# Urban Agglomeration in Itanagar Capital Complex, Arunachal Pradesh

**(NAQUIM 2.0, Inception Report)**

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Central Ground Water Board
North Eastern Region
Guwahati

**Inception Report**

# Urban Agglomeration studies in Itanagar Capital Complex, Papum Pare, Arunachal Pradesh (Area 490 sq km)

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## 1.0 Introduction:

With the growth of towns and increasing population density in the Itanagar capital complex or Itanagar capital region, the need for potable water and its uses in various forms has increased many folds. It is obvious that stress on groundwater in coming days will escalate and improper withdrawal of groundwater may attract unwanted consequences. It is of utmost importance to identify the potential aquifer zones to meet the demand of increasing urbanization and its optimum use to sustain groundwater resource.

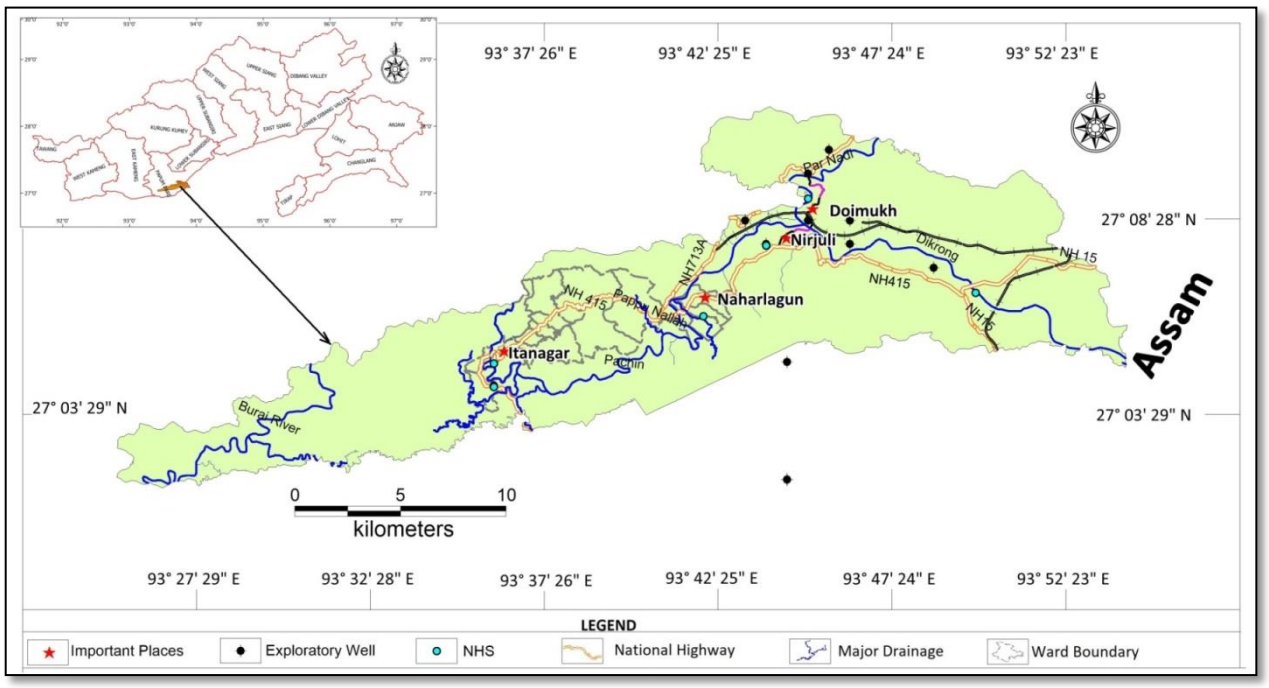


Fig. 1: Itanagar Capital Complex

## 2.0 About the Study Area:

The Itanagar capital complex (ICR) of Papum Pare district is confined within North Latitudes $27^0$ 1'36.0336" and $27^0$ 11' 18.87" and East Longitudes of $93^0$ 25'11.78" and $93^0$ 54'8.52". As per the master plan of the Capital Complex, the entire township stretches in ENE-WSW belt from Banderdewa in the east to Pam Valley in the west, covering an area of 490 sq.km. It forms part of the Survey of India toposheet numbers 83E/12 and E/16. Presently there are 20 wards under Itanagar Municipal Corporation. Total ward area is 51.69 sq.km where 1,01,772 persons are living.The Itanagar capital complex lies in the foothills of the Outer Himalaya locally named as Dafla Hills. It is characterized by rugged hilly terrain with altitude varying from 80 m to 1540 m. Pachin River is the main river that passes through most of the area before it debouches to Dikrang river near Nirjuli.

