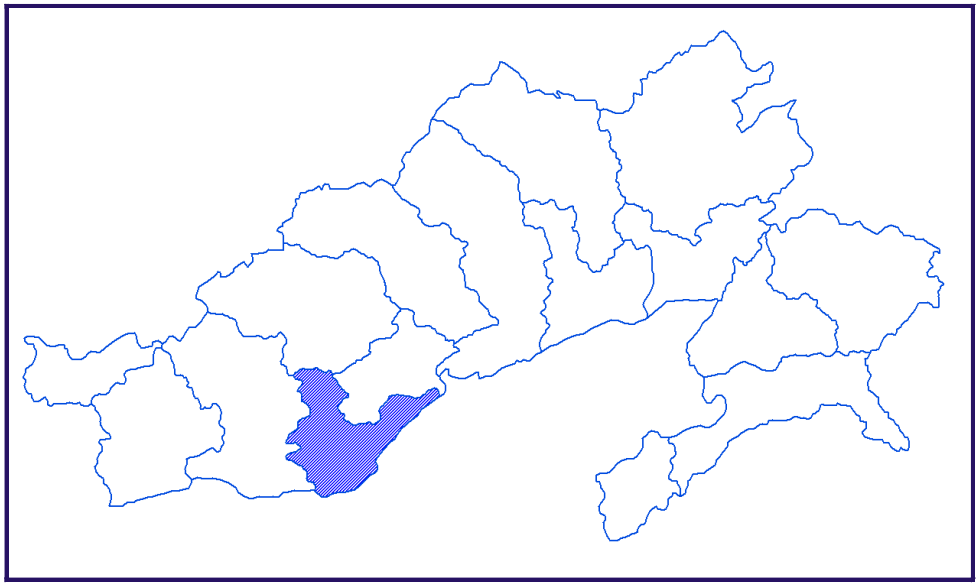
Technical Report Series: D

No:

Ground Water Information Booklet
Papum Pare District, Arunachal Pradesh



Central Ground Water Board

North Eastern Region

Ministry of Water Resources

Guwahati

September 2013

PAPUM PARE DISTRICT, ARUNACHAL PRADESH

AT GLANCE

Sl. No.	Items	Statistics
1.	GENERAL INFORMATION	
	i) Geographical area (Sq Km)	2,875
	ii) Administrative Divisions (As on 31-03-04) Number of Tehsil/ Block Number of circles Villages	2 4 9 273
	iii) Population (As on 2011 census)	1,76,385
	iv) Average annual rainfall (mm)	3200
2.	GEOMORPHOLOGY	
	Major physiographic units	High and low relief structural hills, dissected and highly dissected hills, intermontane valleys, piedmont and alluvial plain
	Major drainages	Dikrang, Subansiri
3.	LAND USE (in Ha) 2003-04	
	a) Forest area:	75%
	b) Net area sown:	11590
4.	MAJOR SOIL TYPES	Loamy or Sandy Loam
5.	AREA UNDER PRINCIPAL CROPS	Paddy
6.	IRRIGATION BY DIFFERENT SOURCES (Area and numbers of structures)	
	Dug wells	-
	Tube wells/ Bore wells	1
	Canals	NIL
	Other sources	NIL
	Net irrigated area (ha)	3
	Gross irrigated area (ha)	106
7.	Numbers Of Ground Water Monitoring Wells Of CGWB (As on 31-3-2007) No of Dug wells No of Piezometers	 2
10.	PREDOMINANT GEOLOGICAL FORMATIONS	Bomdila Group, Miri & Buxa Fm; Gondwana Group; Siwalik Formations
11.	HYDROGEOLOGY	Consolidated formation, semi-consolidated and unconsolidated formations.

