

# Plates - PART ONE



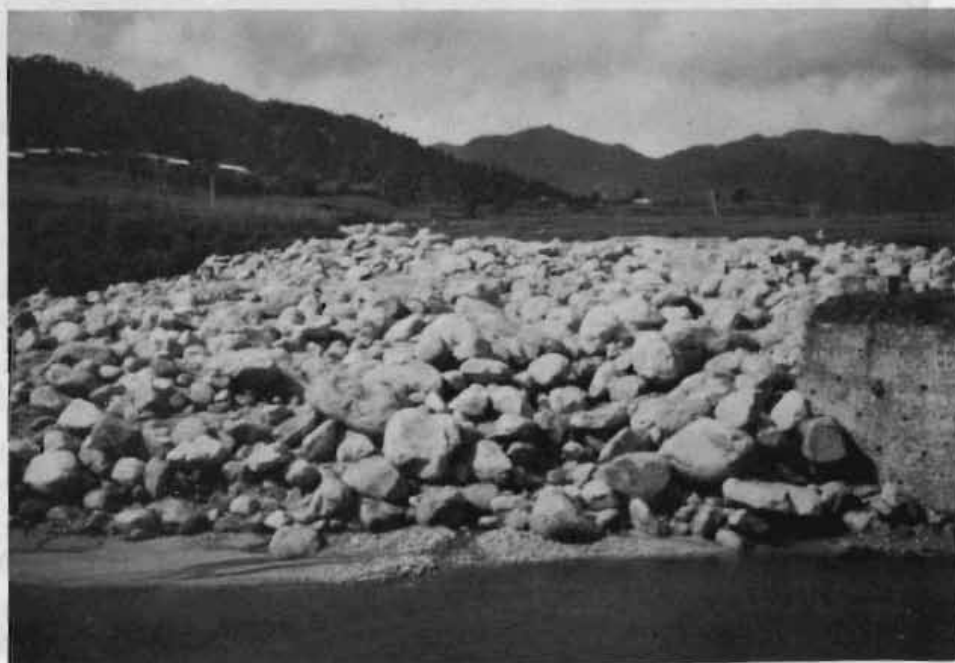
Steep gradient of the Kitini *Khola* viewing north. Notice the cascading flow!



The aftermath of the event along the Kitini course. Notice what a close shave it was for the surviving houses!



Scouring and deep cutting of flashy channels



Typical fan formed by the cascading rivers. The Kitini catchment received over 300 mm of rain.

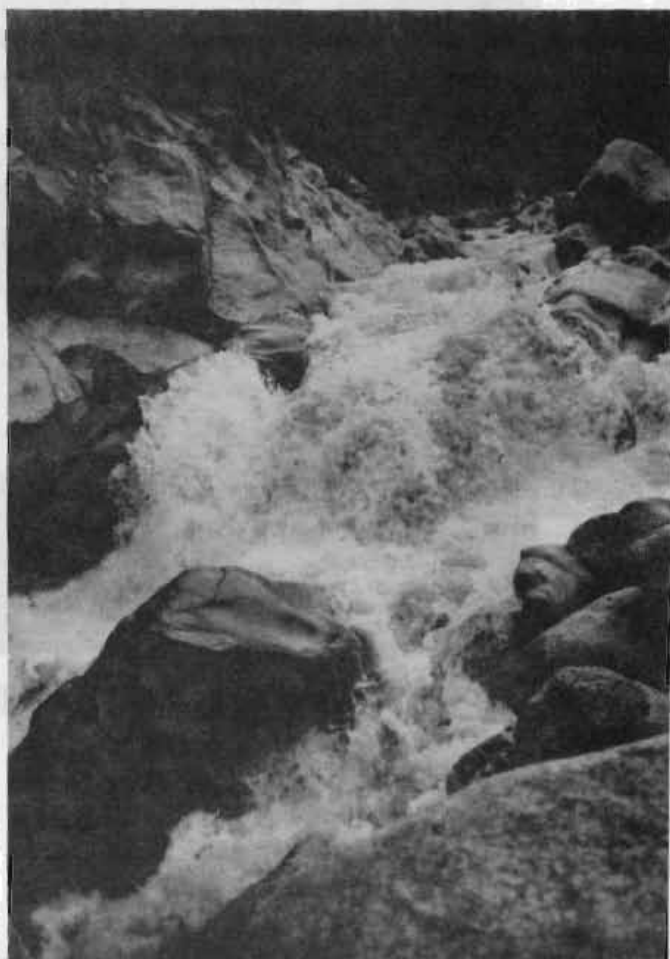


High floods touched the bridge level. Notice the weeds entangled on the railings.



