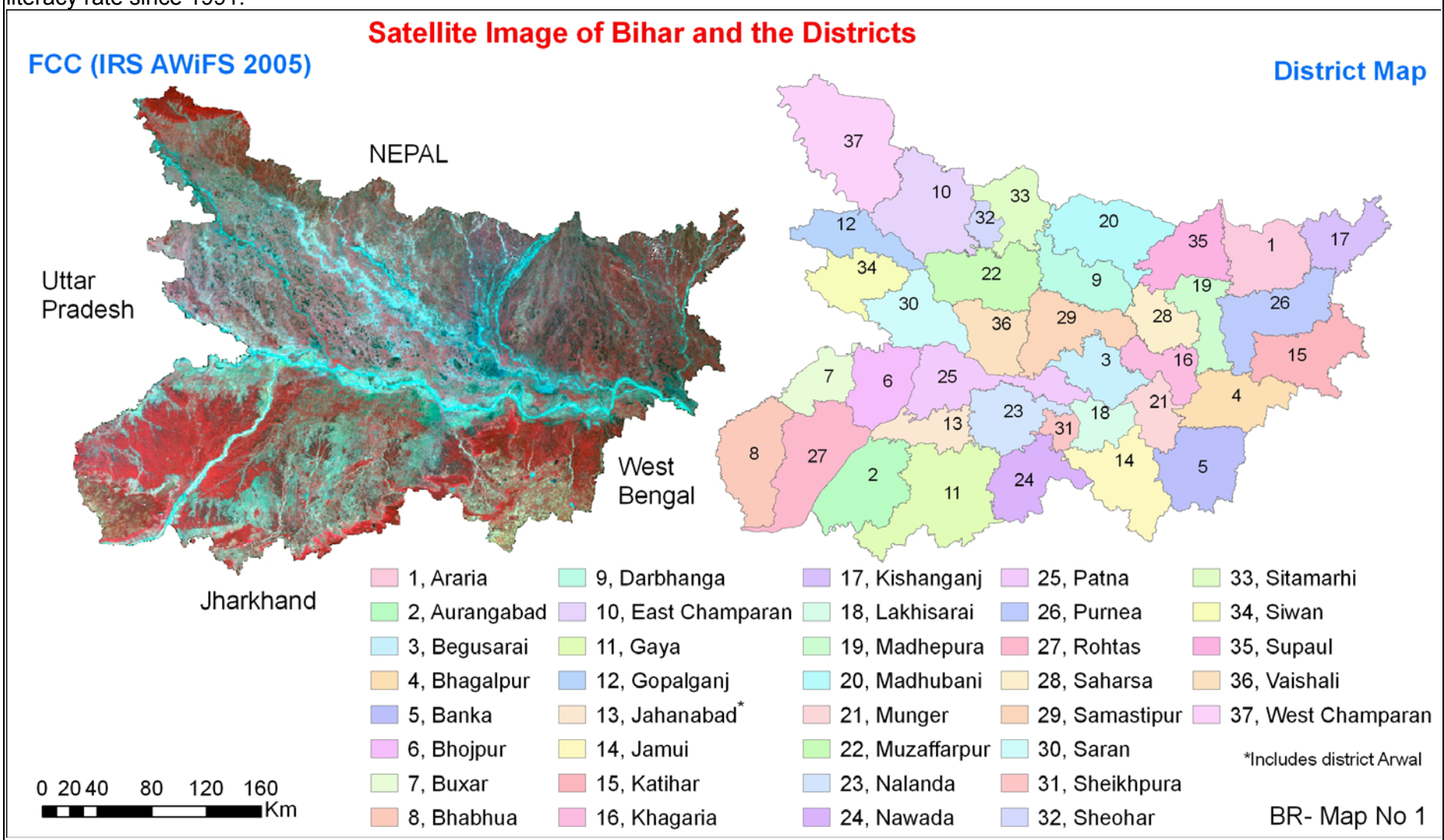
# BIHAR

## INTRODUCTION

**Location and Administrative Setup:** Bihar is situated in the Eastern part of India. It is land-locked state with Nepal in the North, West Bengal in East, Uttar Pradesh in West and Jharkhand in the South. It is located between 21° 30' 10" to 27° 31' 15" N latitude and 82° 19' 50" to 88° 17' 40" E longitude covering an area of about 9416.300 Th ha (94163 sq. km). The total geographical area includes 92257.51 sq km of rural area and 1905.49 sq km of urban area. The state is divided into 9 Divisions covering 38 districts (Map 1), 101 subdivisions, 533 Blocks and 45103 revenue villages. Patna is the state capital.

