



केन्द्रीय भूमि जल बोर्ड
जल संसाधन, नदी विकास और गंगा संरक्षण
विभाग, जल शक्ति मंत्रालय
भारत सरकार

Central Ground Water Board
Department of Water Resources, River
Development and Ganga Rejuvenation,
Ministry of Jal Shakti
Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

**Rania and Arki Blocks of
Khunti District
Jharkhand**

मध्य पूर्वी क्षेत्र, पटना
Mid Eastern Region, Patna



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Central Ground Water Board

**AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN OF RANIA AND
ARKI BLOCKS OF KHUNTI DISTRICT, JHARKHAND STATE**

जलभृत नकशे तथा भूजल प्रबंधन योजना
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State Unit Office, Ranchi
Mid- Eastern Region, Patna,
September 2022

**REPORT ON AQUIFER MAPPING AND GROUND WATER MANAGEMENT PLAN OF
RANIA AND ARKI BLOCKS, KHUNTI DISTRICT, JHARKHAND, 2021-22**

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**REPORT ON AQUIFER MAPPING AND GROUND WATER MANAGEMENT PLAN OF
RANIA AND ARKI BLOCKS, KHUNTI DISTRICT, JHARKHAND, 2021-22**

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REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN OF RANIA AND ARKI BLOCKS OF KHUNTI DISTRICT, JHARKHAND STATE (2021 – 22)

1.0 INTRODUCTION

The vagaries of rainfall, inherent heterogeneity & unsustainable nature of hard rock aquifers, over exploitation of once copious aquifers, lack of regulation mechanism etc has a detrimental effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from “**Traditional Groundwater Development concept**” to “**Modern Groundwater Management concept**”. Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. This leads to concept of Aquifer Mapping and Ground Water Management Plan. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The proposed management plans will provide the “**Road Map**” for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation.

During XII five year plan (2012-17) National Aquifer Mapping (NAQUIM) study was initiated by CGWB to carry out detailed hydrogeological investigation. The Aquifer Mapping programme has been continued till 2023 to cover whole country. The present study of Rania and Arki blocks of Khunti district has been taken up in AAP 2021-22 as a part of NAQUIM Programme. The aquifer maps and management plans will be shared with the administration of Khunti district and other user agencies for its effective implementation.

1.1 Objective and Scope of the study:

The major objectives of aquifer mapping are

- Delineation of lateral and vertical disposition of aquifers and their characterization
- Quantification of ground water availability and assessment of its quality to formulate aquifer management plans to facilitate sustainable management of ground water resources at appropriate scales through participatory management approach with active involvement of stakeholders.

The groundwater management plan includes Ground Water recharge, conservation, harvesting, development options and other protocols of managing groundwater. These protocols will be the real derivatives of the aquifer mapping exercise and will find a place in the output i.e, the aquifer map and management plan.

The main activities under NAQUIM are as follows:

