shall be shown on the dashboard. Dashboard should be feature rich.

5.6.3 CPM (Critical Path Method) and PERT(Program Evaluation and Review Technique):

- What tasks must be carried out.
- Where parallel activity can be performed.
- The shortest time in which you can complete a project.
- Resources needed to execute a project.
- The sequence of activities, scheduling and timings involved.
- Task priorities.
- The most efficient way of shortening time on urgent projects.

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This module will either interface the out of the box project planning and management tool or automate the algorithms to achieve the above mentioned features of CPM and PERT methodology.

5.6.4 User Management Module

The user management module will be present for complete system handling along with the permission role management of every user of the web application. This will be inline with platform user management module.

5.6.5 Broadcasting and SMS Integration Module

In this module provision for information related to internal meetings, Emergency calls and interrelated broadcasts will be integrated. This will be inline with platform information dissemination module.

5.6.6 Dashboards & Reports

The system should generate various reports for progress tracking as given below:

- Following reports to be made available in downloadable xls/pdf format:
  - Project/Package cumulative and balance works as on particular date
  - Weekly progress per package and Project
  - Monthly progress per package and project
  - Issue Reported, Open & closed per Package & project.
  - Issue report analysis with delay in resolution, priority and mitigation plan.
  - Exception reports
  - Packages showing zero progress today
  - Which packages did not show progress day/week/month
  - Which projects have been extended the date of completion further

- Enable the administrator to add/modify/delete Projects
- Packages with in the project
- Primary and Secondary users for the packages
- Scope data including budget
- Cumulative achieved to date

5.6.7 Alerts and Escalations

- The system should raise alerts for timelines, project progress, delays, and any custom alert raised by the authorities and field staffs
- System should raise anomaly alert
- It should raise alerts in hierarchy if there is no progress, or work is behind schedule
- Alerts and Reminders should be sent to concerned field engineers to remind on updating work progress status, if concerned user failed to update data, alerts will be sent to next higher-level officials.
- Any issues raised by the field engineers at worksite will be tracked and alerts will be sent concerned officials to act on closure of the issues. The escalation system will track entire life cycle of the issue workflow it gets closed.
- Alerts and escalation history must be maintained and a dashboard should be provided for alerts and issue monitoring

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Water Resource Department PR&RD Water User Associations
Execution Roles	Field validations & data collections Monitoring of work progress KPI monitoring

	Financial activity monitoring
Administrative role	Quality monitoring Permission tracking Financial approvals Land acquisitions and rehabilitations Inventory management Vendor management
Policy Making role	Fund allocations Land acquisition facilitations

5.7 Inflow Forecasting

Inflow forecast is very important in the context of making decisions at various levels of the stakeholders to enable them in understanding the amount of water that will be incoming into the reservoirs, or catchment area over the next few days. The intensity of same decides if its going to converse as flood or not. The state of Tamil Nadu has received severe floods in recent past, which caused immense loss of human life and resources. In this context, real time inflow forecasting system will play a pivotal role, which constitute a major component of flood risk management strategies; the need of the hour for the state. The proposed system should integrate weather forecasts, real time gauge and rainfall data, the state of the river catchment, current and forecast flows along the river, all of which will be used to respond to the forecasted inflows as and when they occur. The Hydrologic-Hydraulic model component which forms the integral part of the system should simulate inflow forecasts; thereby provide advance understanding of the inflows at key points. It should also provide 'what if' scenarios to assess the likely impact of rainfall forecasts from multiple sources, catchment conditions and control structure operations.

These models are to be operated at daily, sub daily or hourly scale to ensure continuous monitoring for potential flood risk.

Using a data-driven approach and machine learning models, the system should be capable of producing reliable probabilistic forecasts. The use of the term "probabilistic" implies that the forecasts attempt to characterize not only future discharges or accumulated flows, but also the uncertainty that is associated with the predictions.

The inflow forecast at a point should consider factors such as:

- Direction of flow (Flow direction, obtained from Digital Elevation Model)
- Rainfall in the self-catchment of the point
- Outflow from the points upstream to the point under consideration
- River profile (Cross-section of the river)

This module of TN-WRIMS should provide information of stream performance and forecasts in an interactive manner to provide last mile information on flows. This module should raise advisories on operating reservoirs so that flood impact can be mitigated. For this below are the tasks which needs to be executed:

5.7.1 Creation of Data

- Hydro-Meteorological data: Rainfall, Temperature, Wind speed, Wind direction, Humidity, and several other parameters, is taken from several Central Government Agencies such as IMD, CWC and corresponding State Government Agencies through Automatic Weather Stations on a real-time basis.
  - The forecast data can be sourced from international agencies like ECMWF, GPM, GEFS.
  - The observed point weather data from both the real-time and forecast sources is merged and interpolated spatially to the smaller

grid level (1,2,5 KMs) using Inverse Distance Square Weighted Interpolation method, which is done every hour of the day

5.7.2 River Gauge and Reservoir Data

- River information and Flow data recorded at various sensors and gauges installed along the river network is obtained from CWC and State agencies. The data for the Reservoirs can be collected through various sources like CWC, WRD, SCADA and a Mobile App..

5.7.3 Spatial Datasets

- The spatial datasets comprise of Digital Elevation Model, Land use map and Soil map of the basin along with Hydrological boundaries, administrative boundaries, Stream network, Reservoir locations and water spread, Observation stations network etc. The developed system must be capable of using high resolution DEM data of upto 1 meter. These datasets will be provided to the consultant by the department at no cost. Cross-sections at suitable interval in river along with section details near structures in river (Bridges or any type of structures) must be surveyed if required.

5.7.4 Inflow forecast points in the basin/region

- This component manages the list of identified weak, vulnerable points and other points of interest in the selected basin or region, by taking into accounts historically flood vulnerable zones, simulated flood vulnerable zones, flood vulnerable atlas, water storage points like reservoirs, and water lifting stations.

5.7.5 Stream Flow Network

- Creation of a stream flow network should be done using all vulnerable points in the basin/region, point of storage, and point of lifting water as

nodes of the network. It takes care of automatic addition, deletion and update of the nodes in the network.

5.7.6 Automation of the models

The entire system should be automated to run at regular interval without any need of manual intervention in the TN-WRIMS.

5.7.7 WebGIS / MIS based inflow forecast

The DSS must enable the user with the following activities:

- Ability to view the entire stream network and click at any point and see flow values for the next couple of days
- Ability to see the actual rainfall in the self-catchment area as well as upstream over the last couple of days, that impacts the flow at that point
- Ability to select basin or region of choice to view the flow forecast
- Ability to click on any vulnerable site and view detailed flow information like site details, water level, highest water level, danger level at that particular site, level trend (rising or falling), upstream inflow, catchment inflow, outflows along with the trend chart. If the selected point is storage structure the user should be able to view real time outflow splits (Powerhouse, Spillway, Canals (Irrigation), Industrial, Drinking, Losses, Others)
- Ability to view forecasts at various granularities of the time intervals (3 hourly, 6 hourly, daily, etc)
- Ability to view the map of the whole state and its rivers
- Ability to view the state's map with appropriate colour coding of the river network determining the flow intensity i.e., if the water level is above/below warning or danger level or High Flood level

- Ability to view rainfall details like rainfall of the day, previous two days actual rainfall, next two days rainfall forecast, normal monthly rainfall and cumulative rainfall for the month, total rainfall data for the whole season that gives clear understanding of the picture of rainfall situation across the state at site level and higher location hierarchy levels etc.
- Ability to view water level details like water level of the day, previous day water level and projection of water level for the next few days along with name of the river, basin and site name.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Lift scheme authorities Agriculture department Water resource department Revenue and Disaster Management Reservoir Authorities River Basin Authorities
Execution Roles	Validate forecast Release planning Cascade scheduling Emergency response planning in case of floods Control the flash floods
Administrative role	Multi department coordination's Workflow integration between the reservoirs Escalations handling Conflict resolutions
Policy Making role	Flood impact mitigations Risk assessments Impact zone analysis Planning preventive strategies

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5.8 Reservoir Operations Optimization

Reservoirs operation optimization would help achieve optimum productivity of the reservoir. This should provide the details of Reservoirs in the state such as the levels of water, availability of water in the reservoirs for various purposes like crop planning, flood planning etc. The Optimization model should be set in real-time operation mode, making it will run automatically on daily basis, by taking the latest information, and provide optimized operation schedule for each reservoir, which can be reviewed and accepted by the respective authorities.

