

CHAPTER - V

CENTRAL ALLUVIAL PLAIN

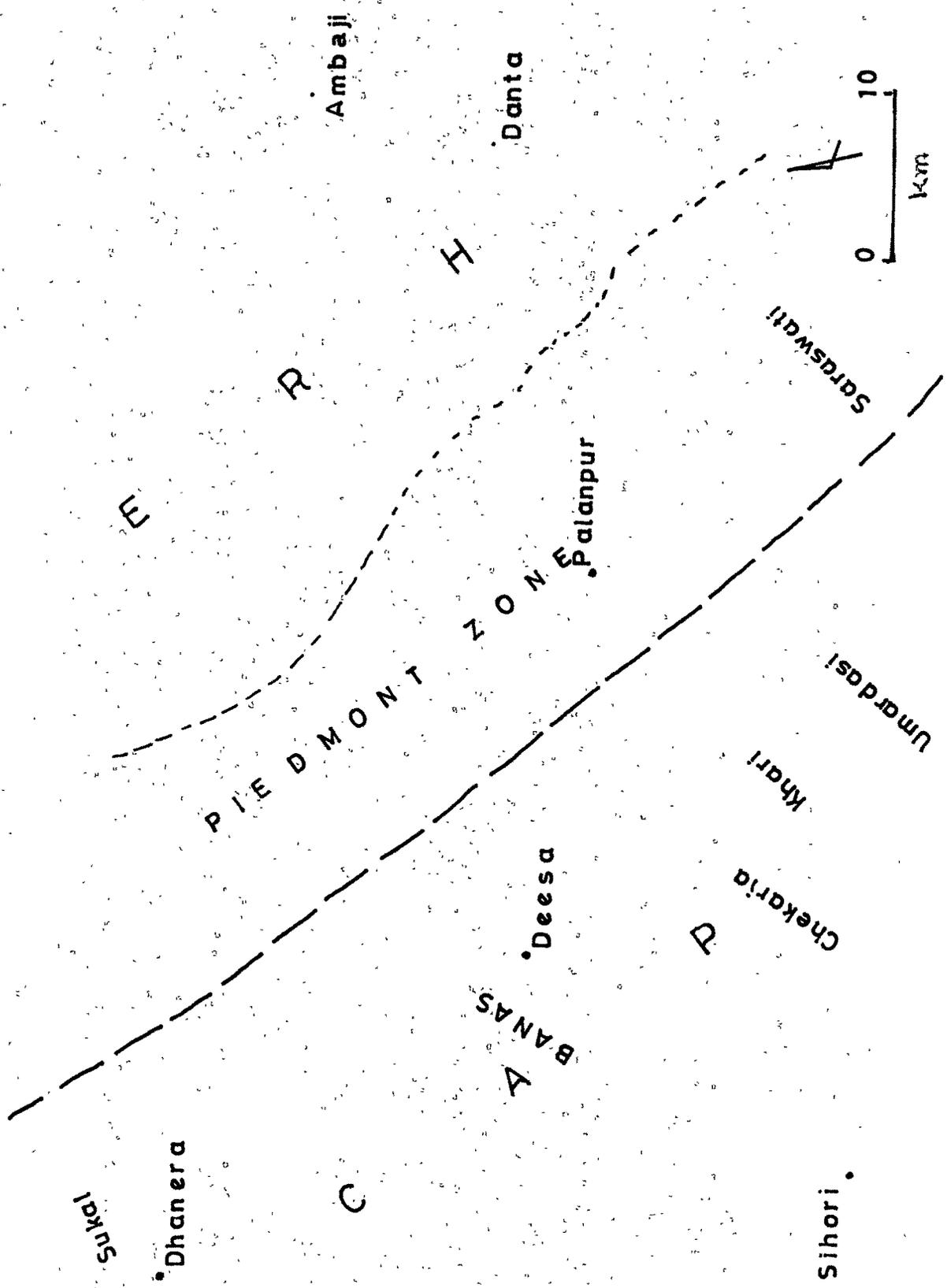
GENERAL

The geoenvironmental unit of Central Alluvial Plain (CAP) occupies the median portion of the district bounded by NNW-SSE limits to the east and west. It extends southward into the Mehsana district and gradually goes beneath the desert sands of Jalor district (Rajasthan) to the north (Plate 5.1). It characteristically forms a very distinct geomorphic unit exhibiting a unique landscape, made up of a gently sloping alluvial plain dotted with cappings of aeolian accumulations. The plain, occupying an area of about 4800 sq km sharing 38% of the district area exhibits its own geoenvironmental features and parameters. The ground very gradually slopes from east to west drained by the rivers of Banas, Umardasi and Chekharia in its southeastern part while the river Baragoan, Sukal(ReI), peplu, Ven, drains the northeastern part of the unit. The western and northwestern part of the unit are marked by the sand dunes, stabilised as well as shifting, and are more or less the precursors of the desolate landscape that lies to the west (Plate 5.2).

Though from the point of view of topography this unit gives an impression of being uninteresting, but when examined in detail, it is found to point out almost all geoenvironmental factors that furnish a wealth of data and information.

TERRAIN ATTRIBUTES

By and large, this geomorphic unit is made up of depositional landforms mainly flood plain deposits of Banas and a few other rivers (the latter more or less stand destroyed today). The alluvial plains are overlain by aeolian deposits.



