DISTRICT GROUND WATER INFORMATION BOOKLET

RATLAM DISTRICT

MADHYA PRADESH

Ministry of Water Resources

Central Ground Water Board

North Central Region

Government of India

BHOPAL

2013

RATLAM DISTRICT AT A GLANCE

S.No.	Items	Statistics	
1.	**General Information**		
	i) Geographical area	486100 Ha	
	ii) Administrative Divisions (As on 2013) Number of Tehsil/Blocks Number of Villages	 6/6 1086	
	iii) Population (Census 2011)	1,454,483	
	iv) Normal Rainfall	992.90 mm	
2.	**Geomorphology**		
	1. Major Physiographic Units:	i. Malwa plateau in east ii. Plateau of Sailana iii. Western hills of Sailana iv. Chambal valley v. Mahi valley	
	2. Major Drainage:	I. Ganga Basin (Chambal Sub Basin) II. Mahi Basin	
3.	**Land Use**	Ha ('000)	
	a) Forest area b) Net area sown c) Gross cropped area	34.30 333 500	
4.	**Major Soil Types**	Sandy and black cotton soil.	
5.	**Principal Crops**	Soyabean, wheat, maize, cotton, opium, gram.	
6.	**Irrigation by Different Sources**	No.	Area irrigated Ha('000)
	Dug wells Tube wells/Bore wells Tanks/Ponds Canals Other Sources	52213 18801 144 41 -	32.67 51.98 1.48 1.39 4.79
7.	**Number 0f Ground Water Monitoring Wells of CGWB (As on 31.3.2013)**		
	Number of Dug Wells Number of Piezometers	24 28	
8	**Predominant Geological Formations**	Alluvium, Deccan Trap basalts, Vindhyan shales and sandstone	
9	**Hydrogeology**		

	Major Water Bearing Formation	Sandy alluvium, Weathered/vesicular basalt, flow contacts and fractured sandstone.
	Pre-monsoon depth to water level range during 2012	2.70 to 23.40 m bgl
	Post-monsoon depth to water level range during 2012	1.48 to 14.28 m bgl
	Long-term water level trend in 10 years (2003-2012)	Pre monsoon Rise: 6.20 – 10.74 cm/yr Fall : 3.64 – 30.90 cm/yr Post monsoon Rise: 11.82 cm/yr Fall : 2.00 – 36.44 cm/yr
10.	**Ground Water Exploration By CGWB (As on 31.3.2013**)	
	No of wells drilled (EW, OW, PZ, Total)	EW-23, OW-17, PZ-37
	Depth Range	32.64 to 203.45 m. bgl
	Discharge	Meager to 20.0 lps
	Specific Capacity	-
	Transmissivity	-
11.	**Ground Water Quality**	
	Presence of Chemical constituents	EC 530 – 3688 µs/cm at 25^0C NO_3 15 – 474 mg/l F 0.4 – 1.27 mg/l
12	**Dynamic Ground Water Resources (2009)**	Ham
	Net Ground Water Availability	66638
	Existing Gross Ground Water Draft	83748
	Projected Demand for Domestic and Industrial uses up to next 25 years	2682
	Stage of Ground Water Development	126 %
13	**Awareness and Training Activity**	
	Mass Awareness Programme Organised Number of Participant	Two MAP Dated: 05.02.2002 and Dated: 30.11.2004 75 and 112
15	**Ground Water Control and Regulation**	
	Number of Over-Exploited Blocks	4
	Number of Semi Critical Blocks	1
	Number of Safe Blocks	1
	Number of Notified Blocks	1 (Jaora)
16	**Major Groundwater Problems and Issues**	Nitrate and chloride pollution at industrial areas in Ratlam City

1.0 INTRODUCTION

Ratlam district is located on northwest part of Madhya Pradesh. It is one of the important tribal district of Malwa regions of Madhya Pradesh. Sailana and Bajna blocks are major tribal blocks. The district is bounded by Mandsaur district in the north, Jhabua and Dhar district in the south, Ujjain and Shajapur districts in the east, Banswara district of Rajasthan state in the west and Jhalawar district of Rajasthan state in the northeast. The district area extends between the parallels of latitude 23^0 05' and 23^0 52' North and between the meridians of longitude 74^0 31' and 74^0 41' East, and it is falling in the Survey of India Topo Sheet No. 46I and 46M.