The Reservoir Operation module should run in real-time Reservoir Operation Optimization models using ensembles of inflows to give better operation results. The real-time Reservoir optimization module should be capable of providing water release schedules at daily, weekly and 10 daily time interval for different scenarios in advance to help meeting multiple conflicting objectives.

It should also use confidence of probability in flood forecasting for enhanced insights in decision making. It should also accommodate expected/forecast flood event by setting the system to state optimal.

The accepted results further should be published in the dashboard, mobile app and SMSs.

Following inputs should be updated automatically by the model,

- Reservoir storage levels
- Reservoir and conveyance losses
- Actual Inflows
- Latest Inflow Forecast
- Canal Releases
- Revised Demand schedules

5.8.1 WebGIS and MIS based operation dashboard

This DSS module provides the reservoir authorities a well-structured, user friendly, practical and complete reservoir management information system.

- It is expected to assist decision makers in taking the right decisions on the basis of good comparison of different strategies under various scenarios and allow them to analyse hydrologic data, run hydrologic simulation models, run reservoir water allocation models and study the effect of potential decisions.
- It should be designed to access or display hydrologic data in an easily accessible manner, to model dynamic hydrologic conditions, and to determine the ability of the river system to meet future demand based on operational and administrative use of storage.
- It should allow users to simulate and evaluate various "What if" scenarios for reservoir operation alternatives. This DSS should enable 'Real Time Operation' of the reservoir in which water control decisions for a finite future time horizon are taken based on the conditions of the system at that instant and forecast of the likely inputs over this time horizon.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Reservoir authorities River Basin Authorities Water Resource Department Agriculture department
Execution Roles	Operations and planning of reservoirs Release planning and recording Planning of inter basin transfers Identify best possible option to optimize

	reservoir usability
Administrative role	Water budgeting & Water audit Reduce the impact of floods Satisfy policies and constraints of river boards Conflict resolutions
Policy Making role	Transboundary cooperation Water allocation or entitlement Identify economic value of water Policy violations and tribunal proceedings

5.8.2 Water Audit: Basin and Admin wise

Water audit is important to understand which admin or basins/sub-basins are in surplus/deficit to develop water management plans and long-term sustainability planning. Water audit should consider:

- **Total inflow of Water into the Basin**
  - Water received through Rainfall
  - Water received as inflow from major rivers and rivulets from other states
- **Net Change in Storage of Water**
  - Change in Groundwater Storage
  - Change in Soil Moisture
  - Change in storage in all major/medium reservoirs
- **Basin**
  - Evapotranspiration losses
  - Utilization - Water used for Drinking
  - Utilization - Water used for Industrial
  - Utilization - Water used for Irrigation/Agriculture
  - Runoff to Sea (as loss)

- Outflow to other states through major rivers and rivulets

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Water resource Department Agriculture Department PR&RD NGOs
Execution Roles	Recording Water Inflows, Water availability in Storage structures and Water Outflows Understanding demand and supply components
Administrative role	Water Conservation Planning Planning drafts in case of transboundary basins Lift schemes or Inter-basin transfers planning
Policy Making role	Transboundary cooperation Water allocation or entitlement Identify economic value of water Policy violations and tribunal proceedings

5.8.3 Deficit Water Indent-Canal Operations

This module should provide information into water to be supplied in various canal and off-take points over the next two weeks. At the same time, it should also provide information into tail end stress through satellite-based data so that appropriate actions can be taken by the department to increase farmer satisfaction levels. The envisage System will address the following from the perspective of Department officials and Farmers.

- Rate at which water needs to be supplied to distributaries, minors and sub minors based on the crop water requirement
- Real time information related to the availability of water at take-off points

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- Information related to the extent of area to be irrigated and the type of crops in the case of diverse cropping pattern within a command area ahead of beginning of the cropping season
- Real time information related to the water requirement at various stages of crop growth, identify locations within the command where there is deficit or excess supply, real time identification of regions of water stress, identify zones where there is non-equitable distribution of water, real time assessment of the performance of the system
- Information to the farmer about water delivery schedules
- Reliable information to the officials about operation and performance of the system, identify regions of stress within the command area and deficit zones

To summarise this module should

- Provide the field officials with real time field level information including the status of associated water bodies thereby assisting them in ensuring efficient irrigation delivery and management
- Visualise, manage and operate the overall irrigation system through demand-based water allocation decisions from the main canal to the level of sub minor.
- Enable officials and Farmers to coordinate based on the feedback related to daily system operation and ensure maximum performance.
- Will be able to prioritise the crop water demands to benefit the farmers
- Will realistically represent the Canal Delivery system from source to Demand site which are agricultural fields.

This includes development of an automated web-based interactive canal monitoring system which brings canal-wise irrigation (i.e., water release) and crop information into the decision support system in both GIS and MIS based system, to track entire canal irrigation practice followed in the field. This system will be made available for individual field level engineers to monitor information related to their jurisdiction through the canal monitoring system. It will have an interactive GIS and Mimic view. The system will facilitate users to visualize water releases information at distributary, minor and sub minor level, cycle-wise water release information for each distributary, minor and sub-minor in an interactive way.

5.8.4 Crop sown information tracking

The Implementing agency should develop a system to capture crop sown information in the canal command area at distributary level, minor and sub minor level. The system should capture details like type of crop, sown area, crop sowing date etc., using both mobile applications (will be developed as part of this project) and satellite data.

5.8.5 Rotation-wise water release information tracking:

As part of this, the system will be able to integrate rotation cycle-wise water releases information level & flow sensor installed as part of the project on real-time basis for identified locations and will capture water releases information for rest of the locations from mobile application.

5.8.6 Development of Mobile App module to track Water Releases at distributary level

Mobile Application needs to have module, which should be used by the department engineers in the command area to update the daily canal water releases in the command area for each of the off-take point in the command.

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Mobile application is also expected to disseminate irrigation scheduling advisories to the department engineers in the field.

5.8.7 Water demand monitoring system

The usual practice adopted is to compute the water demand in a command area based on pre-defined wet and dry crop duty. The canal monitoring system will have the facility to auto-compute total seasonal water demand based on both planned and actual crop sowing area information in the command area at distributary minor and sub-minor level.

The features will include

- Facility to compute full season demand based on Planned crop sown information.
- Facility to compute full season demand based on actual sown area information.
- Facility to compute remaining season water requirement based on total amount of water has been released till-date and total seasonal water requirement (Planned and actual).

5.8.8 Canal Dashboard

The Canal information Dashboard should show, real time canal status in the command area like crop sown in the canal command area, water released till date in the canal, total water demand in the canal, area under stress in the canal command area, if any etc.

Drill Down: Canal information dashboard will have drill down functionality where on the initial view user will be able to visualize details for the entire command area and dashboard will have drill down functionality where user can see detailed information at distributary canal and minor sub-minor level.