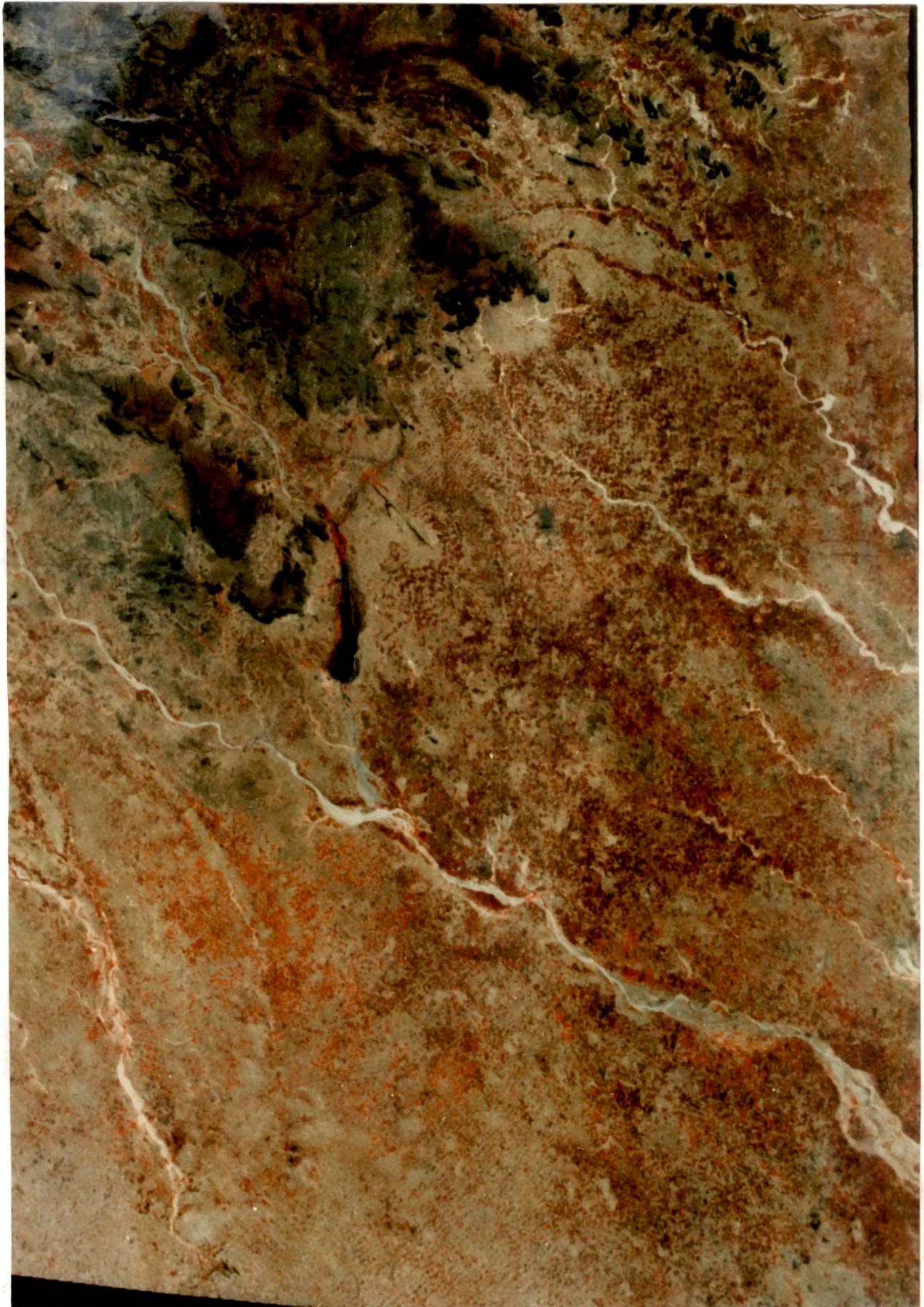


PLATE 5.1 SATELLITE VIEW OF CENTRAL ALLUVIAL PLAIN (CAP)

LANDSCAPE

The landscape of the CAP Unit represents a typical fluvial plain dotted by aeolian deposition. The various, terrain features typical of the landscape are topography, landforms, drainage and soil types etc. have been briefly described hereunder.

TOPOGRAPHY

The overall topography is rather monotonous and consists of a gently undulating landscape with the mounds of dunal sands imparting a certain amount of unevenness. The plain progressively slopes down from east to west and shows a drop of about 150 m over a distance of 100 km. Except for the major river Banas in the southeast, the area is almost devoid of any significant river channels, except a few short drains in the eastern part (Fig 5.1). From the point of view of topographic diversity, this unit can be divided into 3 sub-units:

1. Southeastern part; between Baragaon and Banas rivers.

The average altitude varies between 140-200 m. The topography comprises alluvial plain dotted with sporadic dunal sands and inter-dunal drainage. The area is quite fertile and has a well developed lift irrigation.

2. Southern part; lying south of the Railway line joining Deesa to Deodar.

It is very gently sloping, dominantly fluvial plain comprising the most fertile portion of the district. It has the advantage of river flows of Banas, Chekaria and Umardasi. The area has good irrigation facilities, of canal as well as groundwater lift.