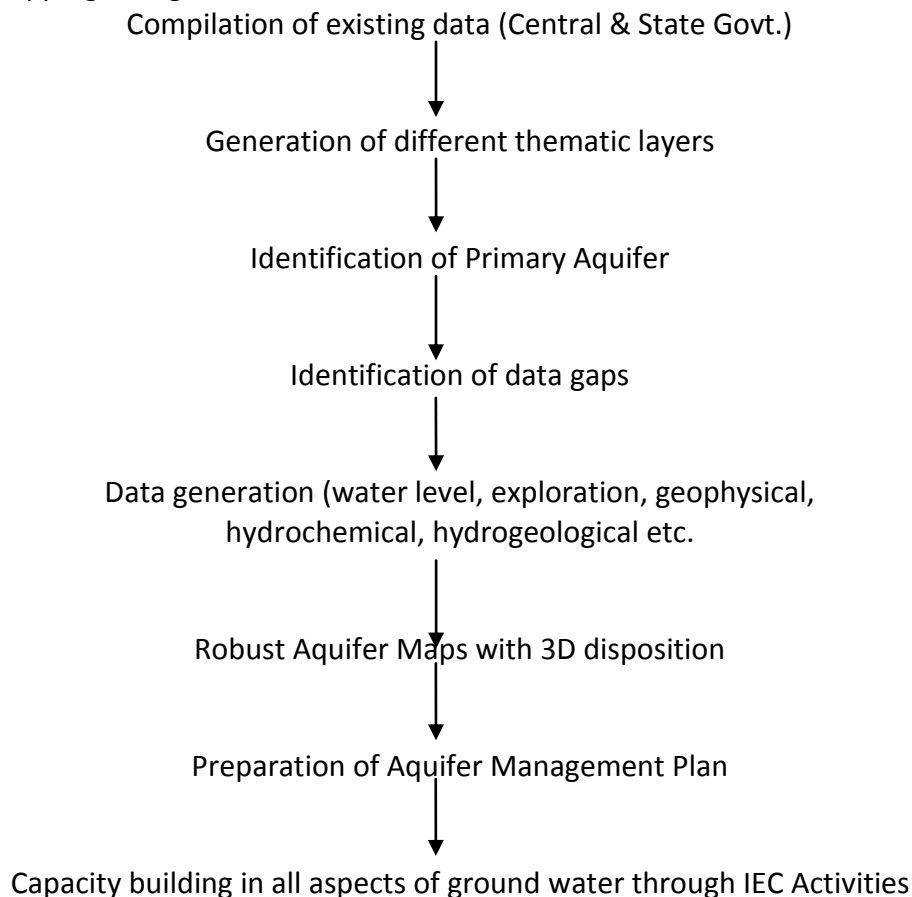
- a). Identifying the aquifer geometry
- b). Aquifer characteristics and their yield potential
- c). Quality of water occurring at various depths
- d). Aquifer wise assessment of ground water resources
- e). Preparation of aquifer maps and
- f). Formulate ground water management plan.

The demarcation of aquifers and their potential will help the agencies involved in water supply in ascertaining, how much volume of water is under their control. The robust and implementable ground water management plan will provide a **“Road Map”** to systematically manage the ground water resources for equitable distribution across the spectrum.

1.2. Approach and methodology:

The ongoing activities of NAQUIM include hydrogeological data acquisition supported by geophysical and hydro-chemical investigations supplemented with ground water exploration down to the depths of 200 meters.

Considering the objectives of the NAQUIM, the data on various components was segregated, collected and brought on GIS platform by geo-referencing the available information for its utilization for preparation of various thematic maps. The approach and methodology followed for Aquifer mapping is as given below:



1.3 Area details: On September 12, 2007, Khunti District was carved out of Ranchi District as the 23rd district of Jharkhand. Earlier it was a Sub-division of Ranchi District. Khunti district spreading over an area of 2611 sq.km with its headquarter at Khunti. The district is divided into 6 blocks namely i) Karra ii) Khunti iii) Arki iv) Torpa v) Murhu and vi) Rania. (Fig-1) The district is bounded in the north by Ranchi, in the south by West Singhbhum and Simdega districts and east by Saraikela-Kharsawan, and part of Ranchi district, in the west by part of Gumla and Simdega districts.

The Rania block is located in southern- west part while the Arki block is located in eastern part of the Khunti district. The total geographical area of the Rania block is 267.43 Sq. km. and Arki block is 515.00 Sq.km. The location map along with post monsoon (Nov. 2021) depth to water level map of the Rania and Arki blocks is shown in figure – 1.

1.4 Data Availability, Data Adequacy and Data Gap Analysis

1.4.1. Data availability: Central Ground Water Board has carried out exploratory drilling in the Rania block and drilled one exploratory and one observation wells while one exploratory wells has been drilled in Arki block through outsourcing drilling activity during the year 2020-2021. At least three exploratory and one observation wells are to be drilled in each block to know the sub – surface geology, depth and thickness of water bearing formation with their yield and determine the different aquifer parameters.