The canal information dashboard will have the GIS and MIS view. The GIS view will have the canal network (main, distributary, minor, sub minor) overlaid on the landuse map and command area map as layers. The user will be able to get information even at the sub minor level. At the takeoff location of a branch, the information related to area of crop sown under that particular branch, type of crop, water demand and the water released till date, expected demand for the season etc. Based on the information related to demand and supply till date, the user will be able to assess the extent to which the water requirement is met and identify the regions subjected to water stress, if any. The information will also be provided in tabular view with length of the branch, area of command, individual crop acreages, water released till date, water demand etc.

5.8.9 Seasonal Demand Dashboard

Seasonal Demand Dashboard should show water demand for the season based on the crop sown information captured from mobile application.

Drill Down:

Season demand will have drill down functionality where on the initial view user will be able to view the demand details for the entire command area and dashboard will have drill down functionality where users can see detailed information at distributary canal and minor sub-minor level.

Dashboard Features:

This dashboard should have MIS & GIS View to provide both Statistical and Visual Understanding of Various demand information like

- Total Season demand
- Demand for next two weeks
- Demand comparison with previous years

- Demand comparison between planned Vs Actual

The GIS view should have the canal network (major, distributaries, minor, sub minor) overlaid over the base map. The base map can be land use map, crop map. The time stamp can be entire season, month, week. As the user clicks at the take off point of a sub minor, the details related to the water demand over the area under the command of the sub minor will be shown. There will be the seasonal demand projected for the upcoming season. In reality, there can be a reduction in the crop area when compared to the normal value or the planned. The demand corresponding to the actual will be actual demand. A trend in the variation in demand will be displayed. This will depend on the water requirement of the season. In case of instances of a cropping season supplemented with rainfall, the irrigation requirement will be less which will result in decrease in the water demand. The MIS view will be providing the corresponding details in table view.

5.8.10 Crop Type Dashboard

Crop type dashboard should give distribution of various crops in the canal command area and their coverage based on the seasonal master data captured from the mobile application

Drill Down: Crop type Dashboard will have drill down functionality where on the initial view user will be able to get crop type details for the entire command area and dashboard will have drill down functionality where users can see detailed information at distributary canal and minor, sub-minor level. The crop related information will be provided at seasonal time step.

Dashboard Features: This dashboard will have MIS & GIS View to provide both Statistical and Visual Understanding of

- Crop Acreage: Shows the key indicators like

- Crop Wise ACZ Area
- Crop Wise Yield (t/ha)
- Crop Wise GVA
- Normal Area
- Parcel/Cadastral level

- Chart view: Shows the year wise comparison
  - Crop Wise ACZ Acreage
  - Crop Acreage as per DES
    - Location wise Dominant Crop
    - Historical and current land utilization pattern
    - Crop type (Agriculture, Horticulture etc.) areas
    - Location wise total crop sown area
    - Crop wise total sown area
    - Comparative view of deviation from the last year

5.8.11 In-season Releases Dashboard

In-seasonal Releases dashboard should give users understanding on the water releases status in the canal command area with respect to total demand in the command area. In season releases data will be captured from mobile application.

Drill Down: In Season releases dashboard will have drill down functionality where on the initial view user will be able to see water releases details for the entire command area and dashboard will have drill down functionality where users can see detailed information at distributary canal and minor sub-minor level

Dashboard Features: This dashboard will have MIS & GIS View to provide both Statistical and Visual Understanding of Various demand information like

- Total Season demand
- Water released till date
- Water to be released in next two weeks
- Demand comparison with previous years
- Demand comparison between planned vs Actual

The GIS view will have the canal network (major, distributaries, minor, sub minor) overlaid over the base map. The base map can be land use map, crop map. The time stamp can be entire season, month, week. As the user clicks at the take off point of a sub minor, the details related to the water release over the area under the command of the sub minor will be shown. There will be the seasonal release based on the seasonal demand projected for the upcoming season. In reality, there can be a reduction in the crop area when compared to the normal value or the planned. The demand corresponding to the actual will be actual demand and the release will be actual release against the planned release. The planned release will be based on the duty fixed by the concerned officials. A trend in the variation in release will be displayed. This will depend on the water requirement of the season. In case of instances of a cropping season supplemented with rainfall, the irrigation requirement will be less which will result in decrease in the water release. The MIS view will be providing the corresponding details in table view.

5.9 Inter-basin transfer

The objective of this module is to ensure optimum planning and operation of lift schemes while optimizing the cost, demand and availability of water. The decision system should create a network of water storage, inflows, demand and transfer links, and provide seasonal and weekly (10 daily) allocation targets.

This system will provide visibility in geoportal for real-time water flows as well as what if scenario simulation to provide operators a glimpse of most optimum transfer scheme.

This system should use demands, expected natural flows, conveyance hydraulic details, lift details, and run mathematical optimization models to provide

- Water Allocation to each demand blocks
- Pump operation targets in the season
- Reservoir operation targets
- This system should result in cost savings by optimizing
    - Pump running time by forecasting inflows ahead of time.
    - Daily Operation schedule with targets for each pump running time, and reservoir operation (accounting forecasted inflow, current storage and demand)
    - Irrigation efficiency using dynamic crop water demand and leveraging the saving in irrigation water to increase crop area in the project.
- The system should provide a dashboard for decision makers.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Lift scheme authorities Agriculture department Water resource department
Execution Roles	Get water allocation to each demand blocks Receive pump operation targets in the season Reservoir operation targets Pump running time by forecasting inflows ahead of time. Daily Operation schedule with targets for each pump

	running time, and reservoir operation (accounting forecasted inflow, current storage and demand)
Administrative role	Irrigation efficiency using dynamic crop water demand and leveraging the saving in irrigation water to increase crop area in the project. Dashboard for decision makers Scheme efficiency monitoring
Policy Making role	Fund allocations ROI Calculations Transboundary cooperation Water allocation or entitlement Incentivize judicious use of water in project area as lifted water is expensive

5.10 Early season drought & drinking water stress

The module for Drought management should facilitate in detecting drought conditions as early as possible in order to implement District Agriculture Contingency Plans and the Crisis Management Plan. It should provide accurate and timely information on rainfall, crop sown area, data on soil moisture (wherever possible), stream flow, groundwater, lake and reservoir storage at the relevant spatial scale at the State / district / sub-district levels.

The Early Season Drought DSS addresses Agriculture Drought. The agriculture drought module aims at automating Drought Manual 2016.

- The DSS takes input like
    - Metrological Indices: Rainfall deviation, SPI and Dry Spell
    - Rainfall Deviation
    - Dry Spell
    - Standardized Precipitation Index (SPI)

- Hydrology Indices: SFI/ RSI/SGWI
- Reservoir Storage Index
- Ground Water Drought Index (GWDI)
- Stream Flow Drought Index (SFDI)
- Remote Sensing based Vegetation Indices
- Crop Situation Related Indices
- Soil Moisture Based Indices
- Percent Avalable Soil Moisture (PASM)
- Moisture Adequacy Index (MAI

System should be automated such that the required satellite data should be downloaded automatically and indices are computed and ingested into the model, without any human intervention and as per GoI drought manual automation, drought is predicated in advance and related alerts will be issued as advisories to relevant stakeholders.

5.10.1 Drinking water stress monitoring

This should predict onset of drinking water stress in rural villages where bore wells are primary source of drinking water supply. It should bring together real-time weather data, ground water data, forecast data, current tanker supply data, historical tanker supply data and historical stress data to present rural water supply stress on a Web-GIS based dashboard

- Identify villages in stress based on historical stress data as well as current groundwater levels. Integrate with village action plan, with data about the date for the start of tanker deliveries and No. of tanker movements per day for village

- Identify villages in stress based on historical stress data and historical as well as current groundwater levels, reservoir levels, local water bodies levels. Integrate with RWSS village action plan, with data about the date for the start of tanker deliveries and No. of tanker movements per day for village
- Identify villages that are identified to be under stress and getting sufficient amount of water through tankers
- Identify villages that are identified to be under stress, but not getting sufficient amount of water through tankers
- Visualize the State, District, Block and Village view on Drinking water Rural Stress, and relief through tankers.