3. Northwestern part between Deesa-Dhanera railway line and Deodar-Tharad-Sanchor road.

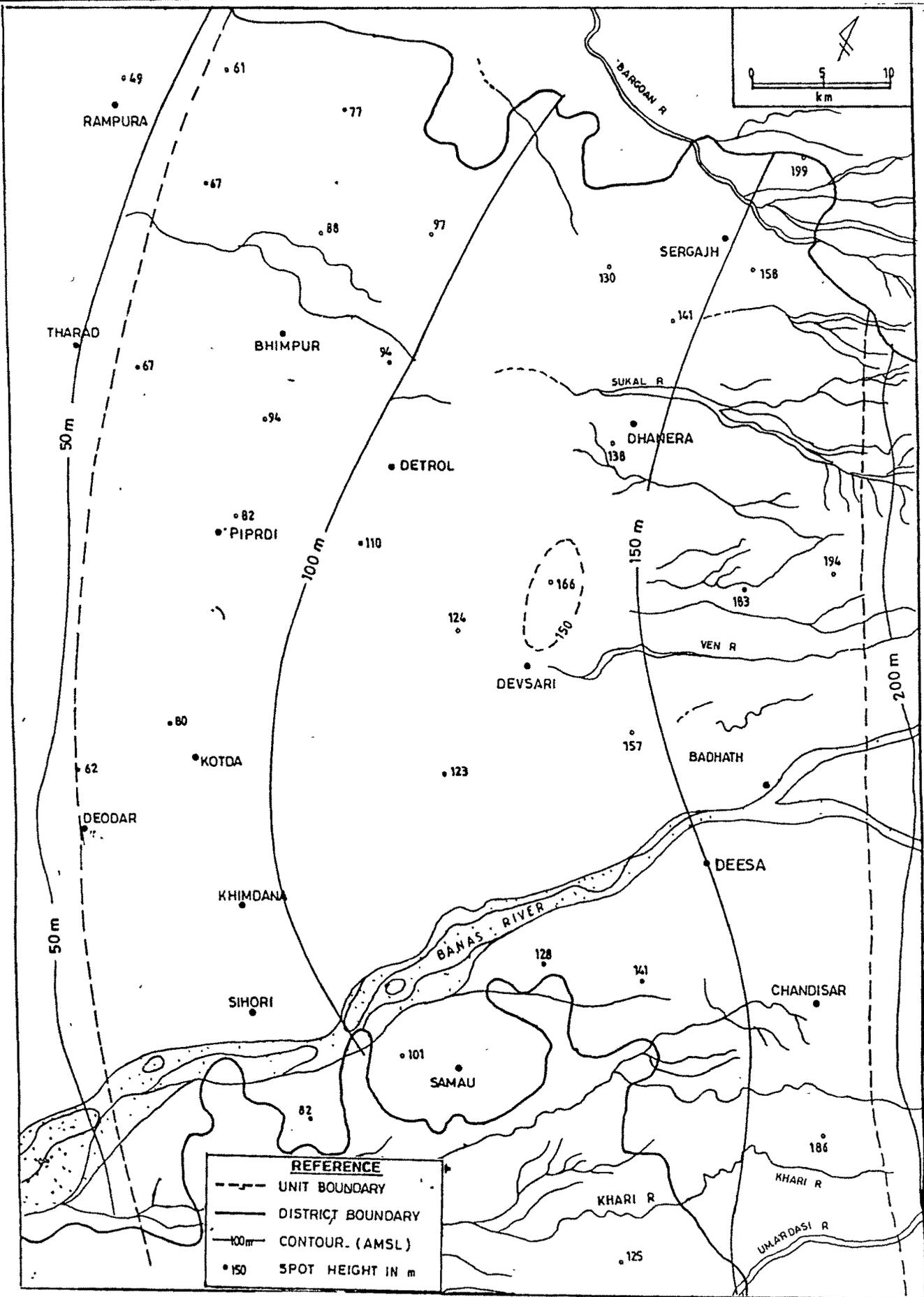


FIG. 5.1 PHYSIOGRAPHIC MAP OF CAP UNIT

This portion provides a typically mixed landscape gently sloping alluvial plain with increasing overlying sand cover northward. The sands mostly are unconsolidated mark the southern fringe of the Thar desert.

LANDFORMS

The alluvial landscape of the CAP shows an interesting assemblage of landforms. It is characterised by a topography marked by abundant high projecting stabilized sand dunes. These dunes have more or less covered the pre-existing older alluvial plains that are seen exposed at lower elevations at a number of places. Ideal exposures of alluvial plains are seen in Banas sections between Deesa and Sihori (Plate 5.3). The eastern parts of the CAP and western part of ERH have considerably eroded down the aeolian dunal landforms and the reworked sands have been deposited in their immediate bank areas. The reworked aeolian material forms the youngest fluvial landforms. In this respect the Central Alluvial Plain reveals an interesting chronology of landform evolution providing a good example of a composite landscape.

The eastern half of the unit is marked by high rising dunes which gradually merge in those of piedmont zone of the ERH. The dunes rise about 30 to 50 m in height from the surrounding low ground. The dunes have been extensively dissected by the numerous streams and rivers flowing from the ERH. These streams have developed ravines due to gully erosion and as the loessic sands are prone to quick flow (Bell, 1980, 1983) large-scale fluvial load is transported by these streams. The bed gradient of the streams in the CAP becomes gentle and the flow velocity gets progressively reduced westward. An appreciable part of the water flow also gets percolated down through the highly permeable nature of the bed formation. Thus, flow water quantity also gets reduced and all this



Plate 5.2 An aerial view of the dunal topography in CAP as viewed from Santhal overhead tank on Deesa-Tharad road.



Plate 5.3...Broad sandy bed of Banas and cliffs section older alluvium. (Loc. near Deesa).

causes progressively increased deposition of the fluvial sand. The bed load deposition blocks up the flow course and the streams either meander or develop braiding. Further downstream, the area has a thicker deposition of dunal sands. The erosion of dunes along the stream courses have created flat bottom wide open linear (NE-SW) depressions. The series of parallel erosional depressions filled up with fresh (reworked) deposits have produced a mixed landscape of high aeolian dunal complexes with interfluves aligned in a NE-SW direction. This geomorphic feature is typically a product of the influence of the drainage originated in Aravalli and drained by the precipitation in the ERH unit.