1.4.2 Data Adequacy and Data Gap Analysis: The available data of the Exploratory wells drilled by Central Ground Water Board, State Unit Office, Ranchi, Geophysical Survey carried out in the area, ground water monitoring stations and ground water quality stations monitored by Central Ground Water Board were compiled and analyzed for adequacy of the same for the aquifer mapping studies. The summarized details of required, existing and data gap of exploratory wells, a ground water monitoring and ground water quality station is given below in table-1 & 2.

Table – 1: Data adequacy and data gap analysis of Rania block, Khunti district

Exploration data			Geophysical data			GW monitoring data (HNS)			GW quality data		
Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap
3	1	2	5	0	5	3	0	3	3	3	0

Table – 1: Data adequacy and data gap analysis of Arki block, Khunti district

Exploration data			Geophysical data			GW monitoring data (HNS)			GW quality data		
Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap
3	1	2	5	0	5	3	1	2	3	1	2

The data adequacy as discussed above indicates that the existing data is not sufficient for preparation of aquifer maps; hence data gap has been identified for Exploratory Wells, Geophysical Survey (VES), Ground Water Monitoring Wells and Ground Water Quality. However, based on available existing data block wise aquifer maps and management plan of Rania and Arki blocks of Khunti district is being prepared.

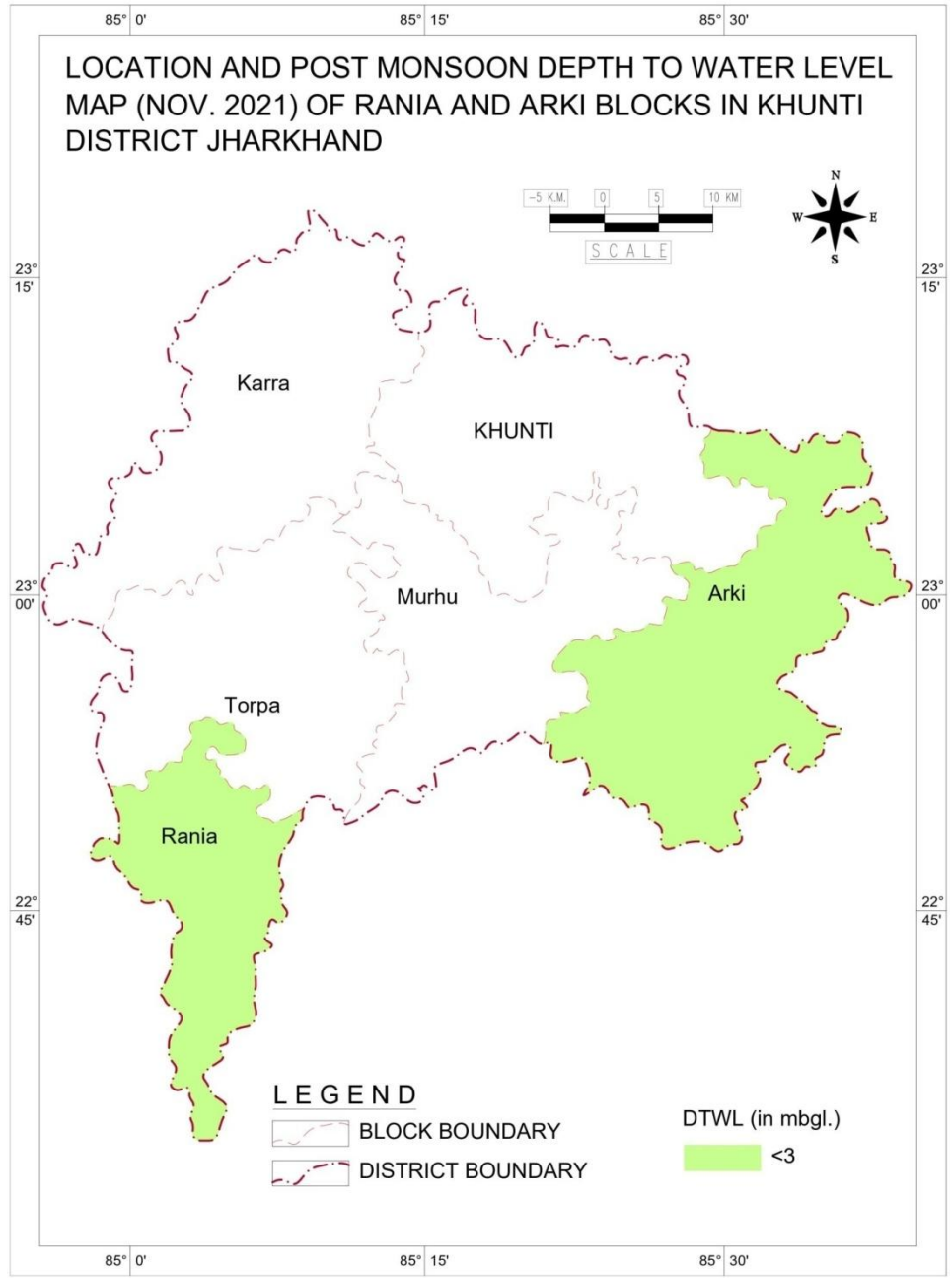


Fig-1

2.0 BLOCK WISE AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS,

2.1 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, RANIA BLOCK, KHUNTI DISTRICT, JHARKHAND

1.SALIENT FEATURES																								
Block Name	Rania																							
Geographical Area (Sq. km.)	267.43																							
Hilly Area (Sq. km.)	64.00																							
Population (2011)	39349																							
1.1 Rainfall Analysis																								