Bihar is the third most populous state in the country after Uttar Pradesh and Maharashtra. According to 2001 census total population of the state is 8,28,78,796 out of which 4,31,53,964 (52.06%)are male. The state has high population density of 880 persons/Sq km. Sex ratio is very sensitive to socio-economic development. The overall sex ratio is 921 i.e. 921 females per 1000 males. The state has population growth of 28.43% in the last decade (1991-2001). The state has lowest literacy rate of 47.53 %, though this has registered an increase of 10.04 % in the literacy rate since 1991.




**Climate:** The climate of Bihar comes under tropical to sub tropical region. The Himalayan Mountains in the north have a significant bearing on the distribution of monsoon rainfall in Bihar. The rainiest months are July and August. The rains are the gifts of the southwest monsoon. In two distinct areas, rainfall exceeds 1800 mm. They lie on northern and northwestern fringes of the state. The southwest monsoon normally withdraws from Bihar in the first week of October. An important feature of the retreating monsoon season in Bihar is the invasion of tropical cyclones originating in the Bay of Bengal at about 12° N latitude. Bihar is also influenced by the typhoons originating in the South China Sea. Normal rainfall for Bihar state is 1255mm. Minimum temperature goes as low as 12°C in the month of January. May is the hottest month with temperature around 41°C at most of the places.

**Land use:** Land use statistics for the year 2003–'04 is given in Table 1.

**Table 1: Major Land Use (Th ha)**

| PARTICULARS | 2003-'04 |
|---|---|
| Forest | 621.635 |
| **Not Available for Cultivation** | |
| A-Land put to Non Agriculture Uses | 1644.585 |
| B-Barren and Uncultivable Land | 436.295 |
| **Other Uncultivable Land Excluding Fallow Land** | |
| A-Permanent Pastures & Grazing Land | 17.544 |
| B-Land under Misc. Tree Crops & Groves | 238.372 |
| C-Cultivable Wastelands | 45.857 |
| **Fallow Land** | |
| A-Current Fallow | 513.044 |
| B-Old Fallow | 130.148 |
| **Cropped Area** | |
| A-Net Area Sown | 5712.088 |
| B-Area Sown More Then Once | 2170.289 |
| Gross Cropped Area | 7882.377 |
| Cropping Intensity (%) | 136.90 |

**(Source: www.indiastat.com)**

**Satellite Data:** IRS P4 LISS III data of two different seasons namely, pre monsoon (April-May, 2003) and post monsoon (November-December, 2002) were used for delineation of waterlogged and salt affected areas of various commands of Bihar.

## WATER RESOURCES AND COMMAND AREAS

**Water Resources:** Bihar is richly endowed with water resources, both the ground water resources and the surface water resources. It has considerable water supply from the rivers, which flow outside the territory of the state. Ganges is the main river, which is joined by tributaries with their sources in the Himalayas. The important rivers that join the Ganges from the north are, from west to east, Ghaghra, the Gandak, the Burhi Gandak, the Kosi, the Mahananda and its tributaries. The Karmanasa, the Sone, the Punpun, the Phalgu, the Sakri and the Kiul are the principal streams that join the Ganges from the south. There are several rivers in Bihar, which contribute a lot to the people of Bihar. These rivers make the water available for irrigation purpose and also help in generating the hydrothermal energy for the state. Apart from this, they provide a medium for water transport, provide fishes for fishery industry and enrich the natural resources of state in many other ways. All the above rivers have their impact on the Bihar plain. State also has non-exhaustible source of ground water, which is in use for drinking purposes, irrigation and industries. The second Bihar Irrigation Commission has estimated 63.58 lakh ha as ultimate irrigation potential from surface water schemes and 34.80 lakh ha from ground water schemes. Rivers are major source of irrigation in Bihar.

