CENTRAL GROUND WATER BOARD

DEPARTMENT OF WATER RESOURCES,

RIVER DEVELOPMENT AND GANGA REJUVENATION,

MINISTRY OF JAL SHAKTI

GOVERNMENT OF INDIA

INCEPTION REPORT

IDENTIFICATION OF RECHARGE AREA IN WATER STRESSED AREA: KASARAGOD BLOCK, KASARGOD DISTRICT

(NAQUIM-2.0)

AAP: 2023-24

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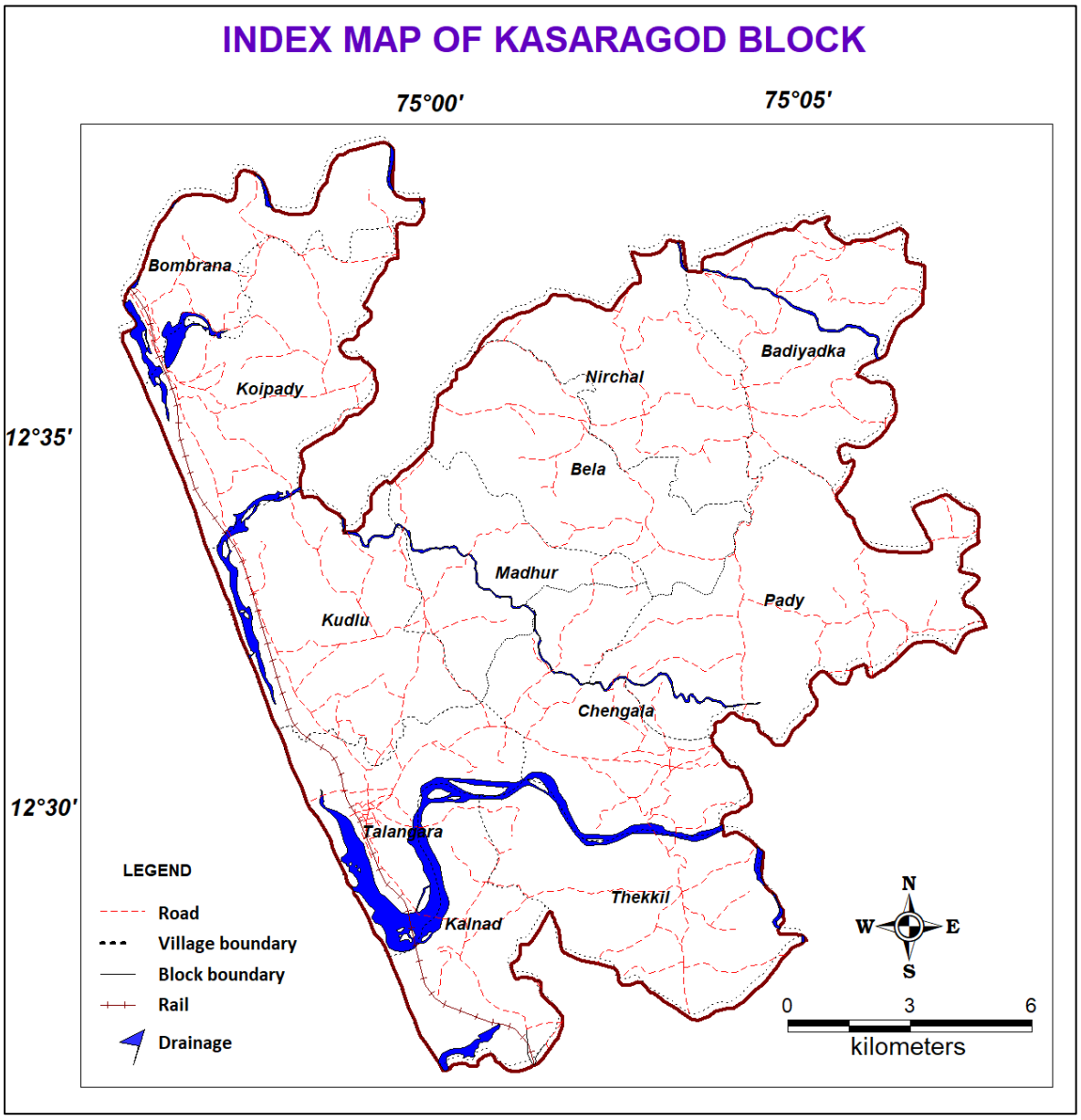
ABOUT STUDY AREA