The total geographical area of the district is 4,861 Sq.Km, with a population of 14,54,483 according to census 2011. The details of administrative units are given in table.

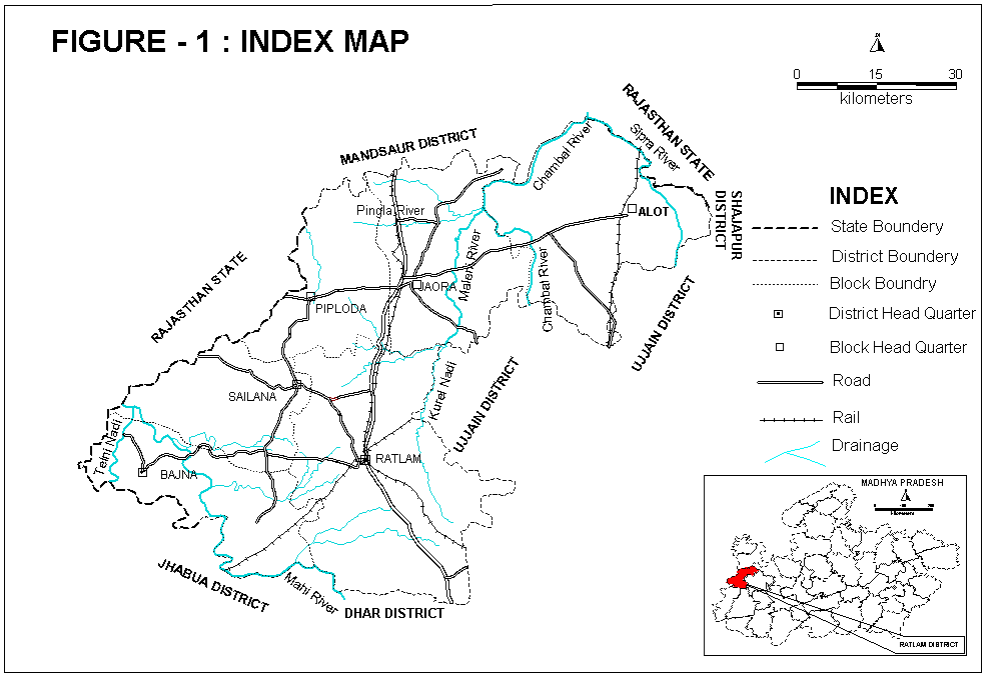


Table: Administrative units of Ratlam district, Madhya Pradesh

S.No	Tehsil	Block	Area in Sq Km	No. of Villages	No. of Villages Panchayats
1	Alot	Alot	945	191	90
2	Jaora	Jaora	763	145	68
3	Piploda	Piploda	604	90	52
4	Ratlam	Ratlam	1331	169	97
5	Sailana	Sailana	536	238	47
6	Bajna	Bajna	682	220	65
District			**4,861**	**1086**	**419**

Drainage

Ratlam district falls under Ganga and Mahi river basins. The tributaries of Chambal River drain about 70 % geographical area of the district. Southwest part of the district is drained by the Mahi River and it tributaries. The type of drainage in general is dendritic developed on Deccan Trap basaltic rocks. The Chambal River flows in the northeast part of the district. The important tributaries of Chambal River in the district are Kshipra, Maleni and Pingla rivers. The Mahi River flows in the southwest part of the district. The Mahi River is a consequent river, which originate from Dhar district. The main tributaries of the Mahi River are Bageri, Jammer, Karan, Pundia, Bunad Pampavati and Telni.

Central Ground Water Board (CGWB) activities

- S/Shri P. K. Sahajpal Jr. Hydrogeologist, Gautam Sen Asst. Hydrogeologist and A .K. Murdia Asst. Hydrogeologist conducted systematic hydrogeological surveys in Ratlam district during 1986-91.

- S/Shri Saurabh Gupta Jr. Hydrogeologist and S. N. Bangar Asst. Hydrogeologist conducted Reappraisal Hydrogeological surveys in Ratlam district during 1996-97.

- Shri M. L. Parmar Jr. Hydrogeologist conducted exploratory drilling in the Ratlam district during the year 2003-2005. During the exploration period 24 exploratory well, 15 observation well and 3 piezometers were constructed.