The scraped banks of the Palung Khola by the debris flow

Typical torrents in the Mahabharat  
headwaters ▶



Gauging on the reconnaissance trek ▼







Typical monsoon cloud cover on route (Kitini watershed, August 4, 1993)



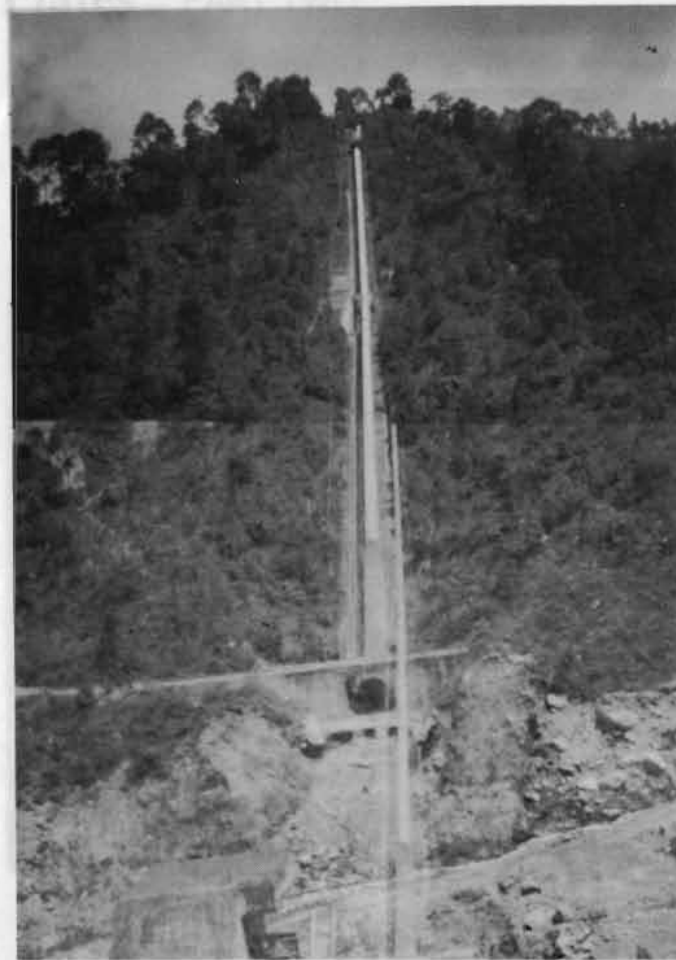
Gigantic boulder slumped in the Mandu Khola. These boulders will be transported as debris flow in future events.



The Kulekhani Reservoir is becoming heavily sedimented.



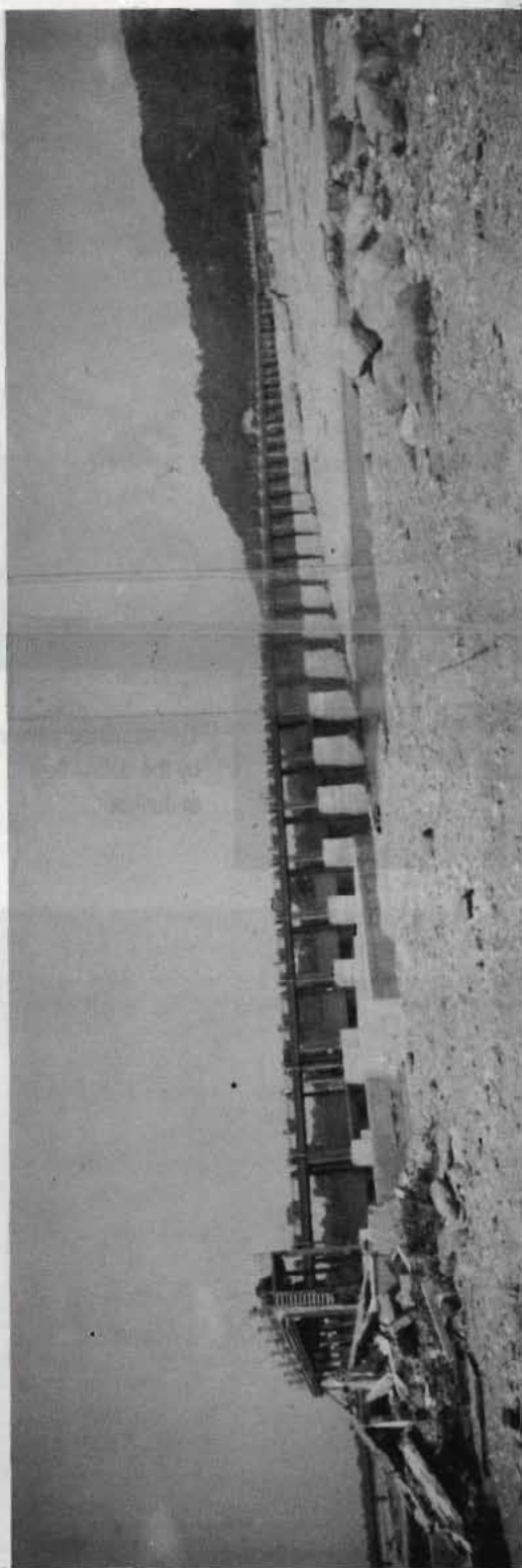
The Tistung Khola surprisingly was less subjected to flooding in spite of an over 500 mm precipitation record upstream. Perhaps the terraced fields in the wide valley have temporarily detained the downpour.