This module will provide workflow, dashboards and analytics to facilitate below key activities for some of the identified stakeholders:

Beneficiary Departments	Lift scheme authorities Agriculture department Water resource department Revenue and Disaster Management Reservoir Authorities River Basin Authorities
Execution Roles	Validate forecast Intervention planning Tanker planning for drinking water stress mitigation Crop planning WCS proposal for mitigating water stress
Administrative role	Drought declarations as per GOI Drought Manual Procurement of water from other than defined sources Inter-basin transfer Transboundary water source management
Policy Making role	Fund allocations

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	Relief planning Facilitate water procurement activities Identify regions of concerns

5.11 System Architecture

System should be designed keeping future in view using standard open protocols , OGC compliant technology and is capable of reading various formats.

5.11.1 Database

The unified database should integrate data from various water supply sources, demand sources, environmental factors, projects and beneficiaries. The system is to be built on a scalable database to handle large amount of data in a reliable fashion. The database is to be designed in such a way that the retrieval of various data sets requires minimal time and effort. The database can be Open source or Industry standard.

5.11.2 Usage Analytics

A user analytics tool should be developed which looks into various factors of incoming data sources like, type, range, frequency etc and monitors the data inflow into system on a regular basis whether the system is able to get the data as per the required format or not and raises alerts in the dashboard if there is issue with data integration or model running and displays it in Health Monitoring dashboard view. This tool should create health index of the system.

5.11.3 My View (User Defined Dashboard)

User should be provided with My View Module where user can customize the various views and visualizations in the dashboard and favorites based on his

interest which will be saved on user login credentials, so that upon login user will see dashboard with user defined customization.

The Dashboard should be role based and user based, System should have content management system where system admin can define access to contents that can be viewed by the new user.

5.11.4 GIS Technology and Features

This system should be based on Open source based GIS technologies as GIS computation, analysis, optimization and visualization will play a major role in the efficacy of decision making.

The platform:

- Should be capable of maintaining data history, version management and conflict detection. The GIS server should be highly scalable
- Software should support Cloud Environments and GIS system should be capable to manage maps, satellite images, GIS data of various points of interest information, infrastructure and assets etc. It should provide access to whatever available free Online 2D, Street, Base map, imagery Services for location reference.
- The software should support Open Geospatial Consortium (OGC) Services such as WMS, WFS, WCS, and GeoJSONetc along with GML, KML, etc.
- The Software should be able to import / export data from / to various formats like .dxf, .shp (shape files), as well as weather related data files like netCDF, GRIB etc.
- The software should provide open API to visualize the published Services
    - Server application should record various service statistics, such as total requests, average response time, and timeouts,

and reports this information in Manager console for better monitoring and performance optimization of services

- Should support server-side geo-processing tasks and have the capability to query across multiple map services.
- Should have out of the box Web Application Functionalities like pan, zoom, identifying features on a map, measure distance, interactive north arrow, magnification window, overview window/ find place, query attribute, search attribute, editing, geo-processing tasks, adding base maps etc.

- System tools can analyze patterns and aggregate data in the context of both space and time -Space-time (spatiotemporal) analysis using time slider over web.
- Software should publish directly on the web for sharing, analysis results or design proposals with decision makers or the public.
- Software should be able to support machine learning algorithms on various drone and satellite-based imageries and detect various point and areas of interest. System should be able to foster deep learning and convoluted neural network-based algorithms.
- Software should Support seamless integration with external data centers, so as to bring near Real time view in the Geo-portal. It should be able to catalogue spatial and non-spatial data and make accessible over web through REST interfaces.
- Software should Support various open source databases to manage spatial and non-spatial data. It should be able to connect to spatial database like Oracle/ POSTGRE SQL/ SQL SERVER directly without using any library/software

- GIS Software should be capable to View and create maps, manage satellite images, GIS data of various points of interest information, infrastructure and assets etc.
- The software should support feature data (Point, line, polygon) as input data type and tabular data.
- Thematic classifications like: Single symbol, Unique value, Match to predefined style, graduated colors or symbols, Proportional symbols, Dot density mapping and/or Chart mapping including pie and bar chart and/or Bivariate and multivariate data rendering.
- Create statistics & various statistical operations, viz. create charts and reports, Sort tables by multiple attributes, populate values based on expression, Summarize data.
- Should be able to plot data on the map directly from the tables.
- Software should be able to provide an Emerging/hotspot analysis
- Software should be able to navigate to the specified co-ordinates
- Software should allow you to play user uploaded video files in your map without any customization.
- Software should Calculates distance and additional proximity information between the input features and the closest feature in another layer and tool should be there to write results to a new stand-alone table and supports finding more than one near feature using buffer.
- Software should provide Drawing tools to create new point, line and Area features
- Software should provide capability to take Snapshot (Screen capture) of displayed data
- Software should display the Co-ordinate read out at the mouse pointer location

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- North Arrow and Map Scale according to drill down should be displayed

5.11.5 Machine Learning and AI enabled

Machine learning and Artificial Intelligence module is to be integrated into the platform for deep learning on the data collected and generated to provide intelligent actionable decisions and advisory based on its learning.

5.11.6 API Architecture

The platform should integrate with existing platforms through APIs and the platform exposed data through APIs for other applications to consume the data. A major benefit of using API gateways is that they allow developers to encapsulate the internal structure of an application in multiple ways, depending upon use case.

5.11.7 Data Administration and Management

Admin module should enable roles-based access controls where the authorized personnel or an admin will be allowed to do required configurations for the set of data in the database. Below are a few of the functionalities that should be done through Admin module.

- GIS Content Management Module should be provided where users can manage spatial layers like map, asset, and thematic layers.
- Users should be able to define new layers and add contents in it or update/delete the existing layers.
- It should allow to integrate GIS WMS/WFS/other OGC complaint layers. This module would allow users to define/add/update any 3rd party WMS/WFS/OGC services.

- Time series module that would allow the users to add new real-time telemetry data points from Sensors, web scrapper, restful API, etc. Some of the sensors are listed below.
- New Sensors installed in reservoirs, rivers, tanks etc
- New Automatic Weather stations or Rain gauges or ET Sensors
- New Ground Water Level Sensors
- New Water Pollution or Water Quality sensors
- New Soil Moisture Sensors
- Archive data module would allow user to archive historical data in standard format.
- User and Role management module.

5.11.8 Data-entry module

Data entry module should allow people to upload the relevant data at a selected geography level. Data entry should go through the primary and secondary level validation to ensure the quality of the data. The below modules cover the scope of entering all relevant data.

The System should be enabled to capture dynamic data entry for users using

- Web-Forms: Web-Forms allowing user to enter data that is sent to a server for processing
- Unified Mobile Application: Mobile application administrator should be able update an existing data collection form, add new fields, add new validation rules or add new workflows/ data entry modules to the mobile app dynamically and assign them to specific users for data collection, without the need to download a new mobile application.
    - The super User should be able to create back-end configurations, which should provide user specific (geography, role based) workflows that can be uploaded without updating

new version of the App to Play store. The User should be able to see the new workflows assigned by the super user as when the data of App is synced.

- The forms should be dynamic in nature and can be configured from backend without the need to upload the application onto Play Store. The App should support a wide variety of widgets like edit text, dropdowns, radio buttons, images, geotagged images, offline maps, tables, etc. The App should allow users to capture geotagged images.
- All Workflow related services should be able to be catered by the Mobile application

5.11.9 Data Entry validation

The data entry validation module should ensure that the data coming into the platform undergo primary and secondary validation to maintain the high quality of data.

