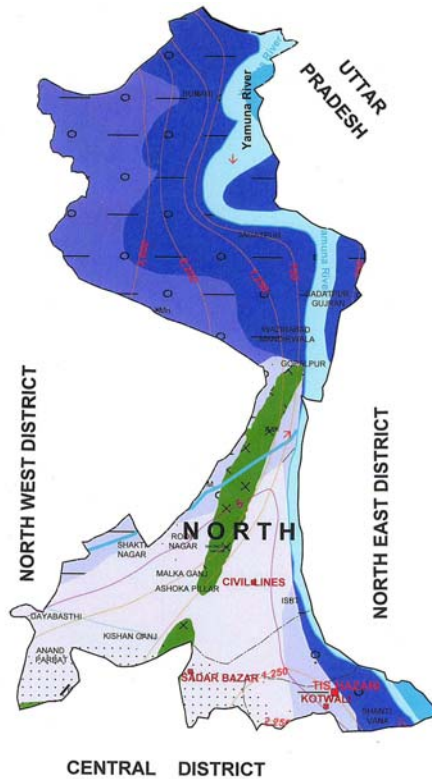




## GROUND WATER INFORMATION BOOKLET OF NORTH DISTRICT, NCT, DELHI



**CENTRAL GROUND WATER BOARD  
MINISTRY OF WATER RESOURCES  
STATE UNIT OFFICE  
NEW DELHI**

**DISTRICT BROCHURE OF  
NORTH DISTRICT, NCT DELHI**

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**DISTRICT BROCHURE**  
**NORTH DISTRICT AT A GLANCE**

S.No.	ITEMS	STATISTICS
<b>1.</b>	<b>GENERAL INFORMATION</b>	
	i. Geographical Area (Sq. Km.)	60
	ii. Administrative Divisions (as on 31.03.2011)	
	a) Number of Tehsils	3
	b) Number of Villages	8
	c) Number of Towns	3
	iii. Population (as on 2011 Census)	
	a) Total Population	8,83,418
	b) Population Density (persons/sq. km)	14,724
	c) No. of households	1,75,890
	iv. Average Annual Rainfall (mm)	887 (Delhi University)
<b>2.</b>	<b>GEOMORPHOLOGY</b>	
	Major Physiographic Units	Yamuna Flood Plain Alluvial Plain Delhi Quartzite
	Major Drainage	Yamuna River
<b>3.</b>	<b>LAND USE (Sq. Km.)</b>	
	a) Forest area	4.81
	b) Water bodies	0.24
<b>4.</b>	<b>MAJOR SOIL TYPES</b>	Sand, silt and clay
<b>5.</b>	<b>NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013)</b>	2
	a) Number of Dugwells	6
	b) Number of Piezometers	
<b>6.</b>	<b>NUMBER OF GROUND WATER EXTRACTION STRUCTURES</b>	
	a) Dugwells	319
	b) Handpumps	11922

	c) Tubewells/borewells	2353
7.	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>	Quaternary Alluvium consisting mainly of fine sand, silt, clay with kankar
8.	<b>HYDROGEOLOGY &amp; AQUIFER GROUP</b> Major water bearing formation Pre-monsoon Depth to water level during May'2012 Post-monsoon Depth to water level during Nov'2012 Long term water level trend in 10 years (2003-2012) in m/yr	Alluvium/Quartzite Sand and Kankar 2.14 to 11.54 mbgl 1.68 to 8.73 mbgl Pre monsoon : Fall (Range 0.06 – 3.69) Post monsoon : Fall (Range 0.04 – 1.50)
9.	<b>GROUND WATER QUALITY</b> Presence of Chemical constituents more than permissible limit (e.g. EC, F, Fe) Type of water Fresh/Saline Interface	EC (600-5200 $\mu$ S/cm at 25°C) Iron :1.09 mg/l, Fluoride -3.2 mg/l Na-Cl, Ca-Cl 22-70 m
10.	<b>DYNAMIC GROUND WATER RESOURCES (2011)- in MCM</b> Annual Replenishable Ground Water Resources Gross Annual Ground Water Draft Stage of Ground Water Development Number of OE Tehsils No. of Safe Tehsils	15.55 9.68 69.18 % 2 1
11.	<b>GROUND WATER CONTROL AND REGULATION</b>	The entire district has been notified by the Government of Delhi
12.	<b>GROUND WATER EXPLORATION BY CGWB (AS ON 31.3.2011)</b> No. of wells drilled (EW, OW, PZ, SH, Total) Depth range (m) drilled/constructed Depth of Bedrock (m) Discharge (liters per minute)	EW-7, PZ-7 24 - 303/ 23 – 88 24-167 300-5252