Decadal average annual rainfall (2012 – 2021)	726.32 mm																							
Standard deviation	318.62																							
Coefficient of variation (in %)	43.87																							
Long term rainfall analysis (2010 – 2020)	Normal = 40%, Excess = 30%, Moderate drought = 30%, Declining trend of 62.52 mm/year																							
	<p>Rainfall analysis of Rania block(2010-2020)</p> <table border="1"> <caption>Data points for Rainfall analysis of Rania block (2010-2020)</caption> <thead> <tr> <th>Year</th> <th>Annual rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2010</td><td>580</td></tr> <tr><td>2011</td><td>1480</td></tr> <tr><td>2013</td><td>950</td></tr> <tr><td>2014</td><td>950</td></tr> <tr><td>2015</td><td>680</td></tr> <tr><td>2016</td><td>600</td></tr> <tr><td>2017</td><td>720</td></tr> <tr><td>2018</td><td>450</td></tr> <tr><td>2019</td><td>480</td></tr> <tr><td>2020</td><td>480</td></tr> </tbody> </table> <p>Regression equation: $y = -62.52x + 12672$</p>		Year	Annual rainfall (mm)	2010	580	2011	1480	2013	950	2014	950	2015	680	2016	600	2017	720	2018	450	2019	480	2020	480
Year	Annual rainfall (mm)																							
2010	580																							
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2014	950																							
2015	680																							
2016	600																							
2017	720																							
2018	450																							
2019	480																							
2020	480																							
1.2 Water level behavior																								
Phreatic aquifer	Pre – monsoon May 2021)	Post monsoon (November 2021)																						
	4.60 – 6.00 mbgl.	1.61 – 2.65 mbgl.																						
Seasonal water level fluctuation between pre monsoon and post monsoon (2021)	2.85 – 4.04 m.																							
2.0 AQUIFER DISPOSITION																								
Major formation	Granite gneiss, Quartzite & schist																							
2.1 Numbers of aquifers	Granite gneiss – Aquifer – I, Aquifer - II																							
2.2 Cross section:																								

