Expression of Interest for Developing an Application for Data Validation & Well Census Data Analysis

Groundwater Department is the nodal agency for groundwater investigation and construction of groundwater extraction structures in the State. The department has started functioning as a part of the Agriculture Department and later evolved as an independent department in the year 1978. The initial focus of the department was to provide solutions to irrigation needs and later extended to domestic and industrial needs also. Ever since its inception, Groundwater Department has been dealing with various groundwater-related issues and has been a key service provider to all the sectors across the State. The department is also presently engaged in implementing mini water supply schemes, conservation and management of groundwater resources and groundwater regime monitoring.

The development of an application to analyze the Well Census Data collected under the National Hydrology Project's Groundwater Department in association with "Kudambashree" during the financial year 2023. The primary objective of this application is to perform data analysis and visualization of the Well Census Data through a GIS interface to derive crucial insights for groundwater management and sustainability in the state of Kerala.

Project Overview:

The proposed application,will be a user-friendly and interactive GIS-based platform capable of processing and interpreting the Well Census Data collected from 7.5 lakh wells across 33 blocks in Kerala. The application should have the capability to generate maps, perform data interpolations, and visualize key parameters related to groundwater resources. The following are the main functionalities that the application should provide:

1. Depth to Water Level Analysis: The application should calculate the depth to water level in meters below ground level by utilizing relevant parameters from the dataset. The generated data should be plotted and interpolated to obtain a map depicting various ranges of static water level in "mbgl" (meters below ground level).

2. Groundwater Recharge Assessment: The application should analyze the depth to water level data in conjunction with other relevant parameters to identify areas suitable for implementing managed aquifer recharge. It should consider factors like slope, geology, and depth to bedrock to demarcate areas necessary for groundwater recharge.

3. Groundwater Quality Mapping: The application should generate a map showing the general groundwater quality of the surveyed area based on the available data (good/bad).

4. Groundwater Extraction Analysis: The application should classify the groundwater extraction based on the purpose (domestic, agriculture, industry) and calculate the well density in each area. It should also estimate the annual groundwater draft and compare it with the national and state-level standards.

5. Groundwater Sustainability Mapping: The application should analyze various parameters to categorize areas as groundwater sustainable and non-sustainable. It should identify areas with perennial wells, unaffected by drought, and with good water quality for sustainable groundwater management.

6. Spring Shed Management: The application should map springs in the surveyed area and delineate spring sheds using digital elevation models and geological data. It should assist in implementing micro water supply schemes and rejuvenating springs in need of restoration.

7. Well Statistics and Trends: The application should provide graphical representations of year and area-wise construction of groundwater abstraction structures to assess trends in groundwater dependency and regulate groundwater exploitation.

8. Groundwater Flow Direction: The application should generate a map showing the direction of groundwater flow based on depth to water level and altitude data. This information can be valuable for analyzing contaminant transport within the groundwater system.

Well census was an exercise taken up by groundwater department under National hydrology project in the financial year 2023. It was a massive drive conducted in association with “Kudambashree” on a pilot basis. Data from 7.5 lakh wells were collected from 33 blocks across Kerala was acquired through numerous enumerators of kudumbashree. In order to geo-tag the groundwater abstraction structures a mobile app named“Neerarivu” was developed. The Mobile app was empowered with 32 data fields which is given in the following table.

Sl No	**Data Field**
1	Unique ID (Structure type & spatial reference)
2	Date of observation

3	Location
4	Administrative details
5	Ownership (Private, government) (address)
6	Survey No.
7	Land Type (coastal area/valley/paddy field/side slope/mid slope/highland)
8	Latitude
9	Longitude
10	Year of Construction of well
11	Purpose of well (domestic/agriculture/industry)
12	Status of well (in use/abandoned) (perennial/non-perennial)
13	Well Diameter (m)
14	Well Length (m)
15	Well Breadth (m)
16	Well Depth (m)
17	Height of Parapet (m)
18	Type of lining (Nil/concrete/laterite/brick/Tile)
19	Depth of lining (m)
20	Depth to hard rock (m)
21	Well bottom material (laterite/clay/sand/weathered rock/hard rock)
22	Energised (Y/N)
23	Type of pump used (mono block/submersible/diesel/jet/compressor)
24	HP of motor