12.	GROUND WATER EXPLORATION BY CGWB (As on 31-3-2011)	
	No of wells drilled (EW, OW, PZ, SH, Total)	11
	Depth Range (m)	47.3 to 133.0
	Discharge (liters per second)	0.46 to 10.5
	Transmissivity (m2/day)	5 – 667 m^2/day
13.	GROUND WATER QUALITY	
	Presence of chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	Fe (0.14 to 0.78 mg/lit in springs) Fresh water
14.	DYNAMIC GROUND WATER RESOURCES (2009) in Ham	
	Annual Replenishable Ground Water Resources	13877.41
	Net Annual Ground Water Draft	12489.67
	Projected Demand for Domestic and Industrial Uses upto 2025	113.5
	Stage of Ground Water Development	190.8
15.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized Date Place No of participants	One. 30/12/2010 Naharlagun, A.P 168
16.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	Projects completed by CGWB (No & Amount spent)	Nil
	Projects under technical guidance of CGWB (Numbers)	During XIth plan, under the supervision of CGWB 1 artificial recharge structure amounting Rs. 9.53 lakhs completed, 13 structures are ongoing.
17.	GROUND WATER CONTROL AND REGULATION	
	Numbers of OE / Critical / Notified Blocks	Nil

1. INTRODUCTION

Papum Pare District covers a geographical area of 2875 sq. km in Lesser Himalayan zone and bounded by North Latitude 26°56′11″ to 27°35°44″ and East Latitudes 93°12′45″ E to 94°13′30″. It has borders with Lower Subansiri district in North, East Kameng District in the West. West Siang district falls in its eastern boundary while North Lakhimpur district of Assam is situated in the South.

Papum Pare district is divided into two sub-divisions viz., 1) Sagalee 2) Itanagar which is further divided into 4 blocks and 9 circles and 273 villages.

Total population of the district is 1,76,385 (as per 2011 census). Major part (75%) of Papum pare district is covered by thick forest which has sub-tropical, deciduous and humid type of vegetation. The low land and valleys are occupied by inhabitations. The land utilization pattern of the district is given Table 1.

Table 1: Land utilization pattern, (Area in Ha) 2003-04

Total Geographical area	Net area Sown	Area under current fallows	Fallow land other than current fallow	Other cultivated land	Cultivated land	Cultivated waste land	Land available for cultivation	Net cultivated land
2875	11590	2394	1470	1470	17618	4216	20934	27779

2. CLIMATE AND RAIN FALL

The Papum Pare district falls under mid tropical hill zone. Climate is wet and humid in the southern part of the district. Itanagar, Naharlagun and Doimukh experience severe hot weather during summer. During winter particularly in the Northern Mengio and Sagalee, the climate is cold with temperature falling below freezing point at many places. In the foothill areas winter is not as cold as in the other areas of the districts.

RAINFALL

Rainy season or monsoon season starts from May and continues up to September/ October. The average annual rainfall is 3200 mm.

3. GEOMORPHOLOGY AND SOIL TYPES

Papum Pare district is characterized by low to high relief hills and corrugated landform. The general trend of ridges is NE-SW and the Siwalik Hills form hogback topography. The height of the hilly terrain increases from south to north ranging from about 300 m to 2700 m above MSL. General altitude in major part of the district ranges from 1000 m to 2000 m above MSL. Various geomorphic features in the district can broadly be grouped into following six geomorphic units.

High relief structural hills: Altitude ranges from 1000 to 2000m..
Structural Hills: These structural hills are found further east in Sagalee-Doimukh section where Lower Gondwana rocks are exposed. Gondwana rocks also observed along Kimin-Ziro road section to give rise their characteristics geomorphic signature.
Low relief structural hills: These hills show deep valleys and gullies with gently sloping land developed due to stream or river erosion. Height restricted to 1200m.
Dissected and highly dissected hills: This unit occurs in the central and southeastern part of the district. The hill ranges vary between 300 to 700m and locally to 1000m.
Intermontane Valleys: The broad valley between Naharlagun and Nirjuli represents this unit filled with Quaternary sediments.
Piedmont: It occurs as nearly flat to gently sloping surface sloping southwards, covering a large area towards the foothills. Area around Harmuti, Banderdewa, Holangi represnts this unit and mostly occupied by Quaternary sediments.
Alluvial plain: It occurs along the wide flood plain areas of Pachin and Dikrong rivers. It represents various sub-features, viz., palaeochannel, swampy/marshy land, river terraces, flood plains, point bar, channel bar, and river channel.