<b>13.</b>	<b>MAJOR GROUND WATER PROBLEMS AND ISSUES</b>	Ground water in deeper zones is saline. Depletion of ground water levels is attributed to over exploitation of ground water. Higher Fluoride content at Kingsway Camp and higher Iron content at Burari.
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## **NORTH DISTRICT, NCT DELHI**

### **1.0 INTRODUCTION**

#### **1.1 ADMINISTRATIVE DETAILS**

North District is bounded by the Yamuna River and North East District on the east, North West district on the west and Central District on the south. The district covers geographical area of 60 sq. km. The district is divided into three tehsils namely Sadar Bazar, Kotwali and Civil Lines.

The district has a population of 8,83,418 as per the census, 2011 and average population density of 14,724 persons per sq. km.

#### **1.2 BASIN/SUB-BASIN:**

The district falls in Yamuna sub-basin and forms part of the Ganga basin. The entire district forms part of Yamuna River water shed.

#### **1.3 DRAINAGE:**

The river Yamuna, bordering eastern part of the district, controls the entire drainage system. Parts of Western Yamuna Canal, Najafgarh drain and other minor drains flow through North district.

#### **1.4 LAND USE:**

North District has mixed development with unplanned and planned areas. This district has posh residential colonies, pre 1962 residential colonies and rehabilitation colonies. This district has prestigious Delhi University, Northern Ridge, ISBT and Tis Hazari Courts. The forest cover of the district is 4.81 sq.km. Approximately, 0.24 sq.km area of the district is under water bodies.

#### **1.5 STUDIES /ACTIVITES OF CGWB:**

Central Ground Water Board had covered the entire district under Systematic Hydrogeological Surveys. The district which was formed in 1997, was part of the erstwhile Alipur & City Blocks. Based on the Reappraisal Hydrogeological survey carried out in 1983-84, CGWB, NWR had brought out a consolidated report on Hydrogeological conditions and Ground Water Development Potential of Union Territory of Delhi in 1989. In 1996 and 2009, reports highlighting development and augmentation of Ground Water Resources of the State were published by CGWB. The Dynamic Ground Resources of the district have been estimated in 2011 for understanding of ground water scenario. CGWB, SUO Delhi is also monitoring water level and quality regularly from the existing National Hydrograph Network Stations. The district was covered under Ground Water Exploration by Central Ground Water Board in 1973. A total of 7 exploratory wells, 7 piezometers/ observation wells and 1 slim hole have been drilled in the district. Salient features of ground water exploration in the district are furnished in Table 1.

Table 1: Salient features of ground water exploration

Type of well	No.	Depth drilled (m)	Depth constructed (m)	SWL (m)	Discharge (lpm)	Drawdown (m)	Sp. Capacity (lpm/m)	T (m <sup>2</sup> /day)	S	EC (μS/cm at 25°C)
EW	7	31-303	24-38	1.6-4	300-5252	4.99-20	15-1052	1810	5*10 <sup>-2</sup>	966-18130
PZ/OW	7	24-100	23-88	3.14-3.5	350-700	2.69	260	-	-	16680
SH	1	198								10872

## 2.0 RAINFALL & CLIMATE

### 2.1 RAINFALL:

The average annual rainfall of the district is 887 mm (Delhi University). About 81% of the annual rainfall is received during the monsoon months of July, August and September. The rest of the rainfall is received as thunderstorm rain and as winter rain in the pre and post monsoon months. The variation of rainfall from year to year is large. On an average, rain of 2.5 mm or more falls on 27 days in a year, of which, 19 days are during the monsoon months. Two to three days in June are rainy. In other months, except in November and in first half of December when it is practically rainless, rain falls on a day or two only in each month.

### 2.2 CLIMATE:

The climate of district is mainly influenced by its inland position and prevalence of air of the continental type during major part of the year. Extreme dryness with intensely hot summer and cold winter are characteristics of the climate. The cold season starts towards the latter half of November when both day and night temperatures drop rapidly with the advance of the season. January is the coldest month with the mean daily maximum temperature at 21.3°C and the mean daily minimum temperature at 7.3°C. May and June are the hottest months. In May and June, maximum temperature may sometimes reach 46 or 47°C.