The western half is characterised by a complex pattern of rolling topography of sand dunes. The dunes are all stabilized and there is a good cover of soil formation over them with a scrub vegetation. The flat and gently sloping portions have been developed into cultivated fields. Low rainfall and highly permeable soils of aeolian sands hardly produce any surface runoff to create drainage lines. On the steeper slopes of the dunes, sporadic drainage lines have developed they run for a couple of kilometers and then disappear in the sandy plain (Plate 5.1), most of which have been bunded and converted into ponds by villagers to create local source of water supply. Such drains are of recent origin, post-dating the dunes, and controlled by the local topography.

The Banas-Sipu confluence point at Bhadath, just 5 km north of Deesa marks entry point of river Banas in southern part of this unit. The river maintains its identity throughout its traverse within the unit on account of a large discharge. The area of about 10 to 20 km width on both sides of Banas all along its course through the CAP is marked by fluvial plains. The dunes are almost absent in the vicinity of Banas valley. A few formed, might have been eroded away by the river floods and its shifting course.

Interesting landforms has been developed by Banas all along more or less in its straight course. The convex sides of the curves show large scale bank erosion forming cliffs whereas the opposite concave sides show sediment deposition in form of flood terraces of different levels. The cliff height in the eastern part is found to be maximum, upto 19 m near (Plate 5.4). Deesa which gradually decreases and in the western part it is as low as 4 m near Bodal. The river shows evidences of course migration leaving old channels on the sides. Study of the SOI Toposheet (1:50,000) and satellite imagery (IRS IA, March 1990) clearly reveals the river shifts a zone of within 3 km to 6 km width. The bank height of the river course when traced from east to west reduces, bed deposition increases with migration sweeps. The erosional side of the river banks show formation levee deposition of 3 to 6 m height with varying width between 2-5 km for a length of 5 to 15 km on its bank. The outer slope of the levee bank is about 1:500 to 1:1000.

Thus, in respect of landform development, the Banas river is marked by a wide variety within this unit, significant from the view point of geological environs and water resource regime. High floods, maximum groundwater recharge, sediment deposition, (terraces, levee, shoal etc.) course migration are common.

DRAINAGE

Almost all the major drain derived from the ERH unit, broadly is divided into two; as the areas to the north and south of Banas. Baragaon, Sukal, Peplu, Ven in the north have well defined drainage pattern only in a limited area of 10 to 20 km strip along the eastern border. The Bhildi-Dhanera railway line approximately mark limit of the drain. Chekaria and Sukhana in the south are the tributaries of Banas. Umardasi in the southeast corner flowing for short length in the unit meets the Saraswati.

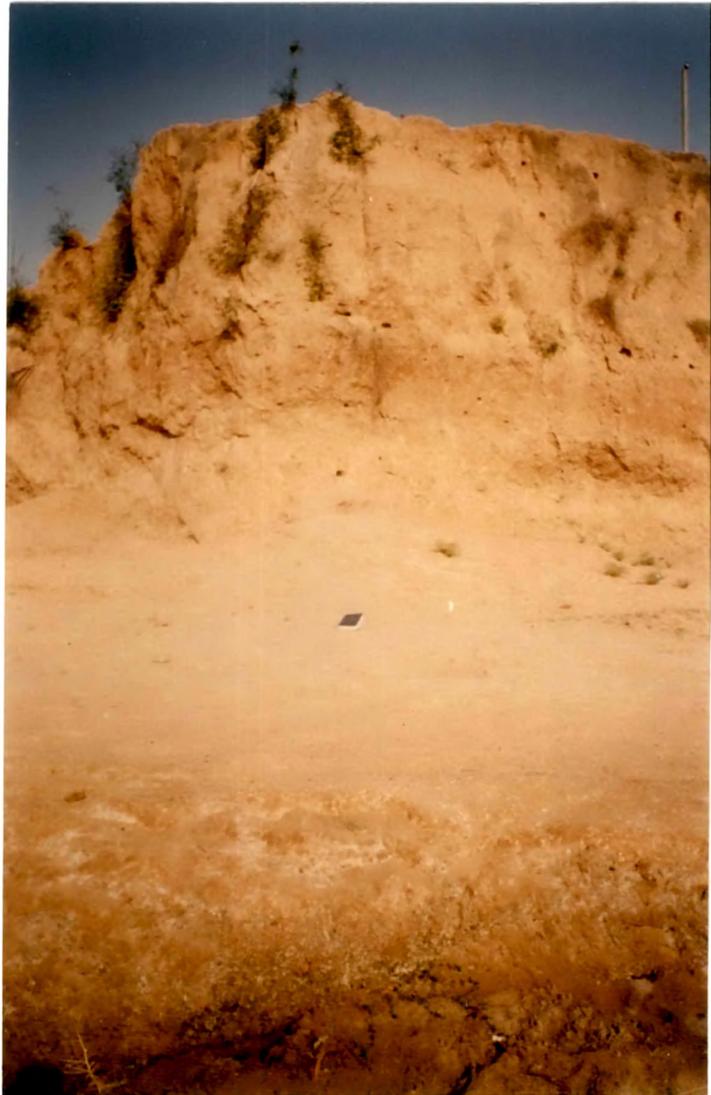


Plate 5.4 Cliff section (10 m) of Banas through older alluvium (Loc.near Deesa).

Almost all these streams and rivers flow from northeast to southwest following Delhi strike. Except for Banas, no significant impact is there on the topography by other rivers and the secondary drainage has developed without any gully erosion.

Baragaon river flows for few km within the district, enters northwestward into the Jalor district of Rajasthan. Sukal (Rel) flows mostly due west for about 15 km. Initially it meanders and forms a channel of almost 1 km width; then narrows down near Runi after which it disappears within the dunal topography. Towards south occur small streams like Ven, Peplu and Laxmanpura nadi which originate from Viruna, Dhanwada and Pamru villages respectively. Interestingly, it is observed that except the major river of Banas, all the other smaller rivers, draining from ERH unit flow for maximum distances of around 25 km through this unit and then disappear (Fig 5.1).