- Under the World Bank assisted Hydrology Project 7 shallow piezometer and 11 deep piezometers had been constructed.

2.0 RAINFALL AND CLIMATE

A hot summer and general dryness characterize the climate of Ratlam district, except during the southwest monsoon season. The year can be divided in to four seasons. The winter commences from middle of November and lasts till the end of February. The period from March to about middle of June is the hot summer season. May is the hottest month of the year. The southwest monsoon starts from middle of June and lasts till end of September. October and middle of November constitute the post monsoon or retreating monsoon season. Nearest observatory is located at Ratlam, hence metrological parameters of Ratlam are used for analysis.

The temperature starts rising from the beginning of February and reaching maximum in the month of May. The normal annual mean maximum temperature is 32.2^0C and normal annual mean minimum temperature is 18.8^0C.The individual day maximum temperature in May goes up to 39.7^0C. The wind velocity is high during the pre monsoon period as compared to post monsoon period. The wind velocity is highest in June around 14.1 km/hr and lowest is 6.0 km/hr in October. The average normal annual wind velocity of Ratlam district is 9.0 km/hr.

The normal annual rainfall of Ratlam district is 992.90mm. Ratlam district receive maximum rainfall during southwest monsoon period i.e. June to November. About 92.8% of annual rainfall is received during monsoon season.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

The whole Ratlam district lies on Malwa plateau. The general scene is of undulating country sloping towards north and marked by series of high hills and valleys. There are isolated hills and attain prominence in the southeast of the district and near the western margins of the plateau. In the west hills are dissected and slopes into the narrow valleys of seasonal steams of Mahi. Geomorphology of Ratlam district can be divided into five divisions.

1. The Malwa plateau in the east
2. The plateau of Sailana
3. The western hills of Sailana
4. The Chambal valley
5. The Mahi valley

In general, Ratlam district is characterized by hilly to undulating terrain with altitude ranging between 434 m and 549 m above mean sea level. The highest elevation in the district is 639.7 m above mean sea level near Sakraoda in Sailana block and lowest elevation of the district is 305 m above mean sea level at village Chandragarh in Sailana block.

3.2 Soils

Two types of rocks, sedimentary and basaltic rocks, mainly cover the district. The nature and characterizations of the soil is dependent on type of lithology in the area. Hence the soil of the district has been classified into two groups.

1.0 Soils of sedimentary rocks
2.0 Solis of basaltic rocks

Soils of sedimentary rocks are found in western parts of the district mainly in Sailana tehsil where the land is occupied by numerous hills of Vindhyans rocks and the soil are sandy in nature and having reddish and brown colour. Soils of basalt are occurring in major parts of the district covering Ratlam, Jaora, Alot and Piploda blocks. It is generally known as black cotton soil, fertile in nature and suitable for cotton crops.