Geologically, the area is underlain by Tertiary (Siwalik) and Quaternary (older & newer alluvium). Geomorphologically, the area can be divided into (i) dissected and highly dissected hills (iii) piedmont (Harmuti, Banderdewa area), (iv)cuesta slopes (NE-SW trending linear ridges present in Itanagar), (v) Intermontane Valleys.

**Climate and Rainfall:** The climate of the area is mild hot and humid with mean maximum and minimum temperature ranging between 27.5º C to 13.5º C, with highest (38º C) temperature in June and lowest (5.5º to 7º) in January.

Average annual rainfall (2013-2021) in the Capital Complex is 3269 mm. Monsoon rainfall is 2423mm while non-monsoon rainfall is 846mm. The relative humidity is around 88%.

**3.0 Priority types**:

Itanagar Capital Region has been selected under the pre-defined priority type (Priority Area 2) of "Urban Agglomerate" considering the following issues

- Itanagar was originally planned for 50,000 population. However the population is increased nearly 5 times more than the original planning (Fig.2).
- Civil construction continues over stream bed blocking or diverting the stream flow as well as over unstable hill slopes.
- Many of the springs and streams are destroyed due to settlements and developmental activities.
- Huge numbers of municipal solid waste (MSW) generated in the capital complex. There is no proper waste disposal system in the urban area.

- Increase of built up area affects infiltration of rainwater into the aquifer.
- GW potentiality of sandstone aquifer of Siwalik is poor.

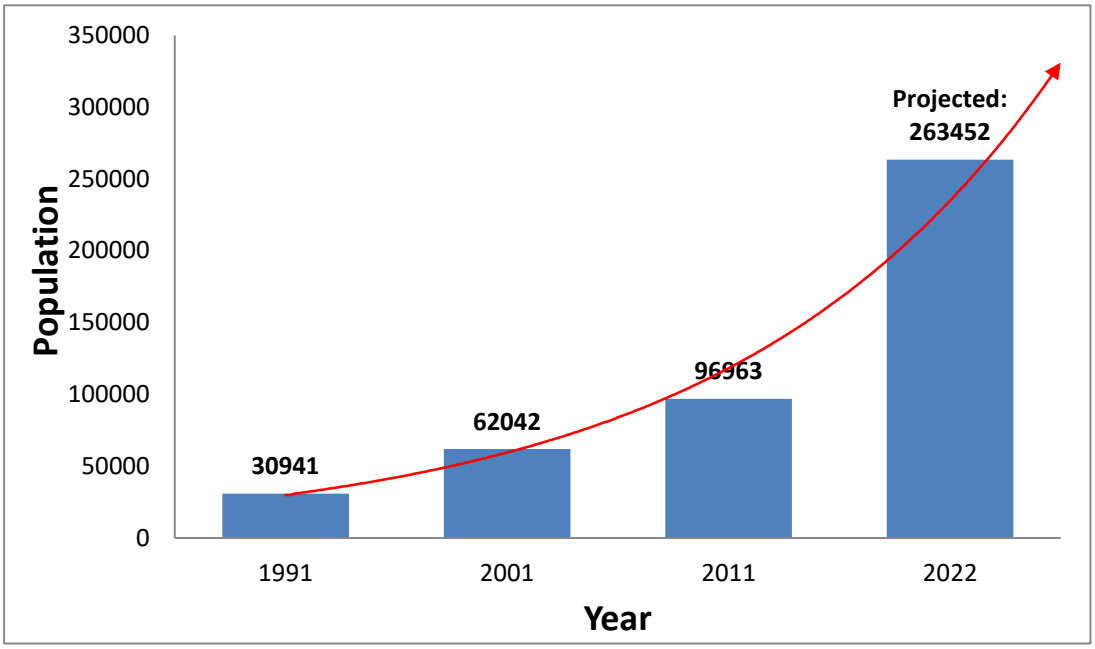


Fig.2: Population spurt in the Itanagar Capital Complex

### 3.0 Objectives:

The study will be carried out to achieve the following objectives

- ✓ Detailed aquifer dispositions
- ✓ Defining aquifer management unit (AMU) and its extension.
- ✓ Aquifer-wise ground water levels.
- ✓ Inventory of Urban Spring
- ✓ Delineation of Recharge Areas.
- ✓ Estimation/Refinement of parameters used for resource assessment.
- ✓ Assessment of ground water resources.
- ✓ Ground Water Quality.