River Banas forms the major river for this unit. After its confluence with Sipu, it considerably broadens its course. The width however fluctuates between Goliya and Najupura Mota, and is marked by high cliffs in the eastern part and low banks in the western part. The cliff height decreases in downstream areas. The river bed is all throughout sandy and supports little water, except in monsoon. Well developed and conspicuous erosional and depositional landforms like flood terraces, levees and ravines are recorded on either bank of the river (Plate 5.5). The river shows broadest bed width within this unit (Plate 5.6).

The study of satellite imagery (1:250,000 and 1:50,000) and 1:50,000 SOI sheets of the study area show the relicts of the previous drainage network in the form of buried channels, ox bow lakes, abandoned channels and discontinuous streams.



Plate 5.5 A river section of Banas through older alluvium near Deesa. Recent sand in the foreground



Plate 5.6 River Banas showing broad shallow sandy bed (Loc. near Bodal)

(Plate 5.1). There are strong possibilities of their channels lying buried beneath the aeolian sand cover. The SW and WSW trends of these streams show a conformity with the channel courses of Banas, and could be belonging to the destroyed drainage system (Ghosh 1979, 1982 and Sridhar 1995).

Umardasi river flows for about 22 km in this unit before it merges into Saraswati river. A distinct flood terrace of about 3 sq km areal extent is seen developed along its bank, rising 2-3 m above the present water bed.

SOILS

Soils derived from aeolian, aeo-fluvial and mudflats are developed and represented by Inceptisols and Entisols orders. Ocrepts (Inceptisols), Psammments and Fluvents (Entisols) are well developed sub orders within this unit.

The major constraints for the soil formation and diversity in this unit are imperfect drainage, flooding, salinity and erosional activities of water as well as wind. The soils on different landforms vary widely in their characteristics. Dominant soils are very deep, somewhat excessively of well drained and fine-loamy to sandy in texture. According to the taxonomic classification of Sharma *et. al.*, (1994), the soils of the unit fall under Typic Ustocrepts, Typic Ustifluvents and Typic Ustipsammments (Fig.5.2 and Table 5.1).

The soils of the gently sloping topography of the unit are characterised by slightly to moderately alkaline, moderately to strongly calcareous coarse loamy/sandy soils with low AWC. The dominant soils are very deep and to some extent saline. These soils have been classified as Typic Torripsammments, and Aridic Ustochrepts (Sharma *et. al.*, 1994). Salinity and sodicity increases towards the parts adjoining to WSW unit.