## 3.0 GEOMORPHOLOGY & SOIL TYPES

### 3.1 GEOMORPHOLOGY:

Around 40% of the North district is under Yamuna Flood Plain, which is further divided into Active flood plain and Older flood plain. The southern part of the district has a thin alluvium cover over Quartzite rock, which is extension of Delhi Ridge near Wazirabad Barrage.

### 3.2 SOIL TYPES:

Major soil types of the district are sand, silt and clay.

## **4.0 GROUND WATER SCENARIO**

### **4.1 GEOLOGY:**

The area is characterized by unconsolidated sediments of Quaternary age. The area comprises of un-oxidized sands, silt and clay occurring in the Yamuna Flood Plain. Small patch of Quartzite belonging to Delhi Super Group, which protrudes in the central part of the district, is also present.

### **4.2 HYDROGEOLOGY:**

#### **Water Bearing Formation:**

Hydrogeological map of the district is presented in Plate-1. The area comprises of un-oxidized sands, silt and clay occurring in the Yamuna Flood Plain. The alluvial cover is dominant with clayey-silt followed by buff coloured semi plastic clay and on the margin of bedrock, angular gravels with fine to coarse sand occur. The bedrock encountered has suffered moderate to high weathering in this area. The borehole logs of the Yamuna Flood Plain are characterized by the granular zones consisting of fine to medium Yamuna sand. The percentages of Silt and Clay in flood plains are on the lower side as compared to that of sand. Depth to bed rock varies from 24-167 m below ground level.

#### **Depth to water level:**

Depth to water level is in general, shallow in the district. The depth to water level in this district ranges from 2.14 to 11.54 m bgl in the pre monsoon period and 1.68 to 8.73 mbgl during the post monsoon period (Plates 2 & 3).

#### **Seasonal Water level fluctuation:**

Seasonal water level fluctuation has been computed from the water level data obtained from the ground water observation wells monitored in the area during pre-monsoon and post-monsoon periods. Fluctuation in water level is the outcome of mainly the amount of rainfall received by the area and ground water withdrawal from the ground water reservoir. The seasonal fluctuation in water level between pre and post monsoon shows rise in water level ranging from 0.05 to 2.81 m and fall ranging from 0.01 to 0.05 m.

#### **Long Term Water level trend:**

The long-term water level trend analysis in the district over the last 10 years period shows

- i) a fall of 0.06 to 3.69 m during the pre-monsoon period and
- ii) a fall of 0.04 to 1.50 m during the post-monsoon period.

## **4.2 GROUND WATER RESOURCES:**

Tehsil wise ground water resource estimation using GEC, 1997 methodology by CGWB as on 31.03.2011 is given in Table 2. Total annually replenishable ground water resources of the district have been assessed as 1555.4 ham, out of which net annual ground water availability has been assessed as 1399.86 ham. Total annual ground water draft for all uses has been estimated to be 968.5 ham, with overall stage of ground water development at 69.18%. Out of 3 tehsils, 1 tehsil is falling under safe category whereas 2 fall under over exploited category.



Table 2: Tehsil wise ground water resources of North district (as on 2011)

Sl. No.	Tehsils	Annual ground water recharge (ham)	Net ground water availability (ham)	Existing annual gross ground water draft for irrigation (ham)	Existing annual gross ground water draft for domestic and industrial uses (ham)	Existing annual gross ground water draft for all uses (ham)	Stage of ground water development (in %)	Category of Tehsils
1.	Civil Lines	1358.94	1223.046	85.55	678.55	764.10	62.48	Safe
2.	Kotwali	142.53	128.277	52.84	98.13	150.97	117.69	Over-exploited
3.	Sadar Bazar	53.93	48.537	0	53.43	53.43	110.08	Over-exploited
	Total	1555.4	1399.86	138.39	830.11	968.5	69.18	Safe

#### 4.3 GROUND WATER QUALITY:

Generally, ground water is potable at all depths. Pockets of brackish water in northern part of the district are observed. The general ranges of various important chemical constituents in the ground water samples collected from the district are given in Table 3 :