**Deliverables**

The following are the deliverables of the above objective.

- Ground Water Quality Management Interventions, including demarcation of safer aquifers..
- Source wise (surface & groundwater) water availability and planning for future.
- Springshed management plan.
- Supply and demand gap calculation
- If there is gap between supply and demand, then examine scope to fulfill gap from supplementary water source. Demarcate source, duration of pumping
- Demarcate Municipal Solid Waste disposal sites and suggestive measures to protect aquifer from pollution.
- A plan for drinking water source sustainability.
- Scope for artificial recharge Identification of potential aquifers for drinking water supply.
- Cost-benefit ratio estimation of installation of artificial recharge structure

**Previous Studies:** Studies of hydrogeology and ground water conditions in Lower Subansiri district (At present Papum Pare and Lower Subansiri districts) were taken up by the CGWB in the field sessions 1986-87 and 1988-89. Dr. Nabandu Majumdar, AHG carried out reappraisal survey in the field session 2001-02. Shri B.Ray, JHG carried out GW Management studies during AAP2006-07.

Dr. D. J. Khound, AHG carried out special study for development of water supply through springs in Papum Pare District, Arunachal. This study determines that majority of springs in the capital complex are $6^{th}$ to $8^{th}$ order as per Meinzer (1927) classification. Almost all the springs are contact springs. Few depression springs are also found. Water balance equation is used to estimate the size of the source area. For sustainable water supply throughout the year two fold strategy was proposed, i.e., protecting the existing perennial springs and spring source area development programme.

During AAP 2008-09, Shri A. Kar, Sc-D prepared district report of Papum Pare district compiling all the previous data. He also prepared conceptual model showing changing land scape of the twin urban areas and its impact on groundwater regime.

AAP 2012-13& 13-14, NAQUIM studies was carried out covering 172 Sq.km rechargeable of Papum Pare district including the capital complex. This study report contains sections depicting 2D & 3D Aquifer dispositions. The study also finds that springs originated in Siwalik sandstone aquifer are not perennial and GW potentiality of alluvial aquifer is more than the sandstone aquifer.

The resource estimation of Papum Pare district is latest performed for the year 2022. The annual extractable GW resource is 20438 ham and Net GW availability for future use is 20150 ham.

The present stage of extraction of the district is 1.28 %

## 5.0 Existing Data:

| Sl.no | Theme | Aquifer | Data Available |
|---|---|---|---|
| 1 | Exploration data | Alluvial | 5 |
| | | Sandstone | 5 |
| 2 | Pumping tests data | Alluvial | 4 |
| | | Sandstone | 3 |
| 3 | Geophysical data | - | 24 |
| 4 | Groundwater level data | Alluvial | 7 |
| 5 | Groundwater quality data | Alluvial | 11 |
| 6 | Soil Infiltration Test | | 3 |

## 6.0 Data gap analysis:

| SN | Theme | | Type | Criteria | Data Gap |
|---|---|---|---|---|---|
| 1 | Borehole Lithology Data | | | At least two for each principal aquifer type | No Gap |
| 2 | Geophysical data | | | At least five for each principal aquifer type | 10 |
| 3 | Groundwater level data | Aquifer 1(older alluvium) | Dug well | At least 3 water level data for each GMU | 13 (Depends on availability of DW) |
| | Spring | | | All available springs | - |
| | Groundwater level data | Aquifer 2 (Sandstone) | Dug well | As per availability | - |
| | Spring | | | Depending on the use of springs | - |
| 4 | Groundwater quality data | Aquifer 1 | Dug well | At least 3 samples for each GMU | 13 (Depends on availability of DW) |
| | | | Spring | All available springs | - |
| | | Aquifer 2 (Sandstone) | Dug & deep tube wells | As per availability | - |
| | | | Spring | Depending on the use of springs | - |
| 5 | Soil Infiltration Test | | | Available soil type in the rechargeable area | 5 |

## 7.0 New Data generation plan

Density of Ground Water Monitoring Stations will be increased from a current total of 53 upto 80. Sampling of ground water for quality analysis for Pre-monsoon and Post Monsoon will be done during the months of March 2024 and November 2023. Monthly water level of monitoring stations

will be carried out throughout the year to learn about the annual variation of water level.