Only one exploratory well and one observation well located in the block.	
3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31 st March 2020)	
Annual extractable ground water for recharge (MCM)	17.85
Current annual ground water extraction for irrigation (MCM)	5.36
Current annual ground water extraction for domestic (MCM)	0.52
Current annual ground water extraction for industrial (MCM)	0
Current annual ground water extraction for all uses (MCM)	5.88
Net ground water availability for future use (MCM)	11.96
Stage of ground water extraction (%)	32.95
Category	Safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
The EC value of the phreatic aquifer varies from 114 to 248 $\mu\text{S}/\text{cm}$. TDS has been observed between 74.10 to 161 mg/l. Total hardness value ranges from 45 to 85 mg/l. Similarly, the Chloride value observed between 14.20 to 24.85 mg/l while the Sulphate value varies from 3.40 to 5.00 mg/l. Nitrate value ranges from 3.75 to 13.83 mg/l. Fluoride value found between 0.40 to 0.58 mg/l. Overall ground water quality of shallow aquifer (Aquifer – I) is suitable for domestic purpose.	
Semi – confined/ confined Aquifer (Aquifer – II)	
The EC value of the deeper aquifer varies from 68 to 396 $\mu\text{S}/\text{cm}$. TDS has been observed between 44.20 to 257 mg/l. Total hardness value ranges from 15 to 135 mg/l. Similarly, the Chloride value observed between 7.10 to 39.05 mg/l while the Sulphate value varies from 0.30 to 18.00 mg/l. Nitrate values observed between 3.20 to 12.76 mg/l. Fluoride value varies from 0.68 to 0.82 mg/l. In general, ground water quality of deeper aquifer (Aquifer – II) is suitable for domestic purpose.	
3.2.2 Suitability for irrigation	
Phreatic Aquifer (Aquifer - I)	Semi – confined/ confined Aquifer (Aquifer – II)
Sodium percentage of ground water of shallow aquifer (Aquifer –I) varies from 20.59 to 47.81 while RSC value observed between -0.10 to 0.30. SAR value ranges from 0.30 to 1.03 and falling in excellent water class. The ground water of shallow aquifer (Aquifer – I) is suitable for irrigation.	Sodium percentage of ground water of deeper aquifer (Aquifer –II) varies from 31.77 to 50.76 while RSC value observed between 0.00 to -0.50. SAR value ranges from 0.71 to 1.06 and falling in excellent water class. The ground water of deeper aquifer (Aquifer – II) is suitable for irrigation
3.3 Other issues	
3.3.1 Ground water exploration: Only one exploratory well and one observation well located in the block. At least two more exploratory wells may be drilled in the block. Similarly, minimum one hydrograph net work station should be established in the block.	

4.0 SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 32.95%. To enhance the ground water development construction of 664 dug wells (10 -20 m depth; 2 to 4 m diameter) and 221 bore wells (up to 100 m depth) are recommended for creating additional irrigation potential	
4.2 Proposed number of artificial recharge structures	The average post monsoon depth to water level observed less than 3 m (2.00 mbgl). Hence, artificial recharge structures not proposed.
5.0 Demand side management	
<ul style="list-style-type: none"> • Promoting Micro irrigation Technique (drip or sprinkler irrigation, etc.), • Crop choice management and diversification(Promoting less intensive crops) 	

2.2 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, ARKI BLOCK, KHUNTI DISTRICT, JHARKHAND