25	Static water level (mbgl)
26	Daily pumping (litres)
27	Tank capacity (litres)
28	Time to fill tank (hour /minutes)
29	Drought affected area (Yes/No)
30	Water quality (good/saline/muddy)
31	Picture of well
32	Additional information if any

Data analysis procedure

The basemap should have all the generic information such as survey numbers of plots, drainage, roads, panchayath boundary, ward boundary etc. A unique ID shall be generated for each well using survey number and type of well. The data collected shall be analyzed in a GIS interface for a visual interpretation of various data fields of the Neerarivu Mobile App.

Sl. No	Parameter	Required data fields & procedure	Inference	Other Useful Departments

I	Depth to water level	1,8,9, 25,17 The depth to water level in the unit of meters below ground level should be calculated by subtracting the 17^{th} parameter from 25^{th} parameter. The generated data should plot and interpolated to obtain a map depicting various ranges of static water level in 'mbgl'. Each range of water level should be marked in different colours for easy recognition.	The depth to water level in an area is an indicative data pertaining to the depth at which ground water occurs beneath earth's surface. Generally the term is expressed in the unit 'meters below ground level, From a map plotted with water level of an area we can predict the possible depth of dug wells in that area. 1. Also we can recommend the depth of waste disposal pits such as septic tanks at a depth 3 m to 10 m above the water level below ground level	Local Self Government, Pollution Control Board, Health Department, Haritha Kerala Mission, Soil Conservation Department, Public Works Department, Irrigation Dept, Disaster Management Authority, Rural Development.

			depending on the nature of the geologic material available in the area. 2. A primary delineation of recharge and discharge areas of groundwater can be done from this analysis. If the water level is in an area is at a shallow depth the chances of contamination of groundwater may also be higher.	

II	Groundwater recharge	1, 8, 9, 25, 17,12 The depth to water level in the unit of meters below ground level should be calculated by subtracting the 17^{th} parameter from 25^{th} parameter. The generated data should plot and interpolated to obtain a map depicting various ranges of static water level in 'mbgl'. The data in 12^{th} field should also be considered. If the water level is less than 3 m below ground level chances of water logging can be expected and the areas can be excluded from rechargeable area. The areas suitable for recharge should be identified by combining various aspects such as slope, geology, depth to bedrock etc.	Demarcating areas necessary for implementing managed aquifer recharge.	Soil Conservation, LSGD, Rural Development and all Departments involved in JSA activities

III	Groundwater quality	1,8,9,30 General groundwater quality of the area shall be plotted in a map using 30th field. From the available data only 2 parameters (Good/Bad) can be demarcated.	General groundwater quality of the area can be analyzed and can be categorized the area into good and bad groundwater yielding areas. Areas with bad groundwater quality can be demarcated and concerned authorities can take necessary steps to provide safe drinking water for the community.	Pollution Control Board, Health dept LSGD, Haritha Keralam Mission.

IV	Groundwater extraction	1,8,9,11,22,23,24,26,27,28,29 In a map the abstraction structures shall be plotted according to the category mentioned in 11th field (Domestic, Industry, and Agriculture). Well density of each area has to be calculated and should plot in a map depicting various ranges. Ground water extraction can be calculated from the 26th field and it has to be converted to annual draft. The domestic draft should be calculated and interpolated to various ranges. The ranges have to be compared with the national and state level lpcd. The same procedure can be adopted for irrigation draft.	The ground water extraction can be classified as per the purpose for which ground water is being extracted using mechanical methods. Generally the ground water utilization can be classified as domestic, agriculture and industry uses. From the values of daily domestic extraction a realistic quantification of groundwater extraction by each household in an area can be obtained. This value can be compared with the existing National and state level liters per capita daily value. If land use pattern and crop pattern in the area is combined, crop water utilisation can be assessed and can	CGWB, Irrigation Dept, Agriculture Dept LSGD, NABARD, CWRDM, Industries, Economic and Statistics

			generate the comparison report with the crop water ratio. Groundwater extraction is above the national standards authorities can prescribe regulatory measures. When the data relating to ground water extraction became more realistic, the ground water estimation will also became more accurate which in turn help the policy makers to identify and act upon areas were regulation is required.	