| | Item | | Planning |
|---|---|---|---|
| 1 | Exploration | Alluvial Aquifer | No plan for Exploration in AAP 2023-24 |
| 2 | Groundwater level data | Water level of shallow alluvial aquifer | Efforts to be made to establish ward wise key well |
| 3 | Groundwater quality data | Water quality of shallow alluvial aquifer | Efforts will be made to collect water sample ward wise. Sampling density will be more near MSW disposal sites |
| | | Water quality of deeper alluvial aquifer | Efforts will be made to collect water sample from existing TW of CGWB/PHED/Private. |
| | | Aquifer-II | Efforts to be made to collect water sample from existing TW of CGWB/PHED/Private |
| 4 | Soil Infiltration Test | | At least 05 nos. will be carried out to determine RIF |
| 5 | GW resource: Unit draft | On spot discharge measurements & interaction with GW users | Efforts will be made to estimate resource GMU. |
| 6 | Springs | Available springs will be inventoried | Spring discharge data, chemical quality data will be generated. |
| 7 | Isotope study | To delineate recharge area | $\delta^{18}O$ and $\delta^{2}H$ will be used |

**Table No 5: Month Wise Activity plan:**

| Activities | Officers Assigned | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Map Preparation & Inception Report | RG & DJK | | | | | | | | | | | | |
| Field Visit and interaction with State Govt | RG | | | | | | | | | | | | |
| Detailed Field Work | RG | | | | | | | | | | | | |
| Key Well Establishment | RG | | | | | | | | | | | | |
| Pre-Monsoon Water level Monitoring | RG | | | | | | | | | | | | |
| Data Entry in WIMS | | | | | | | | | | | | | |
| Pre-Monsoon Sampling | RG | | | | | | | | | | | | |
| Data Collection | RG | | | | | | | | | | | | |
| Pre-Monsoon Sample Analysis-Inhouse | RB | | | | | | | | | | | | |
| Pre-Monsoon Map Preparation and Aquifer Geometry | DJK | | | | | | | | | | | | |
| Post-Monsoon Water level Monitoring | RG | | | | | | | | | | | | |
| Post-Monsoon Sampling | RG | | | | | | | | | | | | |
| Data Collection | RG | | | | | | | | | | | | |
| Post-Monsoon Sample Analysis-Inhouse | RB | | | | | | | | | | | | |
| Post-Monsoon WQ Data Analysis | RB | | | | | | | | | | | | |
| Post-Monsoon Map Preparation | DJK | | | | | | | | | | | | |
| Geophysical Data Acquisition & Map Preparation | MV | | | | | | | | | | | | |
| Data Entry in WIMS | | | | | | | | | | | | | |
| Aquifer Disposition | DJK & RG | | | | | | | | | | | | |
| Climatological Data Analysis | DJK & RG | | | | | | | | | | | | |
| Interaction with Villagers/ Stakeholders | RG | | | | | | | | | | | | |
| Preparation of management plan | DJK & RG | | | | | | | | | | | | |
| Report Preparation | DJK & RG | | | | | | | | | | | | |
| Draft Report Submission | DJK & RG | | | | | | | | | | | | |
| Final Report Submission | DJK & RG | | | | | | | | | | | | |

*Dr. D J Khound (DJK); Sh. Rajat Gupta (RG); Sh. Gopal Sahoo (GS); Sh. M. Vidyasagar (MVS)

## 9.0 Composition of the team:

- Team Leader: Dr D J Khound, Scientist-D,
- Hydrogeologist: Sh. Rajat Gupta, AHG
- Chemist: Sh. Rinkumani Barman(Ch),
- Geophysicist: Sh. M. Vidyasagar, Scientist-B (GP)

## 10.0 Team-member-wise responsibilities and monthly targets for entering in the MIS:

**Table No.6:** NAQUIM 2.0 Task detail Table (Month-Wise) for Itanagar Capital Region, SUO Naharlagun

| | **Field Work/ Lab Work Activity** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NAQUIM 2.0 (2023-24) | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** |
| **Dr D J Khound,** Scientist-D, | LW | LW | FW | LW | LW | LW | LW | FW | LW | LW | FW | LW |
| **Sh Rajat Gupta,** AHG | LW | FW | FW | FW | LW | LW | FW | FW | FW | LW | FW | LW |
| **Sh. Rinkumani Barman,** STA (Ch), | | | | | | LW | LW | LW | | | LW | LW |
| **Sh. M. Vidyasagar,** Scientist-B (GP) | | | | | | | FW | FW | FW | LW | LW | |
| NB : FW : Field Work; LW : Lab Work | | | | | | | | | | | | |

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