Some of the primary validation techniques inbuilt in the platform should be:

- Comparison of time series data between two different sources of measurement using graphs and other visualization tools
- Checking against maximum and minimum data limits
- Checking against upper warning level etc

Some of the secondary validation techniques inbuilt in the platform should be:

- Comparison with neighboring stations to identify suspect values
- Screening of data series
- Scrutiny by multiple time series graphs, tabulations etc
- Checking against data limits for totals at longer durations
- Spatial homogeneity testing (especially for climatic data)

- Checking for systematic shifts in data due to incorrect entries etc

This module should consist of alert mechanism that will automatically raise flags and should not allow user to submit abnormal data during the data entry phase if entered data is invalidated by any of the above procedures.

5.11.10 Addressing Data Gaps

The TN-WRIMS platform should consist of utilities that pass the observed data through a series of operations to ensure reliability of outputs. It should use interpolation and other mathematical methods, satellite data and some other common mathematical and statistical operations.

5.11.11 Scientific and Simulation models

The platform shall require to build and run various hydrology, crop, optimization, and analytical models. The platform should also seamlessly host or integrate out of the box available models.

5.12 Project Governance

5.12.1 Data Governance

Data should be the critical component of the proposed platform and is expected to be sourced from many different sources. Each of these datasets should regularly compete for their analytic importance as the proposed platform targets delivering actionable intelligence and decision support to its stakeholders. Keeping these in view, best practices in the data management and data governance will not only improve the quality of the data that is collected but can also aid in solving data productivity issues. It is proposed that DGI Data Governance Framework, one of the popular models adopted for data management be adopted for the project. This

should be customized to maximize on the intended objectives and goals of the proposed platform. The data governance approach adopted shall aim to ensure the integrity of the data assets through accountability, consistent data distribution policies, processes, and procedures, standardized systems, and education.

5.12.2 Project Management

Following should be the approach for the project management:

- Design a robust Project Management process customized for the project
- Align PM processes with best practices and organizational excellence framework.
- Create a differentiator by demonstrating Technological Prowess and Innovation strengths.
- Institutionalize quality assurance / control to achieve excellence at all stages of project execution.
- Align support processes & blend them with PM processes and excellence standards.

5.12.3 Testing & Cloud Deployment

The testing phase of product development should ensure that the product operates as expected. This phase should begin after the implementation of the product requirements. During the testing phase, testing groups will employ several methods to ensure that the product operates as expected. The methods for testing might vary depending on the type of product we are building but the concepts remain very similar. Testing and deployment options come in many shapes and sizes; start with critical checks to our core features and gradually expand our test infrastructure as our application features stabilize and our user base grows.

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5.12.4 Quality Policy

The quality management process for the project shall aim at customizing procedures and standards for quality keeping in view the stated objectives and goals, select procedures and standards for the project and modify as required to develop a quality plan and ensure that best practices and standards are followed by the software development team to produce quality products.

These are aimed at ensuring that :

- Software developed is free from defects and errors, and thus optimizes the cost and timelines of development
- Software is reliable and satisfies the project requirements
- Software developed is efficient and meets the requirements
- Software is secure and easily maintainable

5.13 Capacity Building & Training

During the project:

- Detailed user manuals should be released to the client after end of every milestone along with milestone completion report.
- State level workshops should be conducted to provide hands-on training to all the officials of the state who will be using mobile application and other data entry modules of TN-WRIMS. User manuals.

- In addition, the consultant should be required to host to co-locate a team of maximum of 3 people identified from the department side along with consultant's development team. The objective of this co-location should be to participate in the daily development cycle of the system and build the capacity at the customer side on basic troubleshooting of the system.

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After Deployment of Final Solution:

- The Consultant shall provide both technical and functional training to selected users on all parts of the system. There should be classroom based hands-on training for different sections of the Decision Support System that should focus on the operation of the system. Technical training should be provided for basic troubleshooting of the system.
- Help and Troubleshooting guidebooks shall be provided for each section. All training material should be provided with easy diagrams, screen shots, videos, and help menus on the decision support systems. Modalities of trainings shall be finalized in consultation with Department. The cost of training hall/facilities and all audio visuals etc shall be borne by the client while the cost of training kit and material should be borne by consultant

5.14 Maintenance & Support

The consultant should be overseeing, directing, and controlling project operations. Hardware operations, software support, and maintenance are part of operations support management. The support team should be modifying application or component after delivery to correct faults, improve performance or other attributes, or adapt to a changed environment. Software Maintenance must be performed in order to:

- Correct faults.
- Improve the design.
- Implement enhancements.
- Interface with other systems and new infrastructure (IOT Services).
- Accommodate programs so that different hardware, software, system features, and telecommunications facilities can be used.
- Migrate legacy software.

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5.14.1 Client Responsibility

- Client shall form a project management committee to act like a single point of interface for addressing any project related need, and for any other coordination work including active role in approving project plans, requesting changes, raising issues and risks, approving milestones, releasing payments, and accepting the final deliverables of the project.
- The client should facilitate access to all the data/ information available with them and needed for developing the unified digital platform & Decision Support System
- The Client should facilitate the process of data collection from other central government, state governments or other agencies by issuing permissions, authorization letters etc
- Client shall make sure data provided by the client and other Global, Central & State Agencies will be provided free of cost. In case any cost is incurred, client will born the cost or re-imburse the cost on at actual basis.
- The Client should authorize and facilitate for integrating the necessary web and IT services into the system from data centers or web enabled systems hosted by various other departments.
- Client should provide working space for the consultants, and lodging, and boarding space in case of work in remote site locations if government facility is available.

5.14.2 Consultant Responsibility

- The Consultant shall provide the deliverables as agreed with client and mentioned in the Scope of work
- Consultant should appoint on project team leader who will act like single point of contact for all project related work.

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- Consultant should form project specific team within 30 days from signing of the contract.
- Consultant should deploy resources for collection of data necessary for the project from various functionary and agencies, however manual collection of data from the field (like Geo-Tagging, Canal releases, gage station reading, Crop Sown data etc.) is not consultant's responsibility.
- The Consultant shall maintain the confidentiality of data provided by the Client.
- Consultants, Sub-Consultants and the Personnel of either of them shall not, disclose any proprietary or confidential information relating to the Project, the Services, this Contact or the Client's business or operations without the prior written consent of the Client.
- Consultant should be conducting monthly review of the project along with client and other stakeholders and publish monthly project summaries.
- Consultant should deliver necessary cloud enabled Integrated Water Resource Platform, Decision support system modules, Installation of Sensors and hardware, and System support and maintenance as per the Detail Project Report.
- Consultant should be responsible for hosting of the system during the project and operation phase.
- After completion of the project, consultant should hand over all associated software, hardware, source code of developed applications, data and models to client.

5.15 Intellectual Property Rights

Tamil Nadu WRIMS as mentioned in the scope of work will be handed over along with non- proprietary source code to the department. Department will have all

necessary rights to use, host and modify the system for future development and troubleshooting needs.

5.16 Project Timelines

In the below project plan, "T" is defined as the contract signing date. Please note that successful completion of dashboard is dependent on data received. The below timelines assume that the data collection, validation and insertion happen as per timelines for receiving the data. In case, there is a delay in receiving the data for a specific dashboard, then there should be an expected delay in delivering the same.