Soils

The soil developed in each physiographic unit has their distinct morphological and other related properties. It indicates a good soil-landform relationship in this region. The soils in the valley areas are sandy loamy in texture with high acidic content. The pH values ranges between 4.5 to 7.2 and also rich in organic matter 0.8 to 5.2.

Drainage System

The drainage density is high and the pattern is generally sub-dendritic to sub-parallel. Each geomorphic unit has its own drainage pattern.

The district is a part of Brahmaputra river basin. The main rivers of the district are Dikrang, Pachin, Panyar, Pare, Kimin and Kud. The Dikrang, a perennial river is a fifth order stream with a total catchment area of about 2000 sq. km. of which about 1100 sq. km. lies in the Himalayan terrain. The length of the master channel in the alluvial terrain is about 48 km. The South – Westerly flowing Dikrang river meets the eastern flowing Pachin Nala at south of Doimukh and then it flows a meandering easterly course upto the locality west in Harmutti T.G. and then southerly up to Banderdewa and finally it flows southerly along a meandering course to meet Subansiri river at Bedeti.

4. GEOLOGY

Geologically, Papum Pare is underlain mostly by Siwalik group of rocks in the central, southern and southwestern parts being separated from narrow and elongated (east-west to northeast-southwest) tract of Gondwanas in the north by Main Boundary Thrust (MBT) fault that follows the trend of Gondwana sedimentaries. The Siwalik range trends NE-SW, except in the Banderdewa area, where it is ESE-WNW.The western and northern parts of the district are occupied by metamorphics like gneiss, schist, phyllite, quartzite etc. The valleys are characterized by Quarternary alluvium and terrace deposits (boulders, gravel,

pebble, sand, silt and clay. They are locally folded, jointed and fractured.The foothills are composed of Older Alluvium (piedmont deposits) underlain by sandstone, shales and boulders/ pebbles of Siwalik formation. The foothill piedmont zone occurring on the south of Siwalik hills have contact with the Brahmaputra flood plain. The entire older metamorphic formation of Paleozoic is overthrusted over the Younger Tertiary Siwaliks and demarcated the lower boundary of The Gondwana Group.

5. HYDROGEOLOGY

Ground water is available in all geological formations in the district depend in upon their primary and secondary porosities. Hydrogeologically Papum Pare district can be divided into three distinct categories viz., (1) Consolidated formation (2) Semi-consolidated formation and (3) Unconsolidated formation.

Consolidated formation: Hard and compact metamorphic rocks of Precambrian to Upper Paleozoic ages occupy northern part of Papum Pare district. It comprises rocks of Ziro and Bomdila Groups and hard compact sandstones of Gondwana Group. The southern boundary of consolidated formation is marked by the Main Boundary Fault (Thrust). The units occupy more than 50% of the total area of Papum Pare district and are confined to the central and northern parts of the district. Ground water emerges out in the form of springs along the fractures at lower points. The movement and storage of ground water is restricted to the limited areas and as a result, the springs dry up during lean period. Discharge of springs ranges from 0.10 to more than 90 lps during post monsoon period.