Kasaragod block is one of the 6 blocks of kasaragod district which is the northern most district of Kerala covering an area of 259 Sq Km. The block lies within North latitude 12°38' 56.04" and 12°38'22.56" and East Longitude 74°59'15.36" and 75°16'46.56". Administratively, the block has 1 municipality and 6 grama panchayats namely Badiadka, Chemnad, Chengala, Kumbla, Madhur and Mogralputhur. The block is bounded in the north and north-east by Manjeshwar block, east and south-east by karadka, south by kanhangad and west by Arabian Sea. The base map of study area is presented in figure 1



Physiographically the block is divided into lowland land with an elevation of 0 to 7 m and midland with altitude ranging from 7 to 76 mamsl. Geomorphologically, the area is covered by coastal plains in the west, plateau and pedeplain deposits in the remaining parts. Geologically

the area is underlain by sand and silt deposits, laterites and Precambrian metamorphic complex, mainly composed of peninsular gneisses, Khondalite, Acidic rocks

Groundwater occurs under water table conditions in alluvium, laterites and weathered mantle of the crystallines, where as in the deeper fractured crystallines the groundwater occurs under semi confined to confined conditions. Laterite is the most wide-spread and extensively developed aquifer in the block with lateritic thickness developed up to 30 to 40 mbgl. The phreatic aquifers are developed in lateritic terrain. Hence, dug wells tapping the weathered crystallines/ laterites dry up during summer, especially where the thickness of overburden is limited. Also, quarrying for laterite bricks and rocks in parts of midland area and the increased dependence on bore wells in midland areas leads to drying up of dug wells in lateritic mounds and slopes which affects the water needs of farmers and poor people. Due to steep sloping topographical condition, the whole water is drain out into the sea within a short span of time. Also, the District receives less North-east monsoon and least summer showers comparing to other parts of state which in turn cause severe drought condition in summer.

As per GWRA 2022, the stage of ground water extraction is 91.94% (Critical category) making the district water stressed and increasing dependency of deeper aquifer for irrigation and domestic purposes.

Hence the need to source the recharge area within or outside the block is crucial to tackle the water scarcity of the study area by formulating plan to implement suitable artificial recharge structures and water conservation practices. Also, other sources of fresh water need to be mapped for drinking water supply at the times of scarcity.

Priority types

Water Stressed Area. The area falls under Critical category with Stage of Ground Water extraction of 91.94%.

Previous studies

1. Reappraisal survey carried out by Sh. V. Dhingaran (1989-90), Shri V. Kunhambu and Sh. N.C. Nayak (1996-97) and Sh. K. Balakrishnan (2000-2001, 2007-08)
2. Systematic hydrogeological survey in the eastern parts of Kasaragod taluk, Kasaragod district, Kerala by S.V.N.S.Rao (1982-83)
3. Resistivity survey for Ground water Exploration in Kasaragod taluka, Cannanore District, Kerala by P.C.Chandra (1983)
4. Microlevel survey in Kasaragod block by Shri K. Balakrishnan (2002-03)
5. Basic Data Reports of Piezometers drilled in Kasaragod District (2004-05)
6. Ground water resources estimation of Kasaragod district, first compiled by Dr. K.Md. Najeeb (1987) which was later revised in 1995, 2009,2011 as per GEC Methodology 1997 and in 2017, 2020 and 2022 as per GEC Methodology 2015
7. The Ground Water Exploration Report (2022-23)

8. National Aquifer Mapping and Management Plan of Kasaragod district (2021-22) by Sh. S.Singthurai
9. Paper on Ground water Quality and chemical Characteristics of Bekal watershed, Kasargod district, Kerala, India by S. Anoop, C. Saranya, Resma S Pillai has been published in Sustainable Water Resources Management which characterizes the ground water quality of the watershed being acidic.
10. A Hindu Newspaper article "Ground water remains polluted in Kasargod" was published on October 6,2012

The outcome of the previous studies is mentioned below:

- Four hydrogeological units are encountered in the district - Alluvium (including valley fills), laterites, weathered crystallines and fractured crystallines
- In, Coastal Alluvium, The yield of wells ranges from 10 to 50 m3/day and have depth ranging from 3.59 to 6.74 mbgl. The water level ranges from 2.95 to 5.60 m bgl in pre-monsoon period and 1.35 to 4.30 m bgl post monsoon period. The water level fluctuation is in the range of 0.30 to 2.37 m
- The laterite is the most widespread and extensively developed aquifer in the remaining parts of the district. The yield of wells in laterite ranges from 5 to 60 m3/day in monsoon period and it reduces to the range of 2 to 20 m3/day in summer. The depth of wells ranges from 4.84 m to 26.85 mbgl. The diameters of wells are 2.0 to 4.0 m The depth to water level (DTWL) in pre-monsoon period ranges from 2.95 to 25.75 m bgl and in post-monsoon period 1.35 to 22.90 m bgl. The water table fluctuation ranges from 0.30 to 4.05 meters
- Due to its porous nature the dug wells tapping laterite get recharged fast and also the water escapes as sub-surface flow and water level falls quite fast especially in wells located on topographic highs and hill slopes and the dugwells becomes dry during the period of summer
- Majority of the medium water supply schemes in the district are supplied by bore wells.
- CGWB has drilled 35 numbers of exploratory wells and two number of Tube wells in the district of which 10 EW and 8 Pz falls within the block.
- In the fractured crystalline aquifers ground water occurs under semi-confined to confined conditions.
- The depth of the bore wells ranges from 40 m to 200 mbgl. The depth to fracture zones ranges from 20 m to 80 m bgl and the discharge ranges from 0.5 to 11 Lps.
- For the deeper aquifer in hard rock terrains, the ground water quality is good and electrical conductivity ranges from 82 to 500(µs/cm at 25^{o}C

- The Deeper Aquifer tapping the coastal Tertiary formations and recent formations are found to be brackish/saline in nature.
- There are no major irrigation projects in the district
- The major cultivation of the district is cash crop like arecanut and coconut cultivation
- The cultivation is carried by use of ponds, rivers or existing ground water abstraction structures like dugwells and borewells
- Low sustainability of dugwells has increased demand on private borewells and are over exploited in Kasaragod Block.
- There is discontinued usage of micro-irrigation techniques in the block
- Though the Kasaragod District is having 12 nos. of river and getting high Rainfall, due to steep sloping, topographical condition, the whole water is drain out into the sea within a short span of time. Also, the District receives less North-east monsoon and least summer showers comparing to other parts of state which in turn cause severe drought condition in summer.
- The Paper published in Sustainable Water Resources Management characterizes the ground water quality of the watershed being acidic
- As per the newspaper article there is prevalence of endosulfan residues in the ground water of Kasaragod district due to use of pesticides.

Objectives & Deliverables of Present Study

- To identify the recharge area for the water stressed block to tackle the ground water problems by augmenting artificial recharge plans
- Identification of potential aquifers for drinking water supply
- A plan for drinking water source sustainability
- Ground water Quality Management Interventions including demarcation of safer aquifers
- Watershed-based Aquifer Mapping
- Aquifer Disposition
- Aquifer wise ground water levels
- Delineation of Recharge area
- Estimation/Refinement of parameters used for resource assessment by field tests/farmers feedback.
- Assessment of ground water resources
- Ground water Quality
- Ground water Quality Management Interventions including demarcation of safer aquifers

- Mapping of existing ground water conservation structures/artificial recharge structures.
- Artificial Recharge Plan
- Identification of potential aquifers for drinking water supply
- A plan for drinking water source sustainability

Existing Data

EW/OW	VES/TEM	WL (NHS & AQUIFER MAPPING)	WQ	Infiltration Test	Pumping Tests
10 EW, 8 Pz	16	22	16	-	2

Data Gap Analysis

EW/OW	VES/TEM	WL (NHS & AQUIFER MAPPING)	WQ	Infiltration Test	Pumping Tests
10	15	21	21	3	3

New Data Generation Plan

May 2023	➢ Pre-monsoon field work: key well establishment, water sample collection (for basic analysis, heavy metal, bacteriological study and isotope study) ➢ Review of Inception Report
June 2023	➢ Field data Collection, Sample Survey, geophysical studies ➢ Second Review
July 2023	Data compilation and analysis: Preparation of Thematic maps, cross sections, Aquifer disposition etc
August 2023	Data validation and interpretation: Tabulation and correlation of hydrogeological and geophysical data of existing wells.
September 2023	➢ Mapping of water bodies from satellite imagery and its comparison with toposheet for preparation of RWH, AR Plan ➢ Analysis and interpretation of chemical and geophysical data ➢ Mid term Review and guidance by NLEC
October 2023	➢ Analysis and interpretation of chemical and geophysical data ➢ Collection of drilling and other related data from state government agencies, drilling companies, NGOs ➢ Post monsoon water level monitoring
November 2023	➢ Post monsoon water level monitoring ➢ Conducting pumping tests, slug tests, infiltration test, data collection

December 2023	➢ Data Analysis and Draft Report Preparation: Field work for verification and ground truthing . Chemical Analysis of the post monsoon water samples (collected from selected wells for confirmation of issues) ➢ Fourth Review
January 2024	Preparation of groundwater management plans for source sustainability and Report preparation
February 2024	Field checks and Finalization of Report
March 2024	Finalisation of report and sharing of reports with CHQ, SGWCC, DM/DC