Deliverable No.	Activity	Sl. No.	Deliverable	Timelines in Days from T
D-1	Project Initiation & Requirement Gathering	1	Kick-off & Inception report	T+30
		1.1	Kick-off meeting with all stakeholders	T+15
		1.2	Inception report with System Requirement Specifications and Complete Project Plan	T+30
D-2	Beta Version	2	Go-Live with Beta version of Realtime Dashboards modules of the system which will bring real-time information by integrating data from CWC, IMD, Forecast, ISRO, Global Data set, State Data	T+45

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D-3	Design	3	Development of Digital Platform & Unified Database, Satellite processing and admin module	T+90
		3.1	Document on software development process to be followed and identifying owners, responsibilities, escalation matrix etc. on purchaser and consultant side.	T+90
		3.2	Database Schema of the Digital Platform	T+90
		3.3	Detailed Architecture document of the Digital Platform for Tamil Nadu Water Resource Information and Management System	T+90
D-4	Development	4	Development of Decision Support System and Dashboards on Staging System and Submission of report on Quality along with all the test cases run for the DSS and Dashboard for individual Module	
		4.1	Full Scale Realtime Dashboards for all Water supply, demand, quality, users etc	T+210

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		4.2	Village Water Budget	T+365
		4.3	Ground Water Information & Management System	T+365
		4.4	Water Conservation Planning	T+455
		4.5	Project Monitoring and Management	T+455
		4.6	Inflow Forecast	T+455
		4.7	Reservoir Operations Optimization for 90 reservoirs	T+455
		4.8	Water Audit: Basin and Admin wise	T+455
		4.9	Deficit Water Indent	T+455
		4.10	Inter basin Transfer	T+455
		4.11	Early Season Drought and Drinking Water Stress	T+455
D-5	UAT & Go Live	5	User Acceptance Deployment Report & GO Live of the Module	
		5.1	Full Scale Realtime Dashboards for all Water supply, demand, quality, users etc	T+240
		5.2	Village Water Budget	T+395
		5.3	Ground Water Information & Management System	T+395

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		5.4	Water Conservation Planning	T+485
		5.5	Project Monitoring and Management	T+485
		5.6	Inflow Forecast	T+485
		5.7	Reservoir Operations Optimization for 85 dams	T+485
		5.8	Water Audit: Basin and Admin wise	T+485
		5.9	Deficit Water Indent	T+485
		5.10	Interbasin Transfer	T+485
		5.11	Early Season Drought and Drinking Water Stress	T+485
D-6	Training	6	Capacity Building & Training	
		6.1	Quarterly Workshops	T+545
		6.2	Classroom based training	T+545
		6.3	On-site Training at 30 Districts	T+545
		6.4	User Guides	T+545
D-7	Maintenance	7	Technical Support	
		7.1	Tech Support, Maintenance	12 months after Go Live
D-8	Cloud Hosting	8	Cloud Hosting	12 months after Go Live

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5.17 Payment Terms

Sl.	Phase / Milestones of payment	Payment Schedule percentage including applicable taxes
1	Upon Submission of Inception Report (Deliverable - D1)	10% of Contract Value excluding Maintenance and Cloud Hosting Costs
2	Upon going Live with Beta Version as (Deliverable D-2)	10% of Contract Value excluding Maintenance and Cloud Hosting Costs
3	Upon Submission of Detailed Design Documents (Deliverable D-3)	8% of Contract Value excluding Maintenance and Cloud Hosting Costs
4	Upon Development and Deployment of each of the Decision Support System and Dashboards independently on Staging System with beta Go Live (D-4.1 to D-4.13)	upon deployment of each individual Deliverable from D-4.1 to D-4.11, on staging server 3% of Contract Value excluding Maintenance and Cloud Hosting Costs. (Total 33% of the contract value excluding Maintenance and Cloud hosting Charges)
5	User Acceptance Deployment Report & Go Live of each individual Decision Support System and Dashboards (D-5.1 to D-5.13)	upon deployment of each individual Deliverable from D-5.1 to D-5.11, 2% of Contract Value excluding Maintenance and Cloud Hosting Costs. (Total 22% of the contract value excluding Maintenance and Cloud hosting Charges)
6	Capacity Building and	7% of Contract Value excluding Maintenance

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	Training (Deliverable D-6)	and Cloud Hosting Costs
7	Support and Maintenance Period (To be divided equally in 4 Quarters payment payable at the end of the quarter) (Deliverable- 7)	25% of Maintenance Cost Quarterly in advance for four Quarters after Go Live Costs
8	Cloud Hosting Charges (To be divided equally in 4 Quarters. Payment payable at the end of the quarter) (Deliverable -8)	25% of Cloud charges will be Quarterly in advance for four Quarters after Go Live

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Section VI: Annexure

6.1 Tender Submission form

Ref. No.: /_____/___ Date:

To

The Chief Engineer & Director, WRD

Institute for Water Studies, Hydrology & Quality Control,

Tharamani, Chennai-600113.

Sir,

Subject: Submission of Tender - Technical & Financial proposal for Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS) under the control of Institute For Water Studies, Hydrology & Quality Control, Chennai

Ref: Your Tender Notice No.TNWRIM/IWSH&QC/2022-1

We, the purchaser, offer to provide Systems Implementation solutions to Implementation of Tamilnadu Water Resource Information & Management System with your tender notice as in reference above. We are hereby submitting our Proposals, which includes this Sealed Technical proposal and sealed Financial proposal separately.

We hereby declare that all the information and statements made in this Technical proposal are true and accept that any misinterpretation contained in it may lead to our disqualification.

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We undertake, if our Proposal is accepted, to initiate the Implementation services related to the assignment not later than the date indicated in Data sheet.

We agree to abide by all the terms and conditions of the Tender document. We would hold the terms of our Tender valid for 90 days as stipulated in the Tender document.

We hereby declare that we are not insolvent, in receivership, bankrupt or being wound up, our affairs are not being administered by a court or a judicial officer, our business activities have not been suspended and we are not the subject of legal proceedings for any of the foregoing.

We understand you are not bound to accept any Proposal you receive.

Yours sincerely,

(Seal & Signature of the Authorized signatory)

Name & Designation:

Place:

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6.2 : Tenderer Profile

Requirements	Details
Name of the Company/Firm	
In case of JV/Consortium, legal name of each member	
Date of Incorporation (Registration Number & Registering Authority)	
GST and PAN No.	
Legal Status of the Company in India & Nature of Business in India	Public Ltd Company/ Private / Partnership Firm
Address of the Registered Head Office in India	
Date of Commencement of Business	
Address of the office in Tamil Nadu (if any)	
Active ISO/ SEI CMMI Level status (Enclose Certificate)	
Details of the Contact Person	Name: Designation: E-mail id: Phone & Fax number:
Details of the Contact Person to whom all references shall be made regarding this Tender	Name: Designation: E-mail id: Phone & Fax number:

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Web-Site& -mail ID for any grievance	

(Seal & Signature of the Authorized signatory)

Name: Place:

Designation: Date:

6.2.1.Tenderer Profile: (JV/Consortium Member)

Requirements	Details
Name of the Company/Firm	
In case of JV/Consortium, legal name of each member	
Date of Incorporation (Registration Number & Registering Authority)	
GST and PAN No.	
Legal Status of the Company in India & Nature of Business in India	Public Ltd Company/ Private / Partnership Firm
Address of the Registered Head Office in India	
Date of Commencement of Business	
Address of the office in Tamil Nadu (if any)	
Active ISO/ SEI CMMI Level status (Enclosed Certificate)	

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Details of the Contact Person	Name: Designation: E-mail id: Phone& Fax number:
Details of the Contact Person to whom all references shall be made regarding this Tender	Name: Designation: E-mail id: Phone& Fax number:
Web-Site& -mail ID for any grievance	

(Seal & Signature of the Authorized signatory)

Name: Place:

Designation: Date:

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6.3 Declaration on Black listing

(On the Tenderers Letter head)

To

The Chief Engineer & Director, WRD

Institute for Water Studies, Hydrology & Quality Control,

Tharamani, Chennai-600113.

Sir,

Ref: Tender for Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS) under the control of Institute For Water Studies, Hydrology & Quality Control, Chennai

Sub: Declaration of not being banned or blacklisted by State/Central Government /Public Sector Undertakings/ Statutory Boards /Local Bodies of any State.