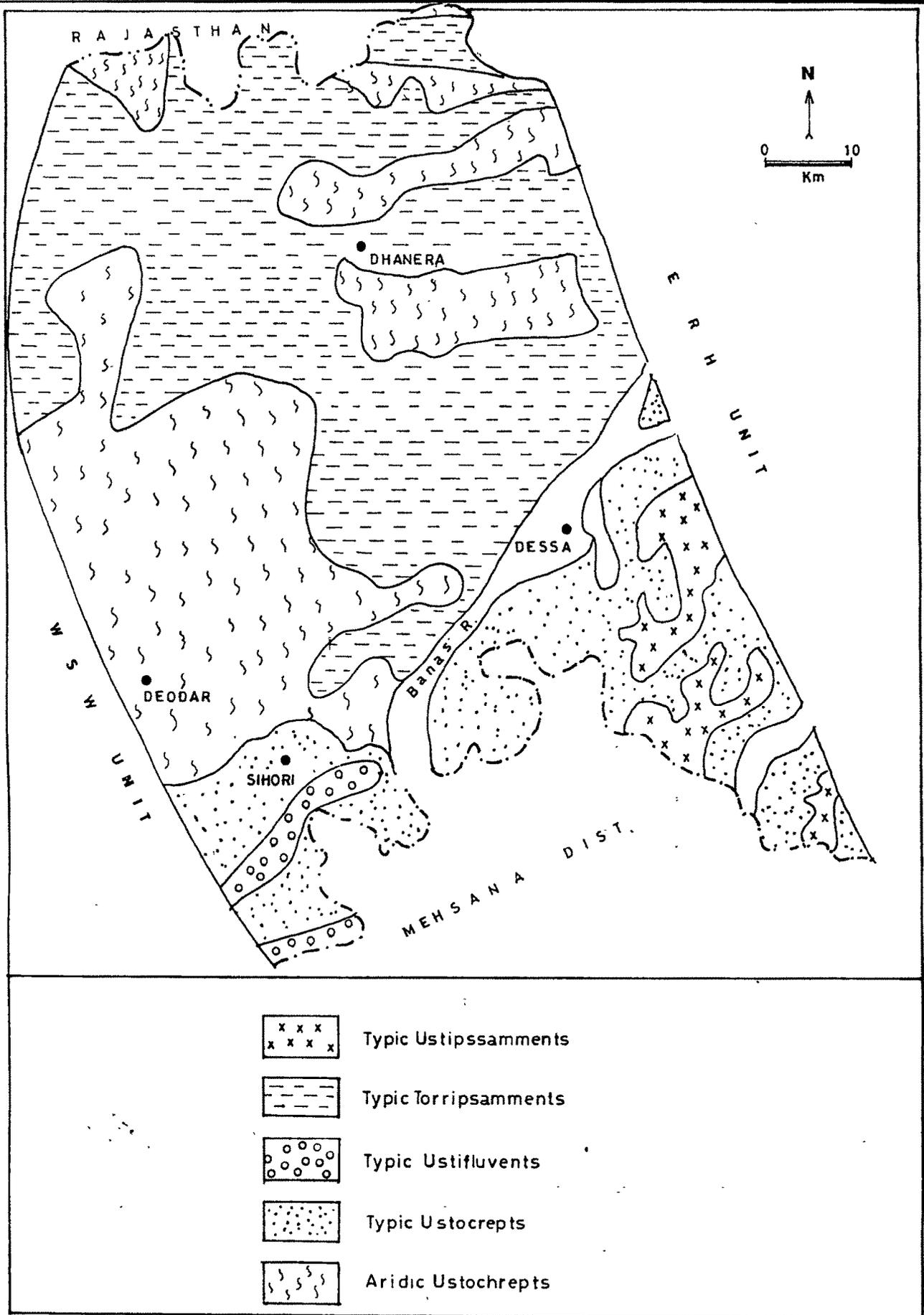


FIG. 5.2 SOILMAP OF CENTRAL ALLUVIAL PLAIN

Table :5.1 Taxonomic soil classification of the Central Alluvial Plain.

| Order | Suborder | Greatgroup | Subgroup | Description |
|-------------|-----------|----------------------|------------------------|---|
| Entisols | Psamments | Usti- psamments | Typic Ustipsamments | Very deep calcareous sandy coarse to fine loamy soils. |
| | | Torri- spsamments | Typic Torripsamment | Very deep calcareous coarse loamy to fine loamy soils. |
| | Fluvents | Ustifluvents | Typic Ustifluvents | Very deep coarse loamy calcareous with strong sodicity and salinity. |
| Inceptisols | Ocrepts | Ustocrepts | Typic Ustocrepts | Moderately Deep to very deep fine to coarse loamy soils with moderate sodicity and strong salinity. |
| | | | Aridic Ustochrepts | Very deep to deep calcareous soils usually associated with stabilised sand dunes. |

GEOLOGY

Geologically, the surface cover of the unit is rather monotonous in the sense that most of its exposed areas as well as stream and river sections are seen to consist of unconsolidated late Quaternary sediments. These are all products of alternating fluvial and aeolian depositional processes, essentially climate related phenomena. A large part of the surface consist of pedogenic fluvial sediments over which rest the aeolian sands as dunes, ridges and sheets. These aeolian phase is primarily responsible for the undulating topography of the area. These late Quaternary sediments form the uppermost part of the Cambay basin Cenozoic sequence, broadly lying between the two basin boundary faults. Whereas, the margin of this unit to the east more or less coincides with the Eastern Cambay Basin Margin Fault (EMCBF), the western limit does not show any direct manifestation on the surface of the Western Cambay Basin Margin Fault (WMCBF). But a

possibility of the latter coinciding the boundary of the two units (ERH-WSW) is quite likely (Fig. 2.4). The marked geomorphic change of this unit westward into the saline wasteland could be a reflection of the reactivation of the WMCBF.

The Quaternary deposits of Mainland Gujarat including the main bulk which is unexposed, according to Chamyal and Merh (1992) comprise a thick sequence of fluvial sediments marked by a number of depositional breaks and periods of non-deposition (Table 5.2).

Table :5.2 Exposed Quaternary sediment profile in the alluvial plains of Gujarat.

| Deposition | Thickness (m) |
|---|----------------------|
| Fine non-calcareous sand | 3.30 |
| Fluvial sandy silt bleached and rubified | 1.60 |
| Carbonate crust | 0.6 |
| Calcareous aeolian silt | 1.7 |
| Fluvial sandy silt bleached and rubified | 2.3 |
| Carbonate crust | 0.6 |
| Fine noncalcareous sand | 1.7 |
| Gravel noncalcareous sand | 3.7 |
| Finely laminated mud with alternating marly bands | 4 |
| Stratified gravel | 6 |
| Sand/Mud | 3.7 |
| Unstratified gravel | 7 |
| Basal mottled clay with | 3 |
| Carbonate pipes | - |
| Based not Exposed | - |

It has now been established that the various rivers which were responsible for the deposition of this continental sequence today stands considerably disrupted, and the older rivers have been modified and partly destroyed. Sridhar et. al. (1995) have, on the basis of the exposed sections in the Sabarmati and Banas river with help of bore hole data, given a stratigraphy for North Gujarat (Table 5.3), of which only the uppermost part is exposed in the Central Alluvium Plain.

Table 5.3 Stratigraphic sequence of the exposed Quaternary sediments in North Gujarat.

| Formation | Member | Lithology | Depositional Environment | Average Thickness m |
|-----------|-----------------|---|--------------------------|---------------------|
| Mahudi | Ogadpura Member | Dunal sands, fine grained with quartz and mica flakes. No sedimentary structures. | Aeolian | 3 |
| | Deesa Member | Fine to medium grained silt, loess like structureless, porous, homogenized and stabilized. | Aeolian | 4 |
| Saroli | | Coarse sand and mud with lenses of gravel chiefly comprising quartz grains, felspar and rock fragments with interlensing of silt, sand and mud. Gravel lenses show cross bedding. | Fluvial | 10 |
| Hirpura | | Red, reddish brown silt, unconsolidated composed of sub-angular quartz grains. Calcareous nodules present in the basal part, concentration increasing downwards. | Fluvial | 8-10 |
| Lakroda | Sindari Member | Gravel, consolidated comprising quartz, felspar in a calcium carbonate matrix, overlain by laminated mud, chiefly comprising fine gravel quartz. | Fluvial | 5-10 |
| | Valasana Member | Gravel, consolidated with clasts of quartzite, quartz, granite, agate, chert, jasper, and other rock fragments. Overlain by fractured map, chiefly made up of quartz and mica flakes. | Marine | 5-8 |
| | | Bluish green clay mottled, with carbonate tubes, veins and strings. | | |

The Cambay basin tectonics which controlled the Tertiary deposition, in a general way have influenced the Quaternary sedimentation as well. The Quaternary fluvial deposition broadly is delimited by the two Cambay basin bounding faults and the various NE-SW trending uplifts and subsidences (Deodar ridge, Piyak depression, Tharad ridge and Sanchor depression) are duly reflected in the numerous faults and fractures affecting the Quaternary deposits (Fig 1.4). Banas river is following a NE-SW fault. According to Sridhar *et. al.*, (1995), the Quaternaries are affected by a deformation of two generations, one pre-dating the Holocene and the other mostly a NNE-SSW fracturing during mid Holocene.