Month wise Activity Plan

May 2023	Pre-monsoon field work: key well establishment, water sample collection (for basic analysis, heavy metal, bacteriological study and isotope study)
June 2023	Field data Collection, Sample Survey, geophysical studies
July 2023	Data compilation and analysis : Preparation of Thematic maps,cross sections, Aquifer disposition etc
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Composition of Team

As per AAP 2023-24, the taken-up study has the following members

1. Sh. Roopesh G Krishnan, Sc-c(Hg)	-Planning, Supervision and Execution of the Project - Work distribution and monitoring of activities of other team members - Preparation of the inception report. - Timely Delivery of the envisaged Outputs - Finalization of the management plan - Presentations at different forums, sharing of the outputs. - Preparation of the draft report as per the approved Quality Standards and its Final Submission. - Other members of the team will assist the team lead.
2. Smt. Anu V, Sc-C(Hg)	- Field Data Collection - Sample collection for quality studies - Secondary Data collection -Entering data in database (WIMS) -Integration of data, preparation of thematic maps, preparation cross sections etc. -Consultation with allied experts like agriculture, irrigation etc. - Preparation of GIS maps and Management Plan
3. Sh. Sh. Pankaj Bakshe ,Sc-B (Chemist) & Sh.Aneesh Kumar V (Asst. Chemist)	- Sample collection for quality studies - Analysis of samples. - Integration with existing data -Validation and interpretation of data - Entering data in database (WIMS) -Preparation of Tables, graphs and maps for reports - Assisting the Team Lead in preparing the reports
4. Sh. V.S.T Gopinath (Geophysicist)	- Field Geophysical Surveys - Interpretation of field data - Entering data in database (WIMS) - Integration with existing geophysical and lithology data - Preparation of inferred lithologs, fresh-saline interface. - Suggesting potential sites for construction of water wells/artificial recharge - Preparation of Tables, graphs and maps for reports - Assisting the Team Lead in preparing the Report

Team Member wise responsibilities and monthly targets for entering in WIMS

May 2023	➢ Pre-monsoon field work: key well establishment, water sample collection (for basic analysis, heavy metal and isotope study)	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
June 2023	➢ Apprising block level authorities about work item and presentation of inception report ➢ Compilation and analysis of data collected during pre-monsoon field work ➢ Geophysical studies	Sh. Roopesh G Krishnan, Sc-C , Smt. Anu V,Sc-C, Sh. V.S.T Gopinath (Geophysicist), Sc-C(GP) Sh. Sh. Pankaj Bakshe,Sc-B (Chemist)
July 2023	➢ Preparation of thematic maps like DTW, EC, Cl Maps, identification of areas with deeper water level, declining trend, drying of wells/reduction in discharge, quality issues	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C Sh. Sh. Pankaj Bakshe, Sc-B (Chemist)
August 2023	➢ Data validation and interpretation: Tabulation and correlation of hydrogeological and geophysical data of existing EW, OW, Pz, DW, VES, TEM	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V, Sc-C Sh. V.S.T Gopinath (Geophysicist), Sc-C(GP) Sh. Sh. Pankaj Bakshe ,Sc-B (Chemist)
September 2023	➢ Preparation of crosssection 2D, 3D showing aquifer dispositions correlating lithologs ➢ Analysis of lithologs ad aquifer properties of previous studies and their incorporation ➢ Mapping of water bodies from satellite imagery and its comparison with toposheet for preparation of RWH, AR Plan ➢ Analysis and interpretation of chemical and geophysical data	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
October 2023	➢ Analysis and interpretation of chemical and geophysical data	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C Sh. Sh. Pankaj Bakshe ,Sc-B (Chemist)

	➢ Collection of drilling and other related data from state government agencies, drilling companies, NGOs ➢ Post monsoon water level monitoring	Sh. V.S.T Gopinath (Geophysicist), Sc-C(GP)
November 2023	➢ Post monsoon water level monitoring ➢ Conducting pumping tests, slug tests, infiltration test, data collection	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
December 2023	➢ Data Analysis and Draft report preparation as per NAQUIM 2 toolkit	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
January 2024	➢ Field checks and preparation of of report	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
February 2024	➢ Modification of draft report and finalisation	Sh. Roopesh G Krishnan, Sc-C &Smt. Anu V,Sc-C
March 2024	➢ Finalisation of report and sharing of reports with CHQ, SGWCC, DM/DC	Sh. Roopesh G Krishnan, Sc-C