Table 3: General ranges of various chemical constituents in ground water

Chemical Constituents	Range
pH	8.13-8.87
EC ( $\mu\text{S}/\text{cm}$ at 25°C)	600-5200
Bicarbonate (mg/l)	30.87-304.45
Chloride (mg/l)	26.95-1150.06
Nitrate (mg/l)	12.3-367
Sulphate (mg/l)	46-496
Fluoride (mg/l)	0.18-3.2
Calcium (mg/l)	45.06-115.5
Magnesium (mg/l)	26.37-227.86

Total Hardness as CaCO <sub>3</sub> (mg/l)	229.99-1238.93
Sodium (mg/l)	47.97-998.7
Potassium (mg/l)	21.8-135.55
Iron (mg/l)	1.09

Electrical Conductivity in the district has been found to vary from 600 to 5200  $\mu\text{S}/\text{cm}$  at 25°C. There is a wide variation of Electrical Conductivity in the district. EC in excess of 3000  $\mu\text{S}/\text{cm}$  at 25°C has been observed in the southern part of the district (Plate 4). Excess Fluoride concentration in ground water upto 3.2 mg/l has been reported in some parts of the district. Nitrate concentration in excess of maximum permissible limit of 45 mg/l has been reported in southern part of district (Plate 5).

#### **4.4 STATUS OF GROUND WATER DEVELOPMENT**

At present level of ground water development is maximum (117.69%) in Kotwali and is minimum (62.48%) in Civil Lines as indicated in table 2 above. The district as a whole is categorized as Safe with ground water development at 69.18%.

#### **5.0 GROUND WATER MANAGEMENT STRATEGY**

##### **5.1 GROUND WATER DEVELOPMENT:**

As stated above, the district as a whole is categorized as Safe with stage of ground water development at 69.18%. Though the development of ground water is not much in the district, but in view of the depleting water levels, sustainable management of this precious natural resource is extremely important.

##### **5.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE:**

In view of depleting ground water levels, it is essential that artificial recharge measures may be implemented. Recharge structures suitable in the area are shaft/trench with recharge well and recharge pit with/without bore.

#### **6.0 GROUND WATER RELATED ISSUES AND PROBLEMS**

##### **6.1 WATER LOGGING:**

The slope of the district is towards south by 0.40 m/km but at places adjoining Delhi Ridge, it gets elevated. Due to this, just northern adjoining areas along the Delhi Ridge form depressions and have been converted into water logged area.

##### **6.2 DEPLETING GROUND WATER LEVEL & QUALITY:**

Analysis of seasonal and long term water level records indicates a very gradual declining of water levels during pre and post monsoon period.

Depth of line of fresh-saline water interface also varies greatly in the entire area. It varies in the range of 22 to 70 m. Higher Fluoride content is observed at Kingsway Camp and higher Iron content at Burari.