I, authorized representative of_____,hereby solemnly confirm that we are not under a declaration of in-eligibility for corrupt, fraudulent or any other unethical business practices and not debarred or black listed by State /Central Government/ Public Sector Under takings/ Statutory Boards/ Local Bodies of any State for any reason in the last 3 years from the date of the response to this Tender.

In the event of any deviation from the factual information/ declaration, the Water Resource Department reserves the right to reject the proposal or terminate the Contract without any compensation.

Yours faithfully,

Signature of the Authorized Signatory:

Name and Designation of the Authorized

Signatory: Company Seal:

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6.4 Technical Qualification Proposal

6.4.1 Prior Project Experience with respect to the Technical Criteria

a) Relevant Project Experience

Relevant project experience	
Name of the Tenderer (Lead or JV/Consortium Member) :	
General Information	
Name of the project	
Client for which the project was executed	
Name and contact details of the client	
Project Details	
Description of the project	
Scope of services	
Technologies used.	
Outcomes of the project	
Status of the project	
Total cost of the project	
Total cost of the services provided by the Tnderer	
Duration of the project (no. of months, start date, completion date, current status)	
The Tenderer should submit the following: i. PO / Work order ii. Work completion certificates / Performance Certificate/ Work satisfactory certificate from the client dept.	

Name :

Designation :

Signature of the Authorized signatory:

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b) Module wise use case submission

Sr. No.	Name of the Module	URL Details

Tenderer has to submit the detailed demonstration of each module on the solution, technology landscape, with the details of the client and project implemented

6.4.2 Approach & Methodology

i. Understanding of Business and Scope of work and all aspect of the Project

ii. Functional architecture, Application architecture, Integration architecture, & Infrastructure deployment architecture proposed solution covering at minimum the below key aspects:

- Modularity of the system
- Scalability to handle future load
- Suitability of Tools & Technologies proposed
- Use of Open standards and open-source products
- Approach to develop the API based system
- Managing the API eco-system
- Risk and mitigation
- Plan to handle multiple

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6.4.3 Curriculum Vitae (CV) of Key Personnel

Position Title and No.	
Name of Expert:	{Insert full name}
Date of Birth:	{day/month/year}
Country of Citizenship/Residence	

Education: {List college/university or other specialized education, giving names of educational institutions, dates attended, degree(s)/diploma(s) obtained}

_____

_____

Employment record relevant to the assignment: {Starting with present position, list in reverse order. Please provide dates, name of employing organization, titles of positions held, types of activities performed and location of the assignment, and contact information of previous clients and employing organization(s) who can be contacted for references. Past employment that is not relevant to the assignment does not need to be included.}

Period	**Employing organization and your title/position. Contact for references**	**Country**	**Summary of activities performed relevant to the Assignment**
[e.g., May 2005-present]	[e.g., Ministry of ……, advisor/consultant to… For references :Tel/e-mail……; Mr. Hbbbbb, deputy minister]		

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Language Skills (indicate only languages in which you can work):

Membership in Professional Associations and Publications:

Expert's contact information: (e-mail……., phone)

Certification:

I, the purchaser, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any misstatement or misrepresentation described herein may lead to my disqualification or dismissal if engaged.

Name & Signature (Personnel)

Name & Signature(Authorized Signatory)

Date of Signing

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6.5 Commercial Proposal

Name of the Work: Implementation of Tamil Nadu Water Resources Information & Management System (TN-WRIMS)						
PRICE SCHEDULE						
S.No	**Item Description**	**Quantity**	**Unit Rate in Rs**	**GST in % & in Rs**	**Total Amount including GST in Rs.**	**Total Amount in Words**
1	**Integration with existing Systems and Data Sources** • **Geo-Spatial Data Integration** (Admin Boundaries, Geo-Tagged data, Tanks, Borewells etc.,) • **Existing Systems** • **Satellite Data Integration**	1 Module				

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S.No	Item Description	Quantity	Unit Rate in Rs	GST in % & in Rs	Total Amount including GST in Rs.	Total Amount in Words
2	**Development of Digital Platform** o Unified Database, o Satellite processing and admin module o Development of Unified Database o Development of various Platform features o Development of GIS processing and publishing system o Automating the ingestion o processing of satellite data o Admin management module o Data input module and mobile application o Machine Learning	1 Module				

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
3	**Setting up and Automation of various Hydrology, Hydraulic, Crop, Operation models;** • Run models, and generate output data, and use them for estimation or prediction of parameters like Run-Off, Soil Moisture and Evapo-transpiration **List of the models, the platform should be able to host** ○ Catchment and Drainage generation ○ Rainfall – Runoff models ○ Hydrodynamic models – 1D and 2D. ○ Network Flow Optimization. ○ Reservoir Operation Optimization Model ○ Crop models – Crop Water Requirement,	1 Module				

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	○ Soil Moisture Estimation, ○ Ground Water Assessment ○ Water budgeting and accounting ○ Other Scientific or Statistical Models					
4	**Development of Realtime Dashboards for all Water supply, demand, quality, users:** ○ Rainfall Dashboard (Including Forecast) ○ Reservoirs Dashboard ○ Ground Water – Dashboard ○ MI Tanks and other smaller irrigation water bodies ○ Soil Moisture Dashboard ○ Lift Irrigation Schemes ○ Water Demand	1 Module				
5	**Village Water Budget** ○ Water available from rainfall to cropped area during the crop life cycle ○ Water available from ground water based on Ground Water	1 Module				

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	○ Estimation Methodology ○ Water available from canal irrigation ○ Amount of runoff conserved and excess runoff					
6	**Ground Water Information & Management System:** ○ near real time information of Ground water levels ○ Level trends based on the historical data ○ Water level fluctuations ○ spatial analysis ○ season wise trends etc.					

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
7	**Water Conservation Planning:** This will help in getting key answers as below: ○ Which villages should be prioritized for water conservation works. ○ What water management strategies (supply/demand side) should be implemented ○ How much additional runoff is available at the required reliability level ○ What is the minimum additional capacity required to mitigate the identified water deficit or conserve available run-off in the deficit region ○ How many water and soil conservation structures should be built in the village based on the	1 Module				

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	village deficit and available run-off. o Location and type of water and soil conservation that can be taken up in the village based on geology, geo- morphology, lineaments, soil type, LULC, slope and other GIS layers o How to fill tanks and utilize flood water and providing mean to better rainwater harvesting by finding suitable zones o Enable field functionaries to validate the location and type of structures or modify as required using a mobile application o Priorities the soil and water conservation activities on a ridge to valley basis and funds available o Track the progress of the activities					

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
8	**Project Monitoring and Management Module:** **Project Module** o Monitoring Module o CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique) o User Management Module o Broadcasting and SMS Integration Module o Dashboards & Reports o Alerts and Escalations					
9	**Inflow Forecasting** o Creation of Data o River Gauge and Reservoir Data o Spatial Datasets o Inflow forecast points in the basin/region o Stream Flow Network o Automation of the models o WebGIS / MIS based inflow forecast.					