**Command Areas:** There are 132 irrigation commands in Bihar. Number of major and medium irrigation commands are 22 and 110, respectively. Based on the maps obtained from Bihar authorities, the commands were combined into 74 groups (Map 2).

## WATER LOGGING AND SALT AFFECTED AREAS IN MAJOR AND MEDIUM IRRIGATION COMMANDS BASED ON SATELLITE REMOTE SENSING

Total waterlogged area in the state is 627.888 Th ha out of which 61.666 Th ha is perennial and 566.222 Th ha is seasonal. Out of 74 irrigation command groups, only 2 commands have no area under waterlogging category. Waterlogging is highest in Gandak, Eastern Kosi and Sone modernization commands. Salt affected area covers 156.887 Th ha. Total 1252 soil samples were collected to check the salinity / alkalinity in the command. Table 2 and Map 3 show the salt affected area and waterlogged areas in major and medium irrigation commands in Bihar state.

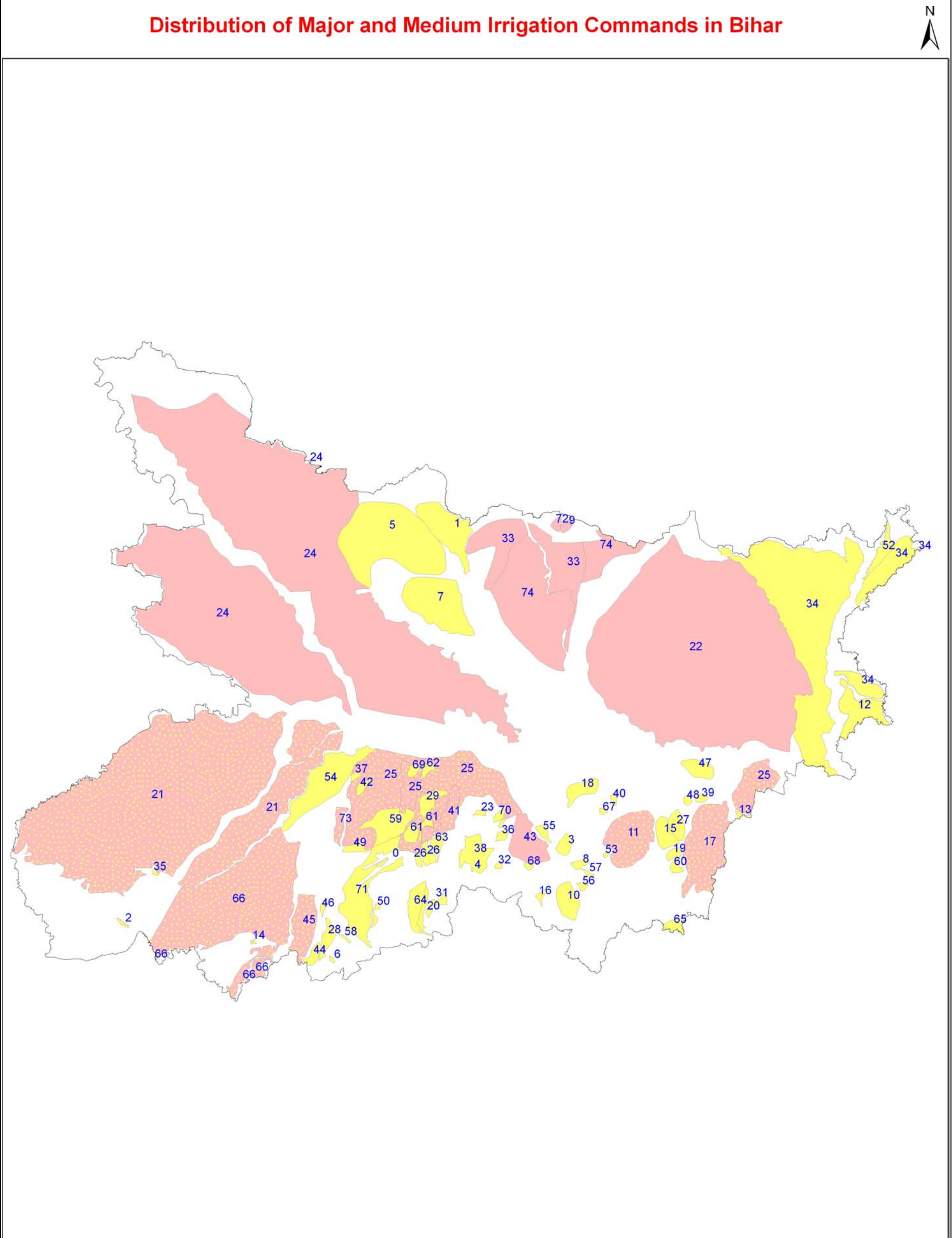
**Table 2: Waterlogged and Salt Affected Area in major and medium irrigation commands of state**