Semi-consolidated formation: The central and southern foothill zones constitute rocks of sedimentary origin and are generally semi-consolidated in nature. The Siwalik group of Tertiary age comprises loosely cemented boulders, sandstones and occasional clay bands and is exposed on the southern side of the Main Boundary Fault. The development of springs is limited and surface runoff is less compared to that in the consolidated formation. Discharge of springs ranges from 0.43 to 2 lps during pre-monsoon period and from 0.02 to 2.4 lps during post-monsoon period. But, most of the springs become dry during dry season because of low water holding capacity of the highly permeable fractured/ jointed formation. Generally, depth to water level in the semi-consolidated formation ranges from 1-5 m bgl. Central Ground Water Board has constructed a few deep tube wells in Kimin – Lekhi – Balijan section upto a depth of 80 to 120 m. Yield of the wells very from 10 to 30 m^3/hr for a drawdown of 9 to 15 m. Large diameter dug wells of 5 to 8 m depth in the bouldery formation or in the weathered sandstone beds are expected to yield good discharge of around 15m^3/day.

Unconsolidated formation: Unconsolidated alluvial sediments are found in the foothill belt (Bhabars) and the intermontane valleys. Even though thickness of the alluvial cover is less it has good prospect for ground water development by shallow ground water structures.

Unconsolidated sediments are found in Dikrang river valley. The depth to water level in the valley is in general 2-4 m bgl in pre-monsoon period. and 2-5 m bgl in post-monsoon period).

Seasonal fluctuation of water level in shallow aquifers as observed in dug wells is within 2 m. Yield test suggests the feasibility of 6-7 m deep dug wells in the valley with yield prospect of 42-63 m^3/day for 3-5 hours of pumping in a day. CGWB constructed seven deep tube wells in Banderdewa, Karsingsa, Nirjuli, Emchi, Lekhi and Naharlagun. Except the tube wells in Lekhi all other tube wells were constructed in loose sediments in the valley. Tube wells of 60-70 m depth are expected to yield 15-35 m^3/hr for a drawdown of 6-18 m. Tube wells in Doimukh and Nirjuli area are found to be in artesian (flowing) condition.

6 GROUND WATER RESOURCES

Ground water resources estimation of the district is done based on GEC'97 methodology. Rainfall Infiltration Factor (RIF) method is applied for computation.

Ground Water Resource potential of Papum Pare district (in ham)

Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for Domestic & Industrial	Existing Gross Ground Water Draft for all uses	Allocation domestic & industrial requirement supply up to 2025	Net annual ground water availability for future irrigation development	Stage of Ground Water Development (%)
12489.669	57.50	56.00	113.50	190.80	12241.366	0.909

Ground Water Development in the study area is only 0.909 % and it falls under safe category. Therefore, Papum Pare district has high prospect for ground water development in the valley and foothill areas.

7. SPRING WATER QUALITY

The spring water of Papum Pare District is slightly alkaline with low dissolved solid content; soft and generally concentration of all the chemical parameters in the spring water are within permissible limit. However, slightly higher concentration of Cl and SO_4 in the water from two springs of Naharlagun area, viz., Barapani and D-colony are indicative of some degree of pollution. Abnormal concentration of Cl may result due to pollution by sewage wastes, salting for certain types of trees like coconuts and leaching of saline residues in the soil.

8 WATER DEVELOPMENT AND MANAGEMENT

PHED, AP is supplying water in Papum Pare district by tapping surface water sources. The poor ground water development in this district is mainly due to lack of agricultural practices using modern techniques and also due to excessive dependence on

surface water for drinking water supply or locally by tapping springs. Moreover, construction of ground water structure like tube wells in this hilly terrain is difficult and in most of the places of the district it is impossible due to approachability problem till date. There is immense scope for the same in the valley and foothill areas, which will boost agriculture and ultimately the state economy.

In this district agricultural practice is mainly depend on monsoon rainfall. Most peoples who are engaged with agriculture are unaware of doing agriculture or horticulture in the lean period by using ground water. In the valley or foothill areas where construction of ground water structures like large diameter dug wells or tube wells are feasible, farmers should be encouraged to adopt the practice of cultivation by using ground water structures at least in which months there is scarcity of rain or surface water. Moreover, in the hilly part of the district, perennial springs are only utilized for drinking or other household purposes only. For this, only a part of the spring water is utilized and rest part is allowed to pass away. This excess water may be tapped fully by constructing collector chamber and then allowed to pass through horticultural field which not only reduce the soil erosion but also recharge the ground water as well as meet the water requirement of the horticultural field in the lean period also.