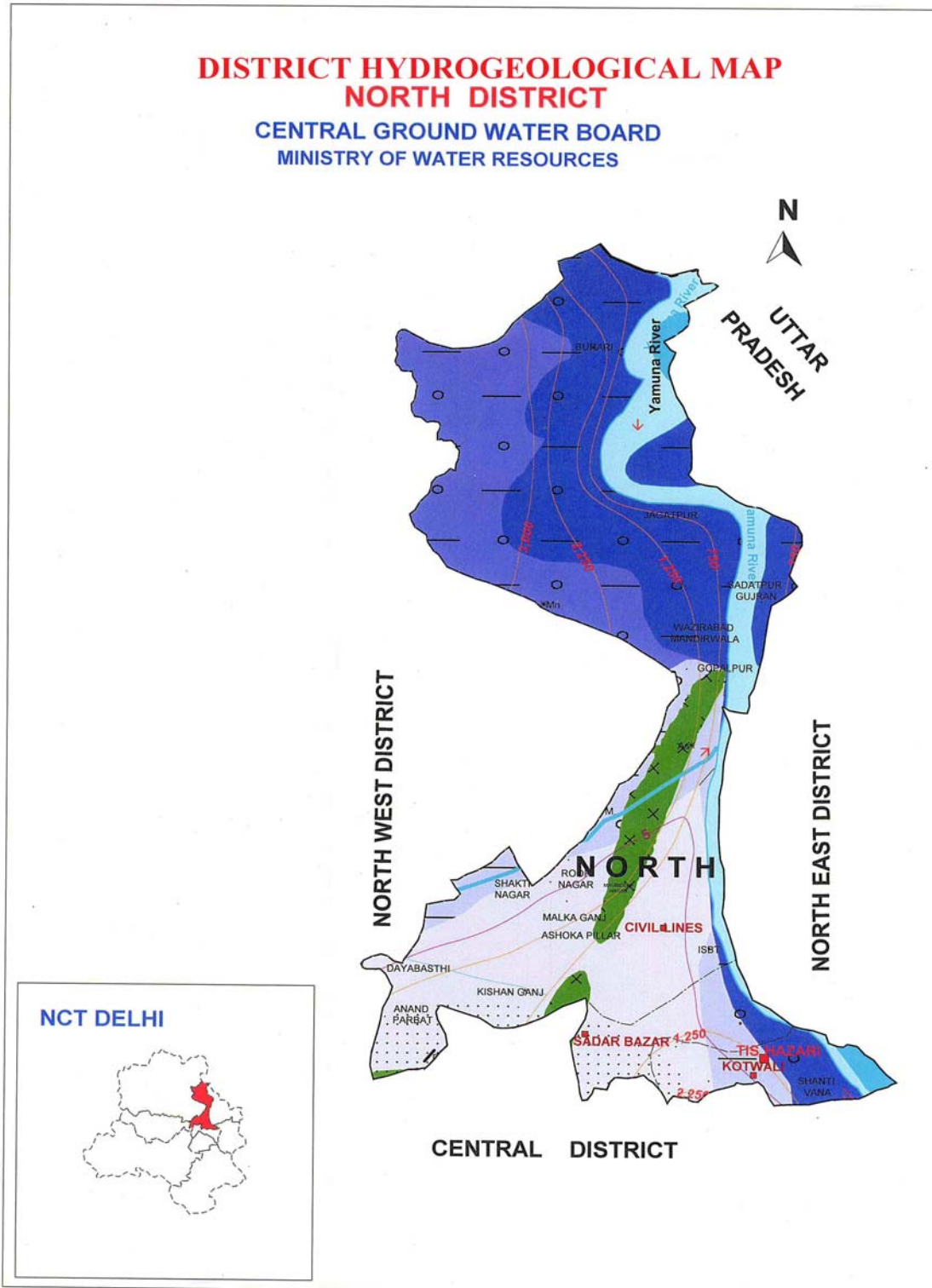
## **7.0 AREA NOTIFIED**

The entire district has been notified by Hon'ble Lt. Governor of Delhi for regulation of ground water development.

## **8.0 RECOMMENDATIONS**








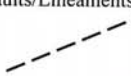










1. Efforts should be made to arrest the declining ground water levels by preventing indiscriminate withdrawal of ground water and adopting roof top rain water harvesting and artificial recharge.
2. Regular monitoring of water levels and chemical quality is essential.
3. Areas receiving drinking water supply from ground water sources should be monitored rigorously for quality consideration. The contaminants, if in the manageable range, should be removed by various techniques.
4. In areas prone to water logging, development of ground water should be encouraged.

Plate 1: District Hydrogeological Map



## NORTH DISTRICT

### LEGEND

	Wells feasible	Rigs suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures **
 Soft Rock Aquifer	Tube Wells	Reverse / Direct Rotary	25-45*	900-1800	Not Feasible
 Soft Rock Aquifer	Tube wells	Reverse /Direct Rotary	25-30*	600-900	Not Feasible
 Soft Rock Aquifer	Tube Wells	Reverse / Direct Rotary	25-40*	240-600	Shaft/Trench with recharge well, Recharge Pit with/without bore
 Hard Rock Aquifer	Tube Wells	DTH / Combination Rig	60-90	90-180	Shaft/Trench with recharge well
Depth to Water level in m (Pre-monsoon decadal mean, 2003-2012 ) 		Electrical Conductivity (Micro mhos/cm at 25° C) 		Major river / Drain 	Faults/Lineaments 
Fluoride > Permissible limit (1.5 ppm) 		Nitrate > Permissible limit (100 ppm) 		Iron > Permissible Limit (1.0 ppm) / * Fe 	
State boundary 		District boundary 		Tehsil boundary 	
Tehsil head quarter 		Over exploited block 		Area feasible for Artificial recharge structures 	
District head quarter 					

Average depth to water level in the major part of the district is about 5 meters below ground level  
\* Depth of the well is restricted to the availability of fresh water. \*\* Feasible in areas where depth to water level is more than 8 m below ground level.