4.0 GROUNDWATER SCENARIO

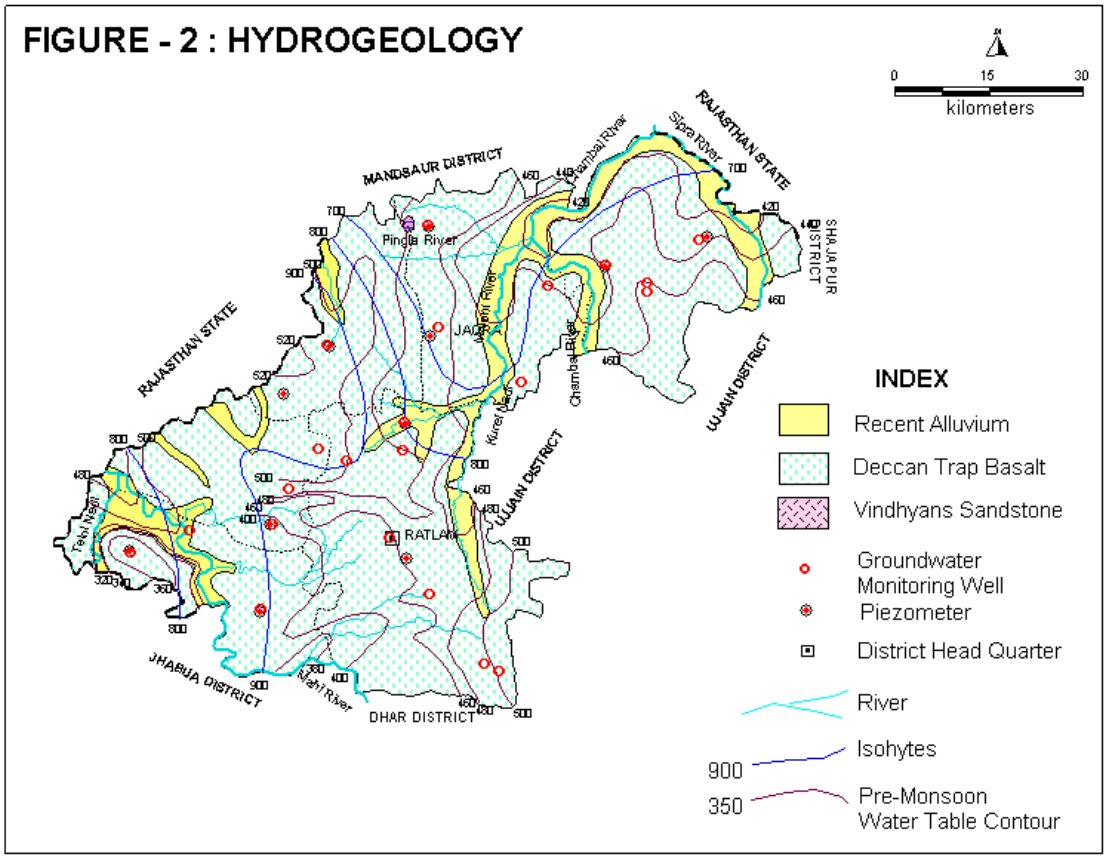
4.1 Hydrogeology

Geologically almost entire Ratlam district is occupied by Deccan Trap basalts except narrow patch of alluvium and sedimentary rocks of Vindhyans super group in isolated patches, which are forming different type of aquifer in the area. Occurrence and movement of groundwater in hard rock is mainly controlled by secondary porosity through joints and fractures. Presences of vesicle in basaltic lava flow of Deccan Traps play an important role in groundwater movement. Groundwater in general occurs under unconfined to semi-confined conditions. The general hydrogeological

conditions of the district are depicted in figure -2 and formation wise settings are discussed below.

4.1.1 Vindhyans

The hillocks of Vindhyans sandstone occur as inlier in northwest and northern block of Piploda, Alot town, Dhodhar and Pingrala village. The sandstone is quartzitic in nature and very hard and compact. At shallow depth the sandstone forms poor aquifer system. Yield of Vindhyans sandstone formation is generally less than 2 litres per second.



4.1.2 Basalts

The basalts underlie a major part of the district and generally groundwater occurs under phreatic conditions in shallow weathered, jointed and fractured horizons. Basalts does not exhibits uniform occurrence of groundwater both vertically and latterly. Physiographic location, thickness of weathered mantle, degree of jointing, fracture or shear zones, characteristics of vesicular horizons and their inter connection are important factor, which play a deciding role in the yield capacity of open wells tapping shallow aquifers. The deeper aquifer system appear to be under unconfined to semi-confined conditions while visualizing lava flow sequence which shows alternate units of vesicular and massive horizons. The hydrogeological regime in different tires, deeper aquifer is more likely to be governed by the secondary porosity jointed/fractured form of massive units is creating possibilities of their acting as leaky confining bed consequently resulting into semi-confined condition for water

bearing vesicular units occurring below it. Yield of basalts in this is reported low to moderates (1 to 5 lps), but at some locations it is 11 lps (Vinoba Nagar), 12 lps (Rajakhedi) and 20 lps at Namli.