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
10	**Reservoir Operations Optimization** Levels of water, availability of water in the reservoirs for various purposes like crop planning, flood planning etc. The Optimization model should be set in real-time operation mode, making it will run automatically on daily basis, by taking the latest information, and provide optimized operation schedule for each reservoir, which can be reviewed and accepted by the respective authorities. o Reservoir storage levels o Reservoir and conveyance losses o Actual Inflows o Latest Inflow Forecast o Canal Releases o Revised Demand schedules o WebGIS and MIS based operation dashboard	1 Module				

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
11	**Water Audit: Basin and Admin wise** • **Total inflow of Water into the Basin** o Water received through Rainfall o Water received as inflow from major rivers and rivulets from other states • **Net Change in Storage of Water** o Change in Groundwater Storage o Change in Soil Moisture o Change in storage in all major/medium reservoirs • **Basin** o Evapotranspiration losses o Utilization - Water used for Drinking o Utilization - Water used for Industrial o Utilization – Water used for Irrigation / Agriculture Runoff to Sea (as loss) o Outflow to other states through major rivers and rivulets	1 Module				

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
12	**Deficit Water Indent** o Crop sown information tracking o Rotation-wise water release information tracking o Development of Mobile App module to track Water o Releases at distributary level o Water demand monitoring system o Canal Dashboard o Seasonal Demand Dashboard o Crop Type Dashboard o In-season Releases Dashboard	1 Module				
13	**Inter basin Transfer** Optimum planning and operation of lift schemes while optimizing the cost, demand and availability of water. The decision system should create a network of water storage, inflows, demand and transfer links, and provide seasonal and	1 Module				

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	weekly (10 daily) allocation targets This system should use demands, expected natural flows, conveyance hydraulic details, lift details, and run mathematical optimization models to provide o Water Allocation to each demand blocks o Pump operation targets in the season o Reservoir operation targets This system should result in cost savings by optimizing o Pump running time by forecasting inflows ahead of time. o Daily Operation schedule with targets for each pump running time, and reservoir operation (accounting forecasted inflow, current storage and demand) o Irrigation efficiency using dynamic crop water demand and leveraging the saving in irrigation water to increase crop area in the project.					

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	The system should provide a dashboard for decision makers.					
S.No	**Item Description**	**Quantity**	**Unit Rate in Rs.**	**GST in % & in Rs.**	**Total Amount including GST in Rs.**	**Total Amount in Words**
14	**Early Season Drought and Drinking Water Stress** Drinking water stress in rural villages where bore wells are primary source of drinking water supply. It should bring together real-time weather data, ground water data, forecast data, current tanker supply data, historical tanker supply data and historical stress data to present rural water supply stress on a Web-GIS based dashboard. ○ Identify villages in stress based on historical stress data as well as current groundwater levels. Integrate with RWSS village action plan, with data about the date for the start of tanker	1 Module				

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	deliveries and No. of tanker movements per day for village ○ Identify villages in stress based on historical stress data and historical as well as current groundwater levels, reservoir levels, local water bodies levels. Integrate with RWSS village action plan, with data about the date for the start of tanker deliveries and No. of tanker movements per day for village ○ Identify villages that are identified to be under stress and getting sufficient amount of water through tankers. ○ Identify villages that are identified to be under stress, but not getting sufficient amount of water through tanks. ○ Visualize the State, District, Block and Village view on Drinking water Rural Stress, and relief through tanker					

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S.No	Item Description	Quantity	Unit Rate in Rs.	GST in % & in Rs.	Total Amount including GST in Rs.	Total Amount in Words
15	**Training and Capacity Building**	L.S				
16	**Project Implementation Support:** Data Collation, Digitization, Cleaning, Project planning, Tracking & Co-ordination, Resource Management. Project Communication	1 Module				
17	**Cloud Hosting Charges for One Year Go Live**	12 Months				
18	**Annual Maintenance and Support for One year post Go Live**	12 Months				
Total Quoted Price in Figures						
Total Quoted Price in Words						

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6.6 Template for Power of Attorney

Power of Attorney (PoA) by Authorized Signatory of Tenderer authorizing a staff to sign and submit the Tender and execute the Contract (if selected as a successful tenderer) on behalf of the Tenderer.

<To be on non-judicial stamp paper of Rupees One Hundred Only (INR 100/-)>

Know by all men by these presents, We (Name of the Tenderer and address of their registered office) do hereby constitute, appoint and authorize Mr. / Ms (name and residential address of Power of attorney holder) who is presently employed with us and holding the position of …… as our Attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our Proposal for Implementation of Tamil Nadu Water Resource Information & Management System including signing and submission of bid, executing the contract (if selected as a Successful Tenderer) and providing information / responses to Water Resources Department, Tamil Nadu representing us in all matters before Water Resources Department, Tamil Nadu in connection with our Proposal for the said Project.

We hereby agree to ratify all acts, deeds and things lawfully done by our said Attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid Attorney shall and shall always be deemed to have been done by us.

For

Name: Designation: Date:

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Time:

6.7: Template for Performance Bank Guarantee

[Guarantor letter head or SWIFT identifier code]

Beneficiary:

The Chief Engineer & Director, WRD
Institute for Water Studies, Hydrology & Quality Control,
Tharamani, Chennai-600113.

Date: _ [Insert date of issue]

PERFORMANCE GUARANTEE No.: [Insert guarantee reference number]

Guarantor: [Insert name and address of place of issue, unless indicated in the letterhead]

We have been informed that _ [insert name of Tenderer, which in the case of a joint venture shall be the name of the joint venture] (hereinafter called "the Tenderer") has entered into Contract No. [insert reference number of the contract] dated [insert date] with the Beneficiary, for the execution of _ [insert name of contract and brief description of Services] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Tenderer, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of [insert amount in figures] ( ) [insert amount in words], such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or

identifying the demand, stating that the Tenderer is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the …. Day of ……, 2…, and any demand for payment under it must be received by us at this office indicated above on or before that date.

[signature(s)

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Glossary and List of Abbreviations:

ACZ	Agro- Climatic Zone
AGRISNET	Agriculture Information System Network
AI	Artificial Intelligence
API	Application programming interfaces
B. Tech	Bachelor of Technology
B. E	Bachelor of Engineering
BOQ	Bill of Quantity
CA	Chartered Accountant
CNN	Convolutional Neural Network
CWC	Central Water Commission
DEM	Digital Elevation Model
DES	Department of Economics and Statistics
DNN	Deep Neural Networks
DPR	Detailed Project Report
DSC	Digital Signature Certificate
DSS	Decision Support System
ECMWF	European Centre for Medium-Range Weather Forecasts
EMD	Earnest Money Deposit
FRL	Full Reservoir Level
GEFS	Global Ensemble Forecast System

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GIS	Geographic Information System
GML	Geography Markup Language
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GRIB	General Regularly distributed Information in Binary form
GUI	Graphical User Interface
IMD	Indian Meteorological Department
IoT	Internet of Things
ISRO	Indian Space Research Organization.
IT	Information Technology
JV	Joint Venture
KML	Keyhole Markup Language
KPI	Key Performance Indicators
LA & RR	Land Acquisition & Rehabilitation and Resettlement
LAI	Leaf Area Index
LSTM	Long Short-Term Memory
LULC	Land Use Land Cover
M.Sc	Master of Science
M.Tech	Master of Technology
MBA	Master of Business Administration
MCA	Master of Computer Applications
MI Tank	Minor Irrigation Tank

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MIS	Management Information System
ML	Machine Learning
MODIS	Moderate Resolution Imaging Spectroradiometer
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
NEFT	National Electronic Funds Transfer
NetCDF	Network Common Data Form
NIT	Notice Inviting Tender
OGC	Open Geospatial Consortium
PBG	Performance Bank Guarantee
PMC	Project Management Consultant
PMU	Project Management Unit
QCBS	Quality and Cost Based Selection.
RFP	Request for Proposal
RNN	Recurrent Neural Network
RTGS	Real Time Gross Settlement
SCADA	Supervisory control and data acquisition
SRTM	Shuttle Radar Topography Mission
TMC	Thousand Million Cubic Feet
TN GIS	Tamil Nadu Geographical Information System
TN SMART	Tamil Nadu System for Multi-hazard potential impact assessment, Alert, emergency Response planning and Tracking

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TNSWARMA	Tamil Nadu State Water Resources Management Agency
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WUA	Water User Association

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