| Code | Command name | Type | Waterlogged area (Th Ha) | Salt affected area (Th Ha) |
|---|---|---|---|---|
| 9 | Balan weir scheme | Major | 0.511 | 0.615 |
| 11 | Belharna, Badua, Mohane link and Bagra | Major | 5.993 | 0.000 |
| 17 | Chandan weir scheme, Sukhnia weir scheme, Dakri weir, Tribeni weir, Chausa pump, Harna weir, Sonahula weir, Sundar weir and Kamarganj pump canal | Major | 1.421 | 0.055 |
| 21 | Durgawati weir, Durgawati reservoir, Khoria reservoir, Zamania pump scheme(Larma), Surara weir, Sone canal modernisation scheme, Sone high level canal, Kumber weir, Sone low level canal | Major | 81.572 | 39.155 |
| 22 | Eastern Kosi Irrigation scheme and Rajpur canals | Major | 115.525 | 22.981 |
| 24 | Gandak, Tribeni, Dhaka canals | Major | 212.044 | 53.882 |
| 25 | Ganga pump canal and Bateshwaran pump scheme | Major | 49.580 | 0.334 |
| 33 | Kamla Irrigation scheme | Major | 5.217 | 32.620 |
| 41 | Kulthi weir and Sakari irrigation scheme | Major | 1.261 | 0.000 |
| 43 | Lower Kiul Weir | Major | 2.452 | 0.000 |
| 45 | Lower Morhar Irrigation scheme, Lilajan weir, Chariari, Upper Jamuna, Kanak Bigha | Major | 0.562 | 0.000 |
| 66 | Punpun barrage, Upper Morhar, Batane, Adri, Tekari, Mansare, Hilua, Madar, Dhawa, Sinane, Chotki, Chor Danda | Major | 4.953 | 0.020 |
| 72 | Trisula weir scheme | Major | 1.256 | 0.085 |
| 73 | Udrasthan, Bharthuanandan weir | Major | 1.573 | 0.000 |
| 74 | Western Kosi Irrigation scheme | Major | 24.047 | 5.106 |
| 1 | Adhwara barrage scheme | Medium | 4.316 | 0.001 |
| 10 | Barnar reservoir | Medium | 0.052 | 0.000 |
| 12 | Bersoi and Phulhar lift Irrigation scheme | Medium | 5.417 | 0.032 |
| 13 | Bhena weir | Medium | 0.450 | 0.000 |
| 14 | Bhutanda reservoir scheme | Medium | 0.000 | 0.000 |
| 15 | Bilasi reservoir scheme | Medium | 0.015 | 0.000 |
| 16 | Bunduni reservoir | Medium | 0.006 | 0.000 |
| 18 | Dakra pump canal I&II | Medium | 4.646 | 0.000 |
| 19 | Dakra reservoir scheme | Medium | 0.030 | 0.000 |
| 2 | Ausane weir scheme | Medium | 0.000 | 0.000 |
| 20 | Dhanarji reservoir | Medium | 0.162 | 0.000 |
| 23 | Firangi bigha weir | Medium | 0.096 | 0.000 |
| 26 | Ghora katora reservoir | Medium | 0.221 | 0.000 |
| 27 | Gogha weir scheme | Medium | 0.151 | 0.000 |
| 28 | Gokhula weir | Medium | 0.073 | 0.000 |
| 29 | Gothwa Weir | Medium | 1.023 | 0.000 |
| 3 | Azan | Medium | 0.481 | 0.000 |
| 30 | Gulsakari weir | Medium | 0.010 | 0.000 |
| 31 | Job, Purain and Kolmahadeo reservoir | Medium | 0.315 | 0.000 |
| 32 | Kailash weir and Tarkol weir | Medium | 0.002 | 0.000 |
| 34 | Kankai and Mahananda | Medium | 42.175 | 0.306 |
| 35 | Kao reservoir scheme | Medium | 0.028 | 0.000 |
| 36 | Kapasi weir | Medium | 0.215 | 0.000 |
| 37 | Kararua weir | Medium | 0.386 | 0.000 |
| 38 | Kaurinar, Nata and Chourdargha weir | Medium | 1.267 | 0.000 |