1.SALIENT FEATURES																								
Block Name	Arki																							
Geographical Area (Sq. km.)	515.00																							
Hilly Area (Sq. km.)	215.01																							
Population (2011)	80589																							
1.1 Rainfall Analysis																								
Decadal average annual rainfall (2012 – 2021)	910.90 mm																							
Standard deviation	415.33																							
Coefficient of variation (in %)	45.60																							
Long term rainfall analysis (2010 – 2020)	Normal = 30%, Excess = 30%, Moderate drought = 30%, Severe drought = 10%, Declining trend of 58.17 mm/year																							
<p>Rain fall analyas of Arki block (2010-2020)</p> <table border="1"> <caption>Data for Rain fall analyas of Arki block (2010-2020)</caption> <thead> <tr> <th>Year</th> <th>Annual rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2010</td><td>750</td></tr> <tr><td>2011</td><td>1500</td></tr> <tr><td>2013</td><td>1550</td></tr> <tr><td>2014</td><td>1300</td></tr> <tr><td>2015</td><td>550</td></tr> <tr><td>2016</td><td>600</td></tr> <tr><td>2017</td><td>600</td></tr> <tr><td>2018</td><td>350</td></tr> <tr><td>2019</td><td>700</td></tr> <tr><td>2020</td><td>1050</td></tr> </tbody> </table>			Year	Annual rainfall (mm)	2010	750	2011	1500	2013	1550	2014	1300	2015	550	2016	600	2017	600	2018	350	2019	700	2020	1050
Year	Annual rainfall (mm)																							
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2016	600																							
2017	600																							
2018	350																							
2019	700																							
2020	1050																							
1.2 Water level behavior																								
Phreatic aquifer	Pre – monsoon (May 2021)	Post monsoon (November 2021)																						
	3.00 mbgl.	0.93 mbgl.																						
1.3 Hydrograph& water level trend analysis:																								
<p>Hydrograph Site Name : Seringathu State : Jharkhand District : RANCHI Tahsil : SONAHATU Block : SONAHATU Village : Seringathu</p> <table border="1"> <caption>Legend for Hydrograph</caption> <thead> <tr> <th>Line Style/Color</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Solid Red</td> <td>PreMonsoonWtrLvl</td> </tr> <tr> <td>Solid Blue</td> <td>PostMonsoonWtrLvl</td> </tr> <tr> <td>Dashed Red</td> <td>PreMonWtrLvlTrend</td> </tr> <tr> <td>Dashed Blue</td> <td>PostMonWtrLvlTrend</td> </tr> </tbody> </table> <p>PreMonsoon Water Level Trend: $Y = 0.017020X + 6.250022$ Post Monsoon Water Level Trend: $Y = 0.004827X + 1.703025$</p>			Line Style/Color	Description	Solid Red	PreMonsoonWtrLvl	Solid Blue	PostMonsoonWtrLvl	Dashed Red	PreMonWtrLvlTrend	Dashed Blue	PostMonWtrLvlTrend												
Line Style/Color	Description																							
Solid Red	PreMonsoonWtrLvl																							
Solid Blue	PostMonsoonWtrLvl																							
Dashed Red	PreMonWtrLvlTrend																							
Dashed Blue	PostMonWtrLvlTrend																							