CLIMATE

Climatically the area is characterised by transitional conditions between semiarid of ERH and arid of WSW units. The India Meteorological Observatory (IMD) at Bhuj reveals detailed climatic characters of the area. The IMD observatory at Mt. Abu in the east and that of Bhuj in the west give an idea of the climatic transitions (Table 5.4). The aridity index of the area is 20% to 30% indicating an increasing trend of moisture deficiency.

RAINFALL

Rains mostly occur in months of June to September. The annual mean rainfall of this unit is about 526 mm and average number of rainy days are 23. Average rainfall and the number of rainy days of the 3 talukas falling in the unit for the period of 70 years (1901 to 1970) from State Department of Agriculture, (1991) are given as shown in Table 5.5.

Table 5.4 Climatic characteristics based on the data from IMD stations at Bhuj, Deesa and Mt. Abu.

| Parameters | Unit | Bhuj station | Deesa station | Mt. Abu station |
|------------------------------|----------------|------------------|-----------------|------------------|
| Distance from highland limit | km | - | 10 km W | 20 km NE |
| Height AMSL | m | 80 | 136 | 1195 |
| Mean Station Level Pressure | mb | 998.85 | 992.45 | 879.35 |
| Temperature | ⁰ C | | | |
| Annual Mean | " | 32.6 | 23.9 | 18.0 |
| Monthly mean max. \ min. | " | 33.0 \ 20.1 | 44.8 \ 5.4 | 35.4 \ 4.0 |
| Daily mean max. \ min. | " | 42.8 \ 5.4 | 34.3 \ 19.4 | 24.9 \ 16.5 |
| Extreme Highest (date) | " | 47.8 (26.5.1886) | 46.3(26.4.1958) | 38.5 (9.6.1889) |
| Extreame Lowest (date) | " | 1.5 (1.2.1929) | 2.8 (10.1.1954) | -1.1 (31.1.1929) |
| Relative Humidity | % | 49.5 | 49.5 | 29 |
| Cloud Amount | Octas of sky | | | |
| All clouds \ Low clouds | | 2.25 \ 12.5 | 2.8 \ 1.4 | 29 \ 25 |
| Mean wind speed | km/ h | 12.1 | 5.1 | 7.6 |
| Rainfall | mm | | | |
| Av Annual | " | 348.7 | 575.2 | 1691.3 |
| Av. No. of Rainy days | days | 15 | 27 | 51 |
| Wettest in y ear | mm | 1177.0 (1926) | 1037.5 (1959) | 3990.5 (1944) |
| Driest in year | " | 21.8 (1899) | 291.3 (1951) | 290.1 (1899) |
| Heaviest in 24 hrs | " | 467.9 (1959) | 53.3 (1960) | 484.9 (1941) |
| Weather Phenomena | days | | | |
| Hail | " | - | - | - |
| Thunder | " | 8.0 | 8.0 | 7.0 |
| Fog | " | 1.0 | - | 32.0 |
| Dust storm | " | 0.4 | 1.7 | 0.2 |

Heaviest rainfall recorded in 24 hrs was 349.5 mm at Deesa on 16 th September

1893. About 90 % of the annual rainfall is received in June to September.

Table 5.5 Talukawise average rainfall for Central Alluvial Plain

| Taluka | Average Annual Rainfall (mm) | Average Rainydays (Numbers) |
|----------------------|------------------------------|-----------------------------|
| Deesa | 593 | 27 |
| Deodar | 406 | 21 |
| Kankrej | 579 | 23 |
| Average for CAP unit | 526 | 23 |

TEMPERATURE , HUMIDITY AND WINDS

After mid March the **temperature** increases rapidly. May is the hottest month with mean daily maximum temperature at 41.7° C and mean daily minimum at 25.3° C. The heat in the summer season and in June before the onset of the southwest monsoon is intense and on individual days the maximum temperature May go more than 45° C. After the onset of the monsoon in the latter half of June there is appreciable drop in the day temperatures. But nights during the monsoon season are as warm as in the summer season. After the withdrawal of monsoon the night temperatures rapidly fall. Day and night temperatures decrease at rapid rate after the month of October. January is the coldest month with mean daily minimum at 10.7° C . During the cold waves associated with northerly winds, the temperature may drop down to about a degree or two below the freezing point of water. The highest maximum temperature recorded at Deesa was 50° C on 15th May 1912 and lowest minimum was 2.2° C recorded on 15th January, 1935. The mean annual maximum temperature is 34.5° C while mean annual minimum temperature is 19.4° C at Deesa station. **Relative humidity** varies from 38 to 57 % in this unit. The higher values are observed in month of July. **Winds** mostly blow from southwest during monsoon and summer while from north in winter. Dust laden scorching winds blow during

summer when the temperature suddenly rises. In summer generally winds are variable but they built up from May onwards and are strongest in months of May to July blowing at speed of 14.8 to 18.7 km/hr as recorded at Deesa station. The annual average winds speed is 7.0 km/hr.