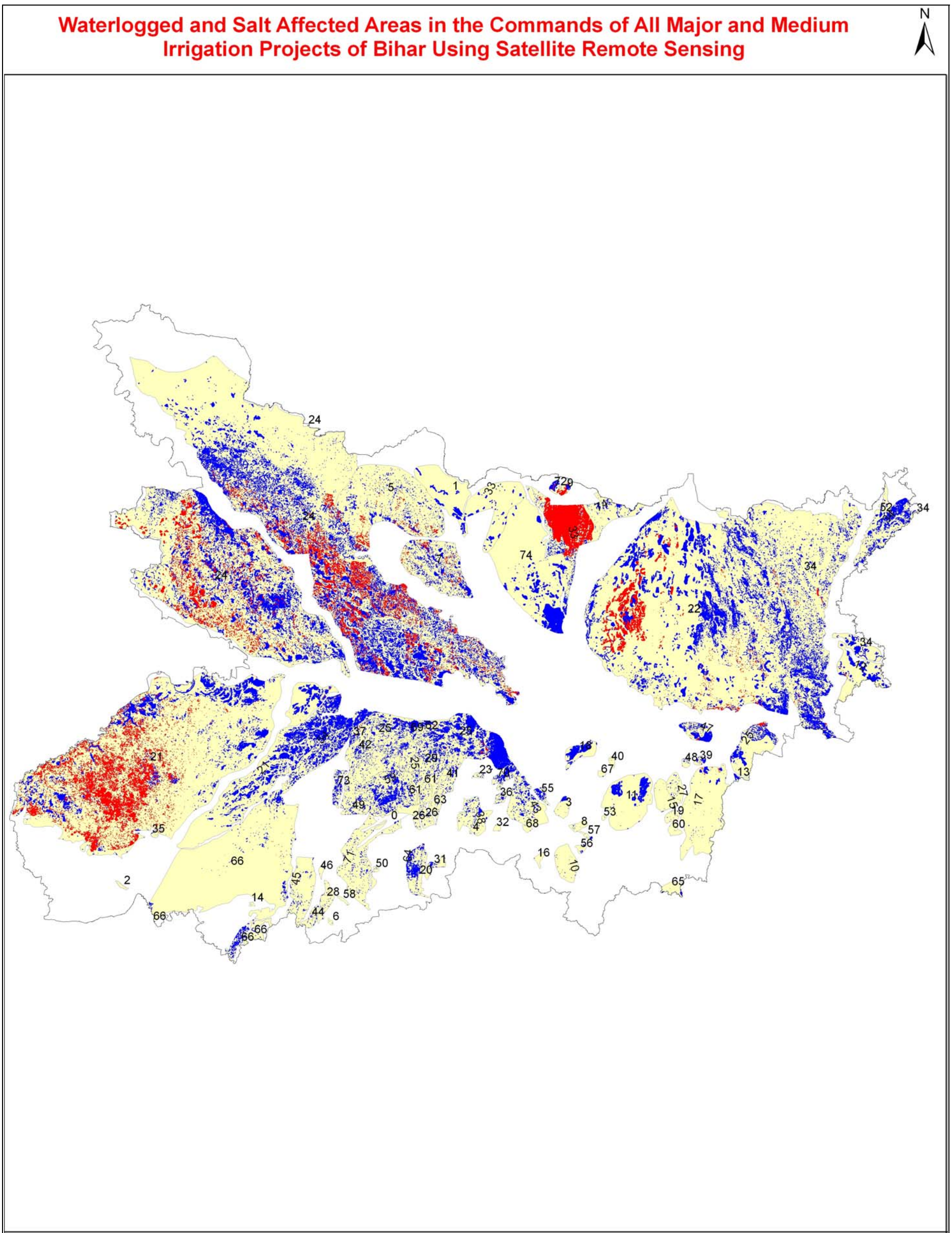
| Code | Command name | Type | Waterlogged area (Th Ha) | Salt affected area (Th Ha) |
|---|---|---|---|---|
| 39 | Khalkhala Irrigation scheme | Medium | 0.479 | 0.005 |
| 4 | Baghel weir | Medium | 0.001 | 0.000 |
| 40 | Khandbihari weir scheme | Medium | 0.003 | 0.000 |
| 42 | Lokain weir | Medium | 0.447 | 0.000 |
| 44 | Lower Lilajan and Golari weir | Medium | 0.189 | 0.000 |
| 46 | Mahabodhi weir | Medium | 0.052 | 0.000 |
| 47 | Mahadeopur pump canal | Medium | 4.114 | 0.057 |
| 48 | Mahmuda weir scheme and Gebua | Medium | 0.056 | 0.000 |
| 49 | Mahmuda weir-I | Medium | 0.272 | 0.000 |
| 5 | Baghmati Irrigation project | Medium | 5.860 | 1.047 |
| 50 | Mahugain weir and Kadhar weir | Medium | 0.014 | 0.000 |
| 51 | Manindra weir | Medium | 0.033 | 0.000 |
| 52 | Mechi weir scheme | Medium | 1.455 | 0.000 |
| 53 | Mohane weir scheme | Medium | 0.002 | 0.000 |
| 54 | Morhar Barrage | Medium | 22.007 | 0.002 |
| 55 | Morwe weir, Baskund, Jalkund | Medium | 0.991 | 0.000 |
| 56 | Nagi reservoir | Medium | 0.126 | 0.000 |
| 57 | Nakati reservoir | Medium | 0.139 | 0.000 |
| 58 | Natane Weir | Medium | 0.000 | 0.000 |