V	Groundwater sustainability	1,8,9,12,29,30 The above parameters should be analyzed to produce a map with various colors depicting sustainable and non-sustainable areas with respect to ground water.	The areas where the wells are perennial, not affected by drought and the quality is good the area can be marked as groundwater sustainable areas. The areas which are not falling in above category should be properly monitored and necessary intervention such as groundwater recharge and the quality improvement measures can be adopted to improve the sustainability of groundwater resource in that area.	LSGD, water Authority, Irrigation, Agriculture

VI	Spring shed management	1,8,9,10,12 Springs of the surveyed area can be mapped and by combining a digital elevation model and geology map of the area the spring sheds can be delineated.	If the spring is perennial and yielding good quality water, suitable micro water supply schemes can be implemented.The springs which are in ruins can be rejuvenated with the proper spring shed management activities with the aid from NABARD, CGWB etc	JJM, NABARD, LSGD
VII	Type of well	1,8,9 Well density according to the type of well can be assessed from these parameters.	If the well density in an area is high necessary restriction for regulating over exploitation of groundwater should be imposed. The administrative authorities can make necessary intervention in health sector especially in case of waterborne disease and empowering the mechanism of implementing necessary	Health dept, LSGD, Disaster Management

			pre-monsoon sanitation.	
VIII	Well statistics	1,8,9,10 A graphical representation of year and area wise construction of ground water abstraction structure can be prepard.	The annual increase in groundwater abstraction structures indicates a gradual increase in the dependency of groundwater for various needs. The trend of the increase in various types of abstraction structures should be analyzed and proper regulatory measures should be implemented.	LSGD, Economic and Statistics dept, Water Authority
IX	Groundwater Flow pattern	1,8,9, (25-17) Depth to water level map generated in “meters below ground level” values should be converted to reduced level and by combining altitude of the area ,a map of ground water flow direction can be generated.	The flow Direction of ground water can give an indicative direction of contaminant transport within the groundwater system in an area i.e. source of contamination can be analyzed.	Pollution Control Board, Health dept, LSGD, Industries Department

The EOI process

Kerala Startup Mission is approached by various Government Departments for the development of mobile and web applications. These requests are met through a facilitation deviced by KSUM. Kerala Startup Mission facilitates the entire process by helping departments to finalise technical specifications, circulating the same among startups, initial technical assessment and short listing for the committee to take final decision.

Following are the steps involved:

1. Call for Expression of Interest among startups incubated/registered with KSUM
2. Submission of EOI (in the link provided by KSUM)
3. KSUM to organize interaction with the Department for clarifying doubts and queries of interested startups.
4. Technical Proposals are then obtained from startups who have submitted the interest.
5. Technical proposals are then evaluated.
6. Startups who qualify the technical evaluation are then asked to submit the financial proposal.
7. L1 among the startups is identified by the method of Quality and Cost Based Selection (QCBS) wherein 70% marks for the technical proposal and 30% for the financial proposal.
8. The L1 startup is then recommended to the Department.
9. KSUM ensures that the startup delivers the product to the Department and the Department is satisfied with the work.
10. The payment is made directly by the department to the startup after signing an Agreement.
11. The Department is also expected to do the Security auditing of the application developed by the startup through CERT-K and also to host the application in the State Data Center

Eligibility for Startup to participate in the EOI

The startup has to be registered with Kerala Startup Mission and Startup India.