WATER REGIME

The total water resources for this unit are governed by the precipitation pattern, terrain conditions, unconsolidated nature of rocks, and hydrogeological setting. The thick Quaternary alluvial deposits provide extensive confined as well as unconfined aquifers are capable of copious supply. The terrain facilitates very little surface runoff. However, the rivers flowing from the adjoining high level unit of ERH bring in large quantities of surface water to the CAP. The phreatic aquifers are located within the mixed aeolian (blown wind) and fluvial deposits forming good infiltration media. Sand dunes have given rise to localised interdunal drainage networks (stream, nalas) and these form ideal sites for collection and storage of surface runoff in the interdunal areas. This is accomplished by constructing recharge ponds, channels and pits. In this respect the CAP is relatively very rich in surface as well as underground water resources.

SURFACE WATER

The factors of gentle ground slopes (1:200 to 1:1000), highly permeable top soil and presence of thick alluvial deposition, are unfavourable for surface runoff generation from the local rainfall. Infact, a major portion of the available surface water comes from the highland. The terrain characters and water potential do not provide conditions suitable for any major or medium size storage schemes in this unit. However, quite a few minor schemes with irrigation potential of 487 ha have been created (TEC, 1996).

Small size surface water bodies in the form of village ponds are plenty. As many as 374 of total number of ponds (larger than 1 ha) exist in the unit covering an area of 913 ha with a storage potential of about 804 ha m.

TEC (1995), estimated a surface runoff index as 62 mm of average rainfall for the free catchment of Banas below Dantiwada upto Khakhal. Considering this value, the surface water potential for the unit works out to about 300 Mm³. Significantly, spillover and regular release from the Dantiwada and Sipu reservoirs provide additional surface water potential to the area.

GROUNDWATER

The hydrogeological framework, within the thick Quaternary alluvium has provided rich groundwater potential in form of confined as well as unconfined aquifers (Rao, 1979; Charlu and Dutt, 1982). In many places the impervious clay lenses and layers mixed with sandy material have given rise to a development of leaky unconfined aquifers generally, and perched water table conditions occasionally. The unconfined as well confined aquifers show a hydraulic continuity, except for local variations where because of bifurcation and coalition of clay, layers, local discontinuities have developed (UNDP, 1976). GWRDC (1991), based on water table fluctuation method has estimated talukawise recharge potential. Accordingly, the average recharge rate for the unit can be estimated as about 15% of the rainfall. Taking into account the talukawise recharge (Table 5.6) as estimated by GWRDC, total groundwater potential for this unit works out as 351 MCM. Of this potential, till 1991, 85% has been developed as against the safe limit of 65%. This indicates over exploitation condition of the resource which has resulted in a progressive depletion of water levels and quality deterioration.

Table 5.6 Groundwater recharge and development for Central Alluvial Plain

| Taluka | Total recharge (MCM/Yr) | Utilisable recharge (MCM/Yr) | Level of recharge Development (%) |
|--------------------|----------------------------|---------------------------------|--------------------------------------|
| Deesa | 175.82 | 149.45 | 60.96 |
| Kankrej | 124.19 | 105.56 | 91.56 |
| Deodar | 113.47 | 96.45 | 116.11 |
| Average for CAP | 137.80 | 873.70 | 89.74 |

Broadly, the confined aquifers are restricted within a depth range of 150 to 500 m. These aquifers show deterioration in quality, both vertically and as well as laterally as traced from east to west (Phadtare, 1989).

ANTHROPOGENIC IMPACT AND INTERFERENCE

The unit is bestowed with rich land and water resource base which has provided large-scale support to the local population in agricultural and animal husbandry activities. About 60% of the geographical area of this unit is under agriculture and of which about 40% receives irrigation (ORG,1993). However, groundwater is the major source of irrigation. It is interesting to note that irrigation commands of the two major dam reservoirs (Dantiwada and Sipu) fall within this unit and this fact has helped further towards intensifying the irrigated agriculture. The development of irrigated agriculture has adversely affected the groundwater resource, which in turn, has serious environmental implications.

In the land utilisation order, next to agriculture comes the pasture land which covers about 300 sq km area supports the almost 2.7 lac population of livestock. Animal husbandry has also significantly contributed in the economy. The area is known for its

domesticated animal wealth. Annual animal trade fair of Kankrej is well known in North Gujarat and South Rajasthan.

The sandy Banas river course and the bank areas are most suited for the potato cultivation. The area is known all over the country for growing best quality potatoes receiving rich harvest. Several other special types of delicate cash crops like 'jeera', 'soonf', 'sarsav' and 'isabgul' being grown in the area. The agro-processing activities in the taluka headquarter of Deesa have greatly flourished.

Deesa is fast developing as one of the important economic activity centre in North Gujarat, the land and water based activities, which provide ideal setof in the area and conducive agro-climatic conditions have influenced the location of the headquarters for the State Agriculture University at Dantiwada. In last two decades, the infrastructure facilities have developed significantly. After the Indo-Pakistan war of 1965, the North Gujarat has received maximum attention in respect of communication and transport linkages. Sections of National Highway (No.15), State Highways (No. 7, 54, 72, 128, 130 and 131) and large number of good District Roads have been developed (Fig 1.6). Even village level roads are in very good conditions, and which have greatly increased economic and social activities. Bhildi-Ranivada and Palanpur-Gandhidham sections of the Western Railway. Metergauge line has also contributed to the developmental activities.

The development process brought in major capital investments, modern technology and enterprenership from outside but the natural resources has been extensively exploited. The finished products and profit generated drained away and local people being poor and illiterate could not participate in the development pace except as wage labour. In the process they got marginalised and a socio-economic disparity is generated. Overstress on natural resources resulted in environmental degradation .