| Code | Command name | Type | Waterlogged area (Th Ha) | Salt affected area (Th Ha) |
|---|---|---|---|---|
| | Nischalganj, Sansi, Paimer weir | Medium | 6.597 | 0.000 |
| 6 | Baglati pyne weir | Medium | 0.004 | 0.000 |
| 60 | Orni reservoir scheme | Medium | 0.005 | 0.000 |
| 61 | Panchane phase-I | Medium | 0.529 | 0.000 |
| 62 | Panchane weir phase-II | Medium | 0.382 | 0.000 |
| 63 | Paura weir | Medium | 0.095 | 0.000 |
| 64 | Phulwaria reservoir | Medium | 3.792 | 0.000 |
| 65 | Punasi reservoir scheme | Medium | 0.265 | 0.000 |
| 67 | Sindhwarni reservoir scheme and Kharagpur lake | Medium | 0.007 | 0.000 |
| 68 | Sirkhindi, Amrit, Kundgat reservoir scheme | Medium | 0.004 | 0.000 |
| 69 | Sirnawa weir | Medium | 0.709 | 0.000 |
| 7 | Bagmati barrage scheme | Medium | 7.635 | 0.587 |
| 70 | Tati weir | Medium | 0.370 | 0.000 |
| 71 | Tilaiya dhadhar diversion scheme, Sohjana | Medium | 1.724 | 0.000 |
| 8 | Bajan weir | Medium | 0.026 | 0.000 |
| | **TOTAL** | | **627.888** | **156.887** |