### OTHER INFORMATION

Name of State	Delhi
Name of District	North
Geographical Area	60 Sq. Km.
Major Geological Formation	Soft Rock - Younger/Older Alluvium
Major Drainage System	Yamuna
Population (as on 2011)	8.83 lakhs
No of Tehsils	3, Civil Lines, Sadar Bazar and Kotwali
Replenishable Ground Water Resources (MCM)/ Draft (MCM)/ Stage of Ground Water Development (%)	Civil Lines-13.59/8.12/66
	Kotwali-1.43/1.62/126
	Sadar Bazar-0.54/0.60/123
Average Annual Rainfall	Delhi University - 887 mm
Range of Mean Daily Temperature	18-31°C
Tehsil Showing Intensive Ground Water Development	Kotwali and Sadar Bazar

Plate 2: Depth to Water Level Map during Pre-monsoon (May, 2012)

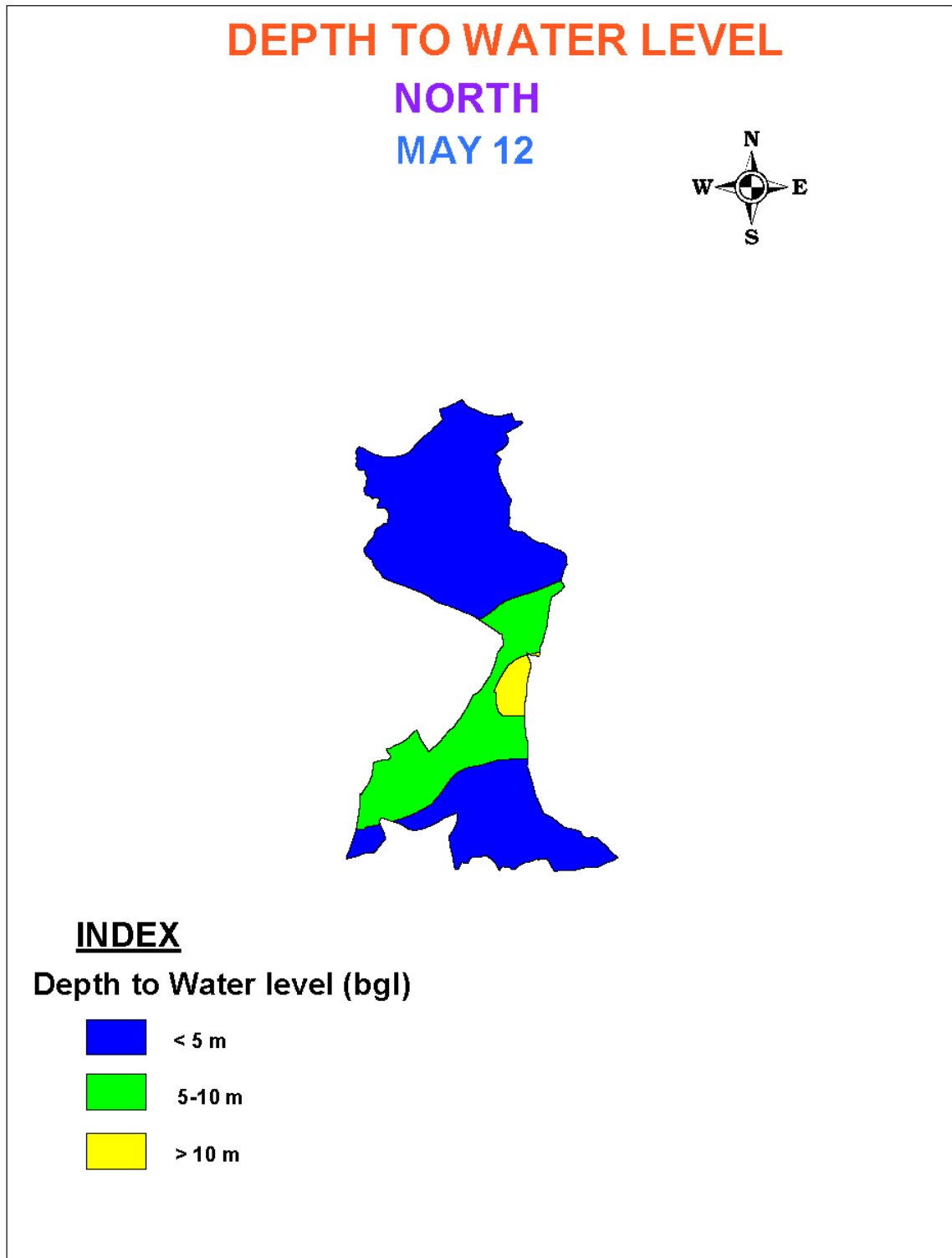


Plate 3: Depth to Water Level Map during Post-monsoon (Nov, 2012)

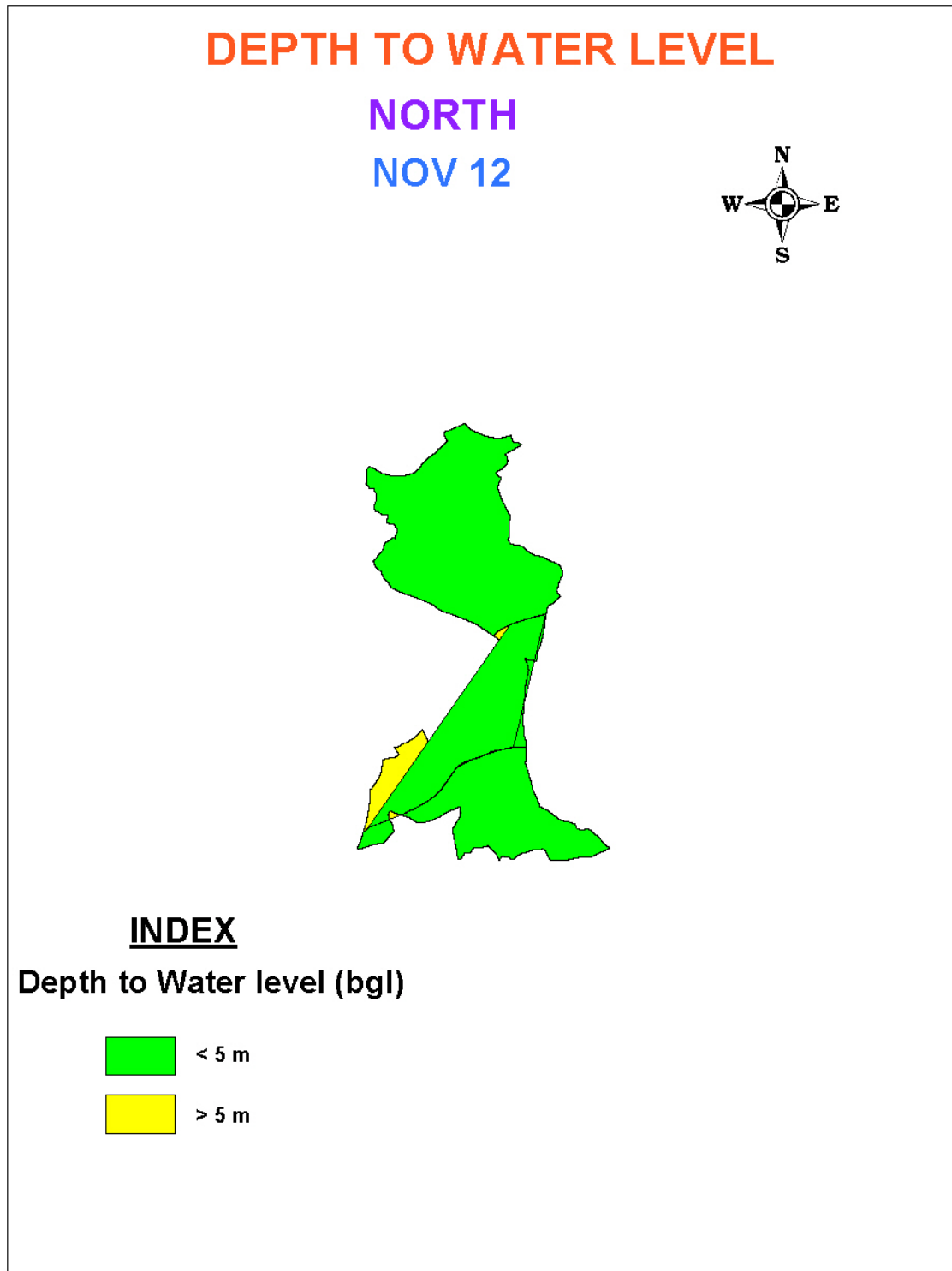


Plate 4: Electrical Conductivity Map (May, 2012)