4.1.3 Alluvium

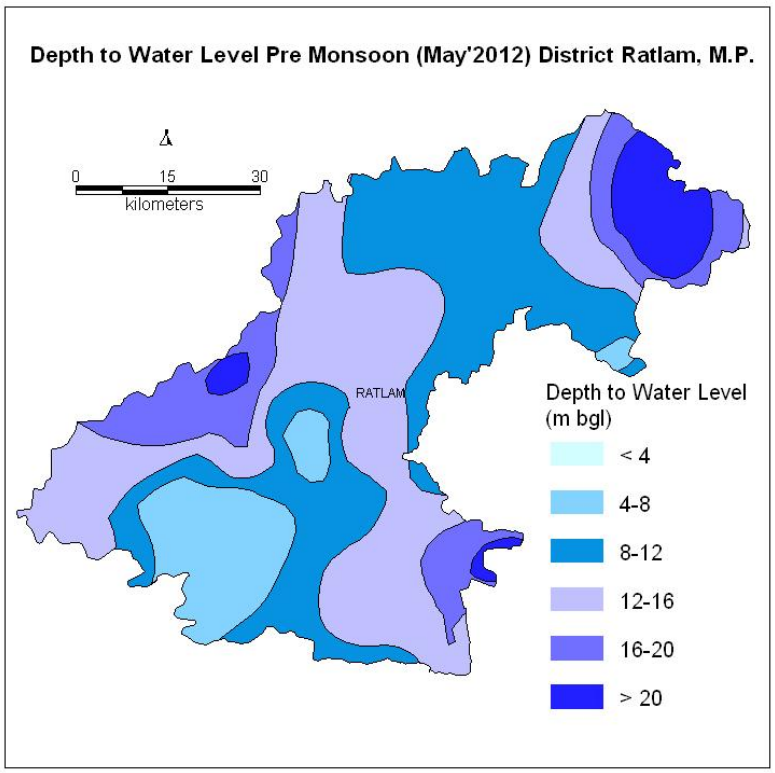
The alluvium deposits are restricted to narrow linear along the river courses of Chambal, Kshipra, Maleni and Mahi. The thickness of alluvium varies from 12 to 15 meters, which is proportionately thinning away from the river line. The thickness of alluvium along the Kurel River reported about 20 meter near Rajhumgarh. The alluvium deposits consist series of consolidated, fine to medium grained sand admix in varying proportion and yield varies from 1 to 8 lps.

4.2 Groundwater Levels

Variation of groundwater levels in an area is an important component of hydrological cycle because it is a physical reflection of aquifer systems. As the change in groundwater level is directly related to groundwater balance and its continuous records provide direct information of subsurface geo-environmental changes due to withdrawal of groundwater. To monitor the seasonal and annual change in quantity and quality of groundwater, CGWB has established 15 Groundwater Monitoring Wells and 21 Piezometers in entire Ratlam district. The monitoring of groundwater levels in these wells is being carried out by CGWB during the month of May, August, November and January. High frequency Groundwater level monitoring is being carried out at Ratlam, Dhodhar and Jaora deep piezometer using Automatic Water Level Recorders. The brief details of groundwater level in Ratlam district for the year 2006 are being discussed below:

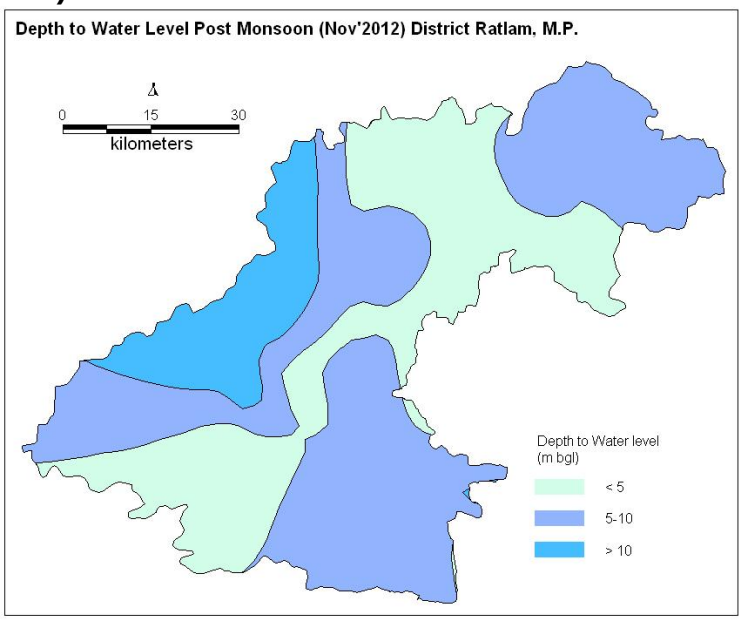
4.2.1 Pre-monsoon (May 2012)

In pre-monsoon period, depth to water level ranges between 2.70 m bgl to 23.40 m bgl. The most part of the district have water level in the range of 8-16.