Hydrographs located at Serenghatu showing Pre- monsoon rising water level trend @ 0.017020 m/year.	Hydrographs located at Serenghatu showing post- monsoon rising water level trend @ 0.004827 m/year.
2.0 AQUIFER DISPOSITION	
Major formation	Quartzite & schist, Granite gneiss, and older alluvium
2.1 Numbers of aquifers	Granite gneiss – Aquifer – I, Aquifer - II
2.2 Cross section: Only one exploratory well is located in the block.	
3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31 st March 2020)	
Annual extractable ground water for recharge (MCM)	22.01
Current annual ground water extraction for irrigation (MCM)	2.73
Current annual ground water extraction for domestic (MCM)	1.06
Current annual ground water extraction for industrial (MCM)	0
Current annual ground water extraction for all uses (MCM)	3.79
Net ground water availability for future use (MCM)	18.22
Stage of ground water extraction (%)	17.21
Category	Safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
The EC value of the phreatic aquifer found from 289 $\mu\text{S}/\text{cm}$. TDS has been observed 187.85 mg/l. Total hardness value found 125 mg/l. Similarly, the Chloride value observed 28.40 mg/l while the Sulphate value found 11.00 mg/l. Nitrate value observed 31.00 mg/l. Fluoride value found 0.03 mg/l. Overall ground water quality of shallow aquifer (Aquifer – I) is suitable for domestic purpose.	
3.2.2 Suitability for irrigation	
Phreatic Aquifer (Aquifer - I)	
Sodium percentage of ground water of shallow aquifer (Aquifer –I) found 11.00% while RSC value observed – 1.30. SAR value found 0.27 and falling in excellent water class. The ground water of shallow aquifer (Aquifer – I) is suitable for irrigation.	
3.3 Other issues	
3.3.1 Low ground water development: Low ground water development is the one major issue of the block. Based on Ground water resource assessment as on 2020 stage of ground water development is only 17.21%. Ground water exploration: Only one exploratory well is located in the block. At least three more exploratory wells may be drilled in the block.	
4. SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 17.21%. To enhance the ground water development, construction of 1012 dug wells (10 -20 m depth; 2 to 4 m diameter) and 337 bore wells (up to 100 m	

depth) are recommended for creating additional irrigation potential	
4.1 Proposed number of artificial recharge structures	The post monsoon water level monitored only 0.93 mbgl. Hence, artificial recharge structures not proposed.
5.2 Demand side management	
<ul style="list-style-type: none"> • Promoting Micro irrigation Technique (drip or sprinkler irrigation, etc.), • Crop choice management and diversification(Promoting less intensive crops) 	

Annexure - I**LAST TEN YEARS (2010 TO 2020) ANNUAL RAINFALL DATA OF RANIA BLOCK, KHUNTI DISTRICT**

Block: Rania (2010 – 2020)

Average annual rainfall (mm): 726.32

Standard deviation: 318.62

Coefficient of variation (in %):43.87

Year	Annual rainfall (mm)	Departure %	Category
2010	567.9	21.81	Normal
2011	1463.7	101.52	Excess
2013	943.5	29.90	Excess
2014	951.2	30.96	Excess
2015	681.1	- 6.22	Normal
2016	588.4	- 18.99	Normal
2017	711.2	- 2.08	Normal
2018	440.7	- 39.32	Moderate
2019	457.3	- 37.04	Moderate
2020	458.2	- 36.91	Moderate

Block: Arki (2010 – 2020)

Average annual rainfall (mm):910.90

Standard deviation: 415.33

Coefficient of variation (in %): 45.60

Year	Annual rainfall (mm)	Departure %	Category
2010	759.6	- 16.61	Normal
2011	1517.7	66.62	Excess
2013	1548.1	69.95	Excess
2014	1283.8	40.94	Excess
2015	587.0	- 35.56	Moderate
2016	635.3	- 30.25	Moderate
2017	643.1	- 29.40	Moderate
2018	358.4	- 60.65	Severe
2019	718.5	- 21.12	Normal
2020	1057.5	0.13	Normal

Annexure - II

DETAILS OF KEY WELLS ESTABLISHED FOR NATIONAL AQUIFER MAPPING STUDY OF RANIA & ARKI BLOCKS, KHUNTI DISTRICT, 2021 –22

Well No.	Village	Block	Owner	Location	Co-ordinates	Type of well	Lifting device	MP (magl)	Depth (mbgl)	Diameter (m.)	DTWL (mbgl)	
											Pre monsoon (May 2021)	Post monsoon (Nov. 2021)
1	Sode	Rania	Silbia Madam	NHO owner, RHS of Rania – Sode road.	22.68741 85.05001	Dug well	Rope & bucket	0.40	5.60	2.00	4.60	1.76
2	Rania	Rania	Jaywanti Champi	NHO owner, RHS of Marcha - Rania road & before Rania chowk	22.77218 85.10979	Dug well	Rope & bucket	0.44	7.30	3.60	5.65	1.61
3	Tangarkela (Lota Toli)	Rania	--	LHS of Marcha – Rania road.	22.81616 85.05491	Dug well	Rope & bucket	0.00	8.10	2.30	6.00	2.65
4	Serenghatu	Arki	Govt.	RHS of Kuhnti – Tamar road near trijunction	23.013888 85.529166	Dug well	Rope & bucket	0.50	7.46	3.25	3.00	0.93