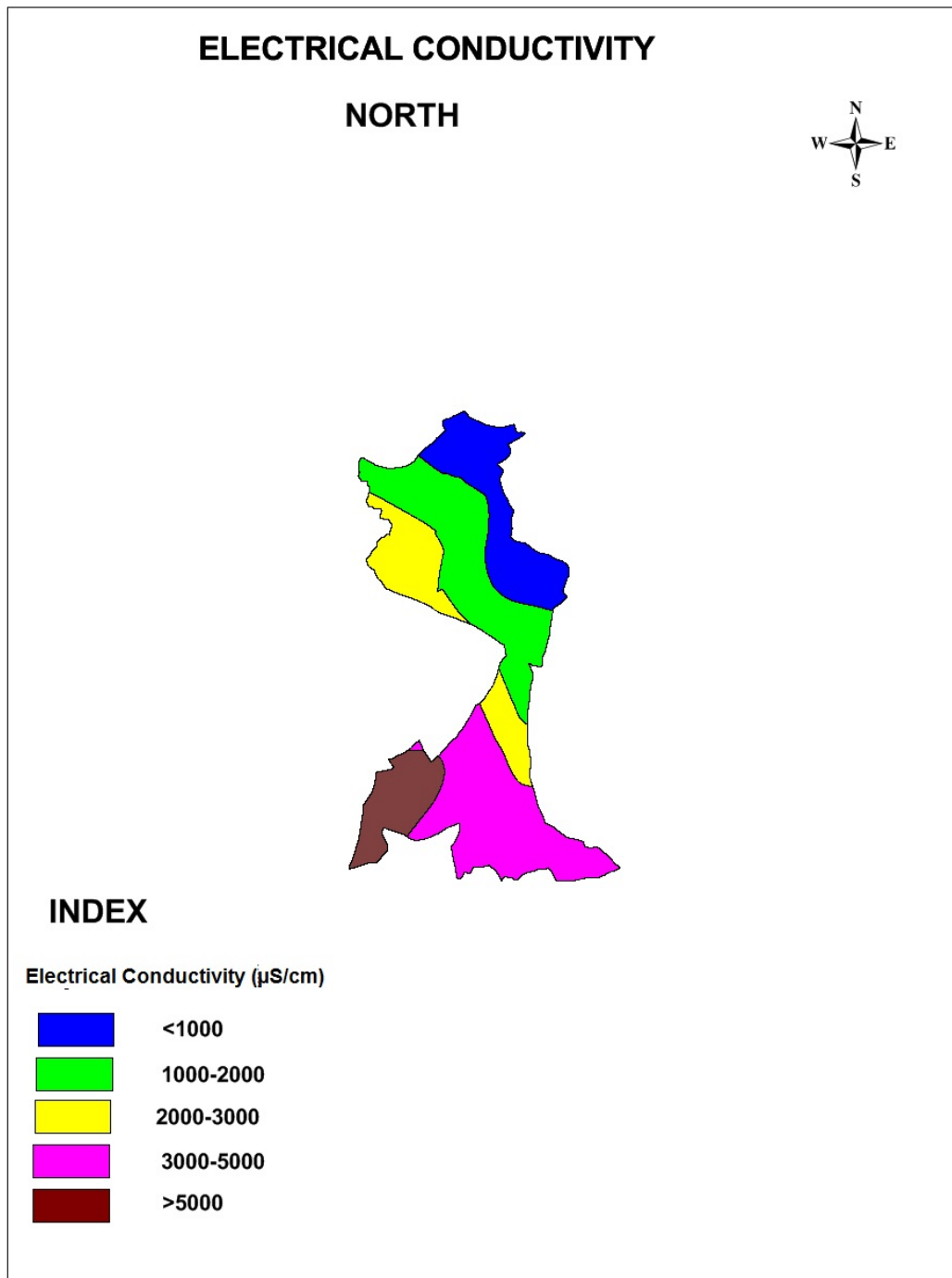




Plate 5: Nitrate distribution map (May, 2012)