The smashed penstock  
by the debris flow  
at Jurikot



Debris entangled above the gates



Downstream view of the crippled Karmaya Barrage - notice the channel bar



## Plates - PART TWO



Plate 1: The Middle Hills of Palung and Daman are made up of granite and Kitni Village is on an old alluvial fan. Notice the numerous landslide scars on hillslopes after the floods on July 19 and 20. View towards the west



Plate 2: The contact between Palung granite (white) and the schist and quartzites of the Kulekhani Formation (grey) as observed near the Sankhamul Khola, east of Okhargaun. View towards the west



Plate 3: A big boulder of granite in the Sankhamul Khola south of Gahate Danda. View towards the west



Plate 4: The folded schist and marble of the Markhu Formation on the right bank of the Kulekhani Khola south of Khani Khet. View towards the south



Plate 5: The Bagmati River gorge west of Malta, in the granite. View towards the south



Plate 6: The Main Boundary Thrust as observed at Luinche. The fault is passing through the saddle along the gully. Notice also several soil slides and debris fans. View towards the east





Plate 7: Very thick bedded sandstone of the Middle Siwaliks exposed to the south of Rai Gaun. The river terrace is seen in the foreground. View towards the north-east



Plate 8: The Flooded Bagmati River at Balkhu on July 19, 1993. The Balkhu Khola is to the left. View towards the north





Plate 9: Flooding of the Bagmati River near Chobhar Gorge on August 9, 1993. Notice the overtopping of the right bank near the temple. View towards the south

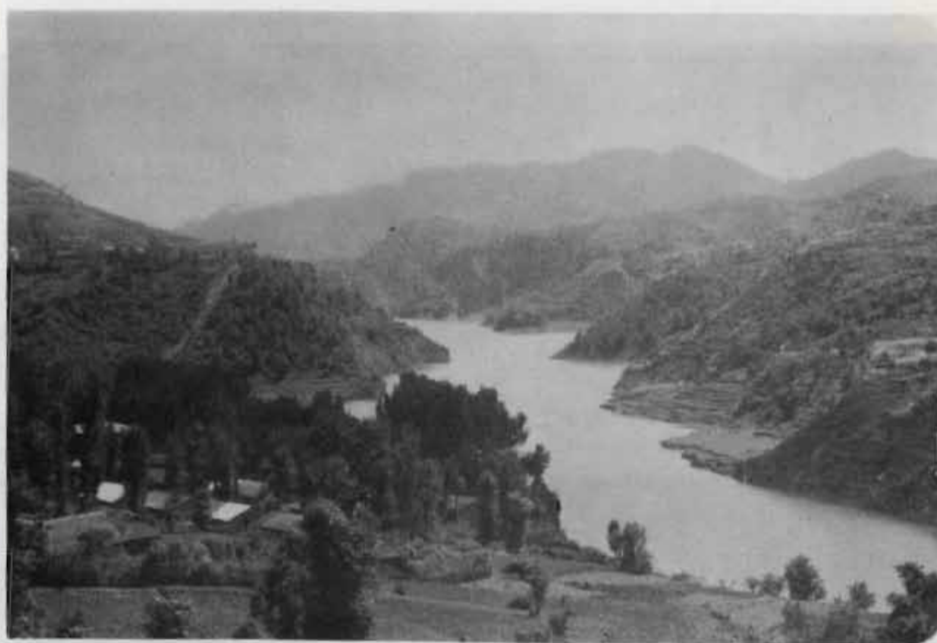


Plate 10: The Kulekhani Valley and impoundment by the dam downstream. View towards the south-east from Markhu