4.2.2 Post-monsoon (November 2012)

During post-monsoon period, the water level ranges from 1.48 m bgl to 14.28 m bgl. It is observed that in most part of the district the water level lies between 5 to 10.



4.2.3 Groundwater level trend (May2003 to May 2012)

Analyses of Groundwater level data of pre-monsoon period indicate that there is rise as well as decline in water level in the district. In general, rise in water level is in the range of 0.06 to 0.1 m/year whereas decline is in the range of 0.03 to 0.36 m/yr.

4.4 Aquifer Parameters

Central Ground Water Board has drilled 23 exploratory wells, 17 observation wells and 37 piezometers in the Ratlam district. Under the World Bank assisted Hydrology Project 7 shallow and 11 deep piezometers have been drilled for monitoring of groundwater levels in entire district. It is inferred from the exploratory data that the yields of Deccan Trap basalt formation vary from 1 to 20 lps and draw down ranges between 1 to 61 m.

4.5 Groundwater Resources (2009)

Ratlam district is underlain by Basaltic lava flows of Deccan trap. Dynamic ground water resources of the district have been estimated for base year -2008/09 on block-wise basis (Table). There are seven assessment units (block) in the district which fall under non-command (98 %) and command (2.% Bajna block) sub units. Alote, Jaora, Piploda and Ratalam blocks of the district are categorized as over exploited and Sailana as semi critical. The highest stage of ground water development is computed as 171 % in Piploda block. The net ground water availability in the district 66,638 ham and ground water draft for all uses is 83,748 ham, making stage of ground water development 126 % (117 % in 2003/04) as a whole for district. After making allocation for future domestic and industrial supply for next 25 years, balance available ground water for future irrigation would be negative .

Table: Groundwater availability and stage of development

DYNAMIC GROUND WATER RESOURCES (As on March, 2009)										
S. No.	**District/ Assessment Unit**	**Sub-unit Command/ Non-Command/**	**Net Annual Ground water Availability (ham)**	**Existing Gross Ground water Draft for Irrigation (ham)**	**Existing Gross Ground water Draft for Domestic & Industrial water Supply (ham)**	**Existing Gross Ground water Draft for All uses (ham)**	**Provision for domestic, and industrial requirement supply to next 25 year (2033) (ham)**	**Net Ground water Availability for future irrigation d development (ham)**	**Stage of Ground water Development (%)**	**Category**
1	Alote	Command								
		Non-Command	12596	14222	388	14609	388	-2013	116	Over Exploited
		Block Total	**12596**	**14222**	**388**	**14609**	**389**	**-2014**	**116**	Over Exploited
2	Bajna	Command	882	77	39	116	44	760	13	Safe
		Non-Command	3044	1841	333	2174	747	455	71	Safe
		Block Total	**3926**	**1919**	**372**	**2291**	**792**	**1215**	**58**	**Safe**
3	Jaora	Command								
		Non-Command	15506	25533	363	25896	363	-10390	167	Over Exploited
		Block Total	**15506**	**25533**	**363**	**25896**	**363**	**-10390**	**167**	Over Exploited
4	Piploda	Command								
		Non-Command	9796	16482	298	16780	298	-6984	171	Over Exploited
		Block Total	**9796**	**16482**	**298**	**16780**	**298**	**-6984**	**171**	Over Exploited
5	Ratlam	Command								
		Non-Command	19957	20092	596	20688	596	-731	104	Over Exploited
		Block Total	**19957**	**20092**	**596**	**20688**	**596**	**-731**	**104**	Over Exploited
6	Sailana	Command								
		Non-Command	4857	3239	245	3484	245	1373	72	Semi-Critical
		Block Total	**4857**	**3239**	**245**	**3484**	**245**	**1373**	**72**	Semi-Critical
		District Total	**66638**	**81486**	**2262**	**83748**	**2682**	**-17531**	**126**	

4.6 Groundwater Quality

Ground water quality in the district is accessed annually by CGWB on the basis of water samples collected from hydrograph stations in the district. Groundwater in the district is generally fresh to saline as electric conductivity values varies between 530 to 3688 µs/cm at 25° C. Fluoride in the district ranges from 0.4 to 1.27 mg/l and the nitrate concentration ranges from 15 to 474 mg/l.