# Distribution of Major and Medium Irrigation Commands in Bihar



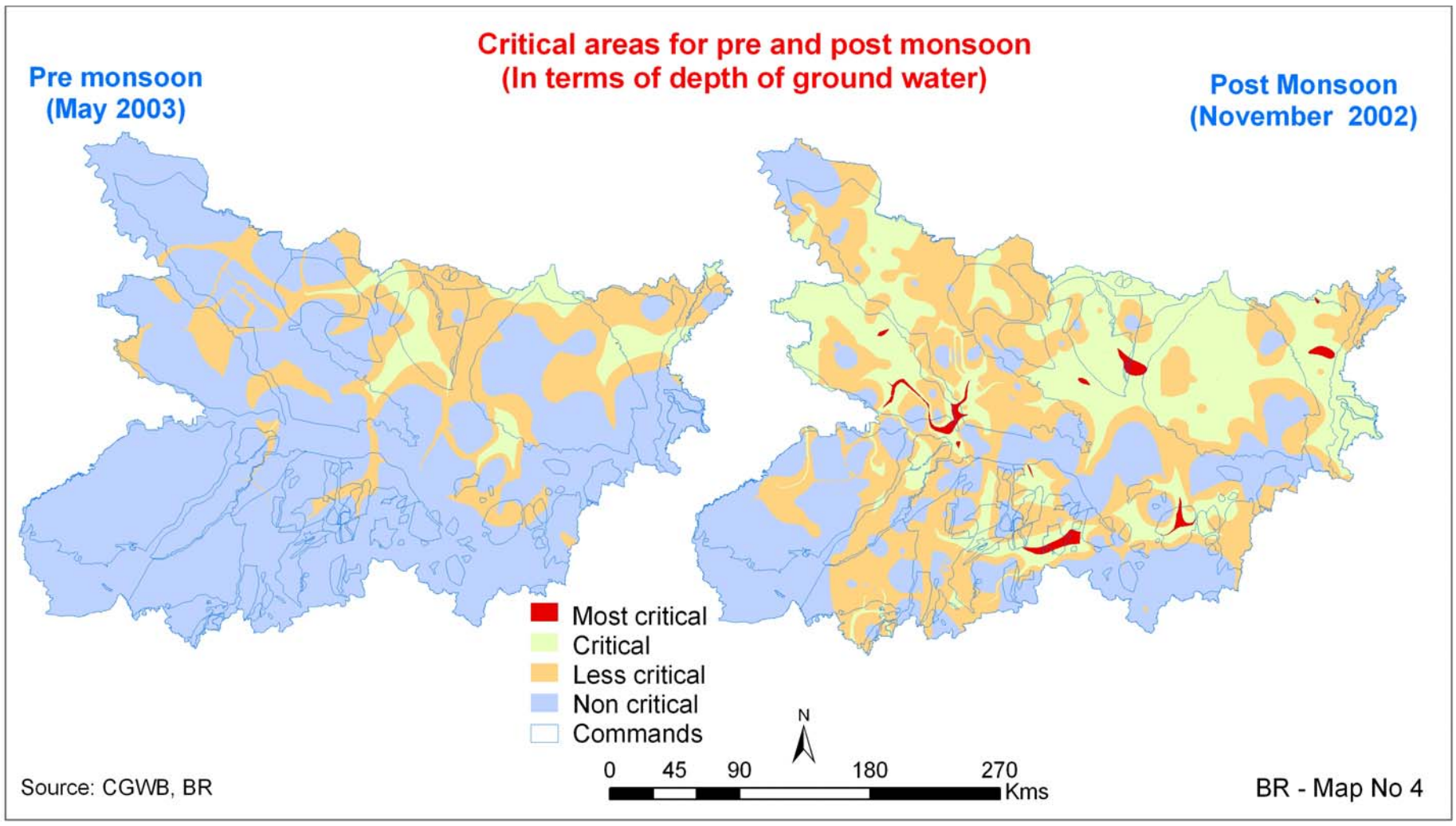
# Waterlogged and Salt Affected Areas in the Commands of All Major and Medium Irrigation Projects of Bihar Using Satellite Remote Sensing



For demarcation of critical waterlogged areas due to rise in water table depth, ground water table data of monitoring stations of CGWB were used. Table 3 and Map 4 show the critical area of depth of ground water for pre (May, 2003) and post (November, 2002) monsoon.

**Table 3: Critical Area of Depth of Ground Water for Pre (May, 2003) and Post (November, 2002) Monsoon**

| | Most critical (< 1m) | | Critical (1 – 2 m) | | Less critical (2 – 3 m) | | Non-critical (> 3 m) | |
|---|---|---|---|---|---|---|---|---|
| | (Th ha) | (%) | (Th ha) | (%) | (Th ha) | (%) | (Th ha) | (%) |
| Pre Monsoon (May, 2003) | 0.083 | 0.00 | 309.035 | 5.20 | 1343.400 | 22.62 | 4286.737 | 72.18 |
| Post Monsoon (November, 2002) | 49.988 | 0.84 | 1996.870 | 33.62 | 2501.310 | 42.11 | 1391.090 | 23.43 |



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