Plate 11: The debris fan on the Dhital *Khola* between Sulikot and Thulotar. Notice a rockslide upstream on the left bank and the old elevated river terraces of the Kulekhani *Khola* on both banks. View towards the west



Plate 12: The Bagmati River and its floodplain at Rai *Gaun*. At present, the river channel is about 20m below the high flood level of July 21, 1993 (cliff to the left). View towards the north



Plate 13: The mid-channel bar on the Bagmati River between Asrang and Gimdi.  
Patches of the river terraces are also seen. View towards the north-west



Plate 14: The channel bar on the Bagmati River at Kholme danda. Notice a school in the  
middle of the bar and an inactive channel to the north. View towards the west





Plate 15: The wood debris brought by the Chitlang *Khola* into the Kulekhani water reservoir. Notice also the high flood mark on the right bank. View towards the south-west



Plate 16: Debris slide . View towards the west





◀ Plate 17: A Plane rockslide on the Tribhuvan Highway in the Tistung Formation near Kulgaon. View towards the south-west

Plate 18: Debris flow and rockslide in the very fractured and cleaved slate and quartzite of the Tistung Formation, west of Kulgaon, the Tribhuvan Highway. View towards the east





Plate 19: The site of a washed-out bridge at Bhainse Dobhan. View towards the north



Plate 20: The washed-out bridge at Trikhandi. The steel beams are bent by the debris and boulders passing underneath the bridge. View towards the north-west



Plate 21: The plane rockslide on the Tistung Formation, near Kulgaun, Km 64, on the Tribhuvan Highway. View towards the south-west



Plate 22: The wedge rockslide on the moderately to highly weathered granite, the Tribhuvan Highway north of Sikharkot. View towards the south





Plate 23: The torrential gully (a tributary to the Kitni Khola) on the road north of Sikharkot. View towards the south



Plate 24: The soil slides at the Daman Horticultural Farm. View towards the east





Plate 25: The shallow soil slides and slumps at the Daman Horticultural Farm. View towards the south



Plate 26: The damaged road and retaining wall on the right bank of the Bisinkhel Khola. View towards the north



Plate 27: The plane and wedge rockslides on the right bank of the Bisinkhel *Khola* which dammed the stream. View towards the south



Plate 28: The previous (washed out) bridge over the Malekhu *Khola*, as observed on January, 1990. View towards the east. Courtesy T.R. Paudel.



Plate 29: The partially damaged bridge over the Malekhu *Khola* replaced by a Bailey bridge. View towards the east



Plate 30: The Bailey bridge over the Agra *Khola* at Mahadev Besi. View towards the south-east





Plate 31: The Prithvi Highway to the east of Jogimara. Notice the thick silt and sand deposits on the road and washed out retaining walls. View towards the south-east



Plate 32: A large debris slide on the right bank of the Mahesh *Khola* at Galchhi. View towards the north





Plate 33: A long stretch of the right bank of the Trishuli River, west of Belkhu, scoured by the flood. View towards the north-east



Plate 34: The rockslide at Jogimara. View towards the south-west



Plate 35: The Jogimara rockslide in slates and limestone. A stone quarry is also seen on the right bank. View towards the south-west



Plate 36: About three metres of thick sand and gravel bed deposited on the former cultivated floodplain (marked by a strip of grass) on the Malekhu Khola, about 200 m upstream from Malekhu. View towards the south-east



Plate 37: Several rock and soil slides around Chaubas, the Agra *Khola*. View towards the north-west



Plate 38: The Kitni *Khola* alluvial fan at Thana Bazaar, the confluence with the Sankhamul *Khola*. All the white boulders are of granite. View towards the north-west





Plate 39: Phedigaun and the debris fans around it. Notice that the middle channel is passing just through the village. View towards the east



Plate 40: A damaged house at Phedigaun. View towards the west



Plate 41: The debris fan at Phedigaun. Notice the green strip of cultivated land to the right. View towards the north-west.



Plate 42: The paddy field in Palung filled up with 0.5 m thick sand. Notice also the damaged houses. View towards the north.