9. Water conservation and artificial Recharge

The entire district is occupied by rugged terrain and it is having hilly and valley portion. There is a limited scope of ground water development in hilly terrain and the scope of recharge in hilly terrain requires a rigorous study. Rainwater can be harvested for drinking water supply.

During XIth plan, under the supervision of CGWB, 1 artificial recharge structure amounting Rs. 9.53 lakhs has been completed, 13 structures are ongoing.

10. Groundwater Related Issues and Problems:

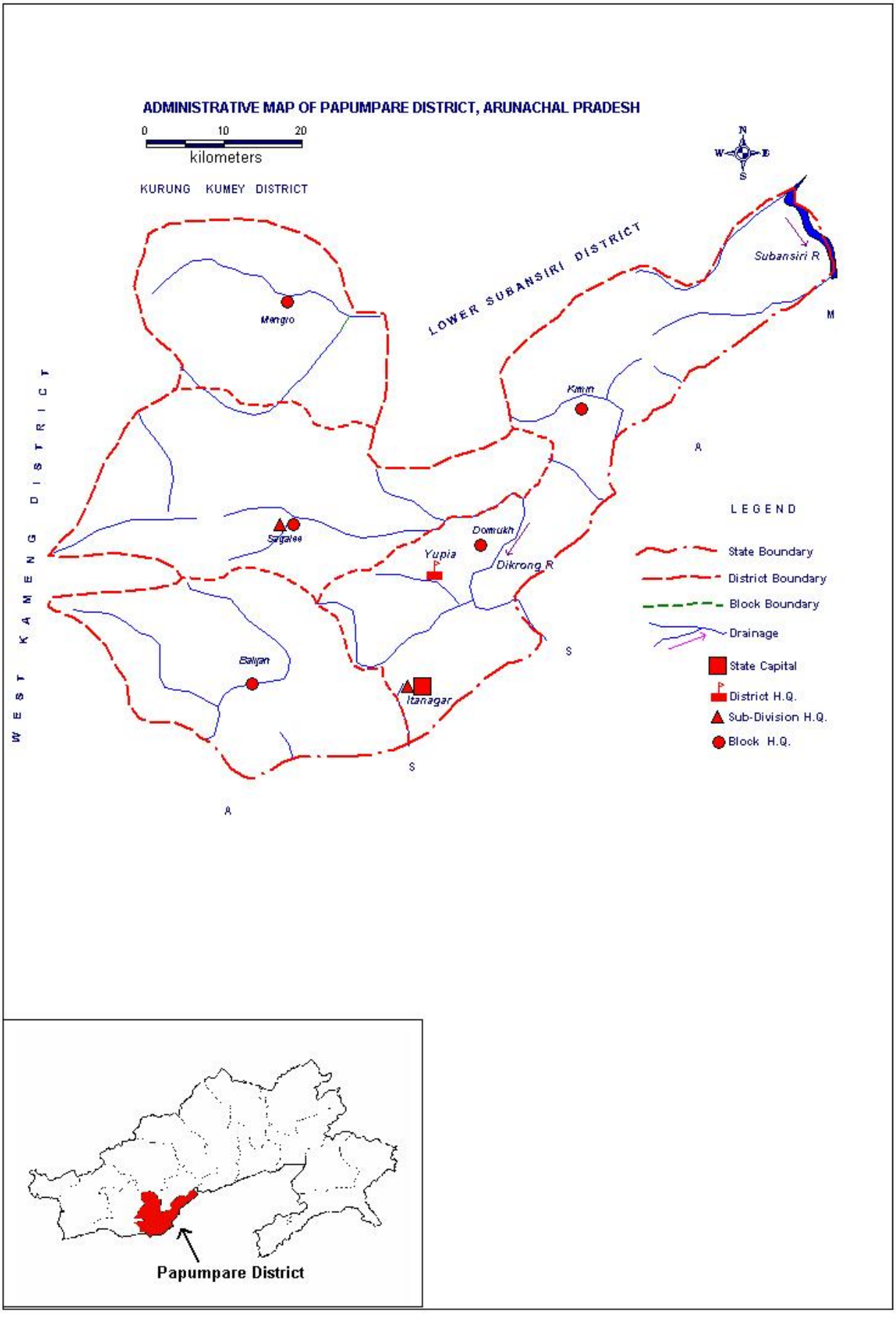
There is no such problem related to groundwater. Sometimes at some locations iron content in groundwater is more than the permissible limit, otherwise groundwater is fresh and portable and may be used for domestic, irrigation and industrial needs.