Annexure - III

DETAILS OF WELLS CONSTRUCTED IN HARD FORMATION OF RANIA AND ARKI BLOCKS, KHUNTI DISTRICT, JHARKHAND

Sl. No.	Location with coordinates	Block	District	Depth drilled (m)	Depth of Well (m)	Thickness of weathering (m)	Length of casing lowered with dia. (m)	Fractures Encountered (mbgl)		Aquifer	SWL (mbgl)	Dis-charge (m ³ /hr)	D.D. (m)	T (m ² /d)	S (Storativity)
								From	To						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Rania EW 22° 46' 28" 85° 06' 34"	Rania	Khunti	184.00	184.00	23.50	23.90 (7" dia.)	29.00 38.00 48.50	16.00 39.00 49.50	Fractured Granite gneiss	9.05	16.20	19.35	65.17	1.39x10 ⁻⁴
2	Rania OW	Rania	Khunti	192.00	192.00	21.00	21.60 (7" dia.)	27.00 108.00 189.00	28.00 109.00 190.00	Fractured Granite gneiss	--	38.74	--	--	--
3	Hunt	Arki	Khunti	201.00	201.00	8.00	8.35 (7" dia.)			Slightly Fractured Granite gneiss	--	0.47	--	--	--

Annexure - IV

WATER QUALITY DATA OF AQUIFER - I (DUG WELL SAMPLES) OF AQUIFER MAPPING STUDY OF RANIA AND ARKI BLOCKS OF KHUNTI DISTRICT (2021-22)

Sr. No.	Village	Block	Latitude & Longitude	pH	EC (µS/cm)	TDS	TH	Ca	Mg	Na	K	HCO ₃	Cl	SO ₄	NO ₃	F
						← Mg / l →										
1	Sode	Rania	22.68741 85.05001	8.09	232	151	60	16	4.86	18.17	12	91.5	14.2	5	13.83	0.4
2	Rania	Rania	22.77218 85.10979	8.06	114	74.10	45	12	3.65	4.63	1.24	30.5	17.75	1.2	3.75	0.48
3	Tangarkela (Lota Toli)	Rania	22.81616 85.05491	8.15	248	161	85	24	6.08	15.7	1.77	97.6	24.85	3.4	7.48	0.58
4	Serenghatu	Arki	23.013888 85.529166	7.90	289	187.85	125	38	7.29	7	0.37	73.2	28.40	11	31	0.03

Annexure - V

WATER QUALITY DATA OF AQUIFER - II (HAND PUMP SAMPLES) OF AQUIFER MAPPING STUDY OF RANIA AND ARKI BLOCKS OF KHUNTI DISTRICT (2021-22)

Sr. No.	Village	Block	Latitude & Longitude	pH	EC (µS/cm)	TDS	TH	Ca	Mg	Na	K	HCO ₃	Cl	SO ₄	NO ₃	F
						← Mg / l →										
1	Sode	Rania	22.68741 85.05001	8.2	140	91	45	12	3.65	10.87	0.1	48.8	14.2	1.3	6.61	0.82
2	Rania	Rania	22.77218 85.10979	8.15	68	44.2	15	2	2.43	6.46	1.09	18.3	7.1	0.3	3.2	0.68
3	Tangarkela (Lota Toli)	Rania	22.81616 85.05491	7.91	396	257	135	38	9.72	28.26	1.02	134.2	39.05	18	12.76	0.68