11. Awareness & Training Activity:

One mass awareness program has been conducted in Naharlagun, Papumpare district, Arunachal Pradesh.

12. Recommendations:

1. Springs should be developed and managed judiciously.
2. The sumps / collector structure in springs should be well protected from surface contamination
3. Geophysical surveys should be carried out the valleys underline by the semi-consolidated formation to delineated water bearing formations / zones for construction of dug wells and shallow tube wells in this area.
4. Roof top rainwater harvesting should be practiced in the hilly area and surplus rainwater can be conserved to mitigate the drinking water problem during lean period. When springs discharge drops considerably.


ADMINISTRATIVE MAP OF PAPUMPARE DISTRICT, ARUNACHAL PRADESH
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KURUNG KUMEY DISTRICT
LOWER SUBANSIRI DISTRICT
WEST KAMENG DISTRICT
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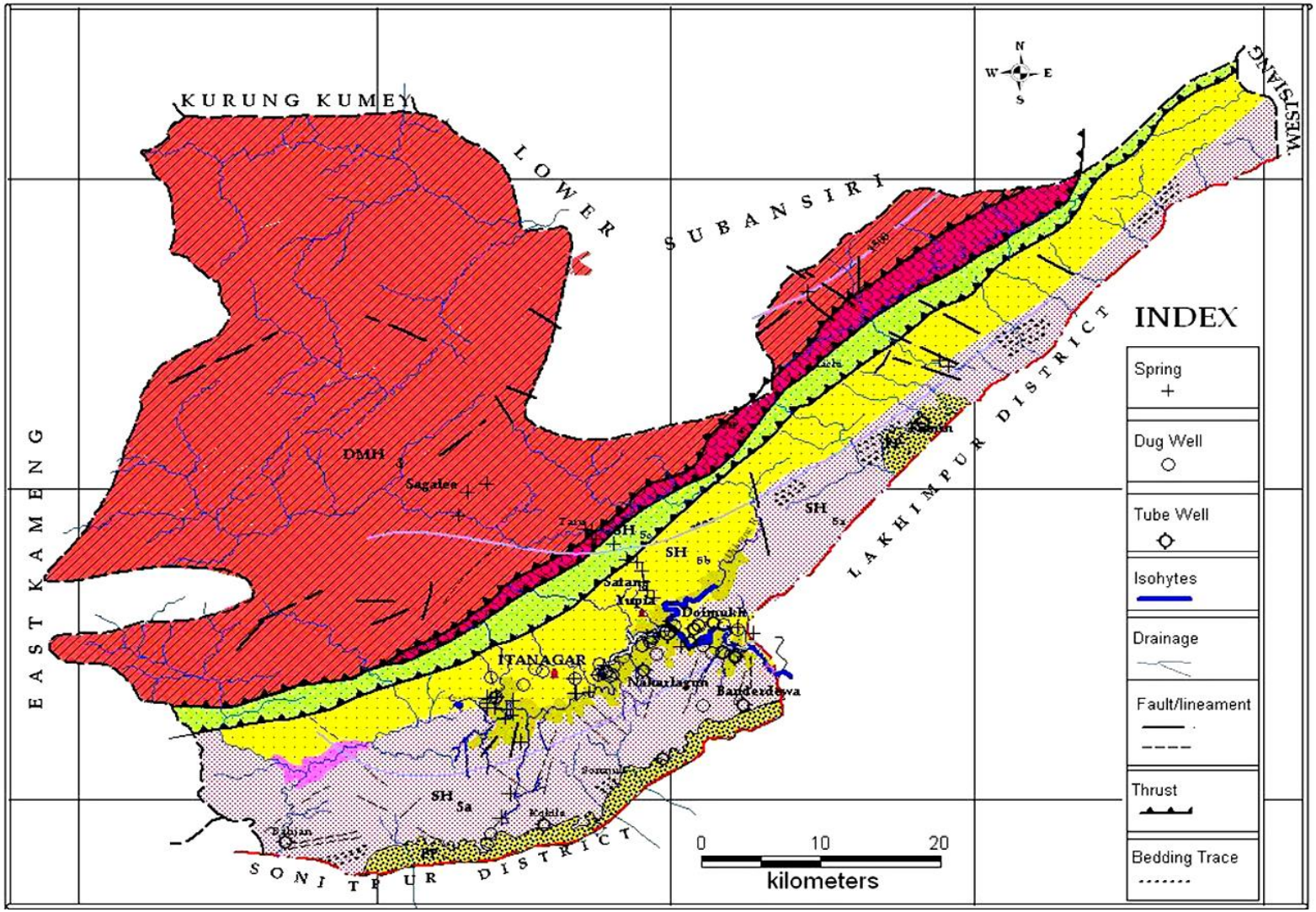

Fig. 1: Hydrogeological Map of Papum Pare District, Arunachal Pradesh

LEGEND						
MAP UNIT		**GEOMORPHIC UNIT**	**LITHOSTRATIGRAPHIC UNIT**	**LITHOLOGY**		**GROUND WATER PROSPECT**
	FP6	**Flood Plain**	**Alluvium and terraces (Recent)**	**Primarily loose sediments like gravel up to pebble size, sand, silt with occasional clay**	**Unconsolidated**	**Good prospect, dug wells with yield of more than 40-60m^3/day, deep tube wells with yield of 15-45m^3/day.**
	PP6	**Piedmont Plain**	**Alluvium (Recent)**	**Fan deposits consisting of boulder, pebble, cobble, granule, sand and minor silt/clay**		
	IV6	**Intermontane Valley**	**Valley fill with little alluvium**	**Granule, pebble, sand with little clay.**		**Good prospect, dug wells with yield 40-50m^3/day, shallow tube wells with more than 20m^3/hr. yield. Moderate prospect large dia dug wells and hand pumps feasible.**
	SH5A	**Dissected & Highly Dissected Structural Hills**	**Kimin Formation**	**Alternations of soft friable sandstone, thin lenses/beds of silt and clay, and gravelly (conglomerate) beds.**	**Semi-consolidated**	**Good prospect, large dia dug wells tapping the weathered zone with yield more than 15m^3/day, deep tube wells with 10-30m^3/day yield possible.**
	SH5B		**Subansiri Formation**	**Salt and pepper appearance, soft, massive sandstone with minor shale and clay. Sandstones often contain calcareous concretions, and disseminated pebbles and/or pebbly layers.**		
	SH5C	**Low Relief Structural Hills**	**Dafla Formation**	**Grey micaceous sandstone with intercalated shale and silty clay beds. Sandstone is moderately hard and compact.**		
	SH4	**Structural Hills**	**Lower Gondwana (Lower Permian)**	**Dark grey to black shales, slates, sandstone and siltstone with coaly material, pyritous slates, phyllites, sandstone and grey shales**	**Consolidated**	**Very poor prospect, large dia dug wells feasible in weathered zone, spring development to be emphasized.**
	DMH	**High Relief Structural Hills**	**Bomdila Group, mainly schists (Precambrian)**	**Mica schists, chlorite schist, phyllite, quartzites**		