Plate 43: The area around the school filled with boulders and wood debris. The present river channel of the Gairi Khola is 2.6 m below the inundated cultivated land. View towards the north-west



Plate 44: The left bank of the Gharti Khola, about 100m north of the school. Notice the one metre thick gravel bed with cross-bedding and scour marks. View towards the west





Plate 45: The cultivated land filled up with sand at the temple of Indrenithan on the right bank of the Palung (Sankhamul) *Khola*. Notice the flood level mark on the houses about 70 cm above the sandbar. View towards the west



Plate 46: The sand and silt deposits in the temples at Indrenithan, about 70 cm above ground level. View towards the west



◀ Plate 47: Debris flow in the gully at Dalsing Pakha destroyed two houses and carried down these two children for 75 m (where the two children are standing). View towards Markhu

Plate 48: Gully erosion and debris flow on the southern slope of the Kulekhani Reservoir near Markhu. View towards the south-west ▶





Plate 49: Large rockslide at the contact between granite (white) and slate (grey) on the right bank of the Ipa Khola. There is a wide debris fan below the slide. View towards the west



Plate 50: Sheet flooding and debris flow in Karsonje. Most of the pebbles are derived from the Upper Siwaliks. Notice buried and destroyed houses. View towards the south





Plate 51: Sheet flooding and debris flow in the southern part of Karaonje. Notice that the damaged village is in the middle of the fan. View towards the north



Plate 52: Rai Gaun inundated by flood. The flow direction is marked by the inclined fence to the right. The high flood level was at the ceiling of the ground floor of the hut. View towards the west



Plate 53: Back water flow marked by an even bed of sand in the Sangle Khola. Notice the landslide on the Middle Siwaliks and the high flood level marked by the colour difference in grass. View towards the west



Plate 54: Sketch of the Bagmati Barrage command area. The total command area is 122,000 hectares



Plate 55: Downstream view of the Bagmati Barrage and the mid-channel bar. Notice a damaged gate (in the centre) and a 33 m long tree trunk. The Bagmati Bridge is seen in the background. View towards the south



Plate 56: A large tree trunk resting over the dividing wall of the western canal. Notice also another log entrapped in the raised gates. View towards the south





Plate 57:

Twisted and torn apart railings of the Barrage road. Notice several logs blocking the road. Most of the wood debris was already removed. View towards the west



- The tangled straw and roots around the gate-raising wires. Notice that straw can be seen up to the ceiling. View towards the north-west



Plate 59:

The washed-out control tower on the left bank of the barrage. Notice also that the sediment undersluices and the eastern canal are filled up with gravel. View towards the north

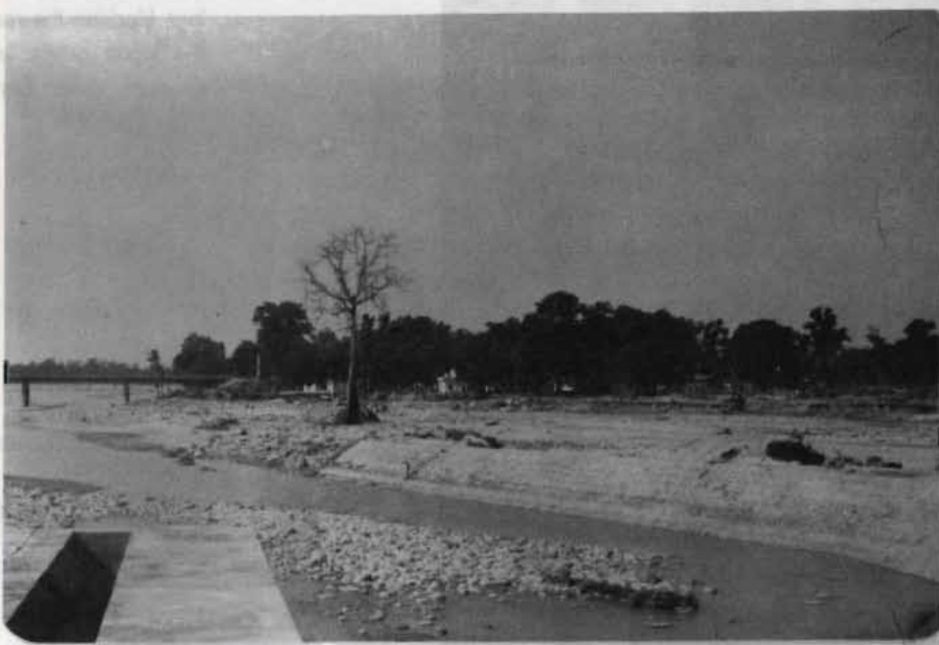


Plate 60:

Downstream view from the barrage towards the western bank. Notice the flood water was flowing beyond the houses of the Canteen Bazaar (in the background). View towards the south-west

Plate 61: The destroyed penstock pipe is seen above the Jurikhet Khola. The damaged pier of the penstock bridge is seen to the left. View towards the north



Plate 62: The outlet portal of the Kulekhari I tailrace tunnel damaged by the debris flow from the Mandu Khola. Notice also the damaged intake canal of Kulekhari II. View towards the north





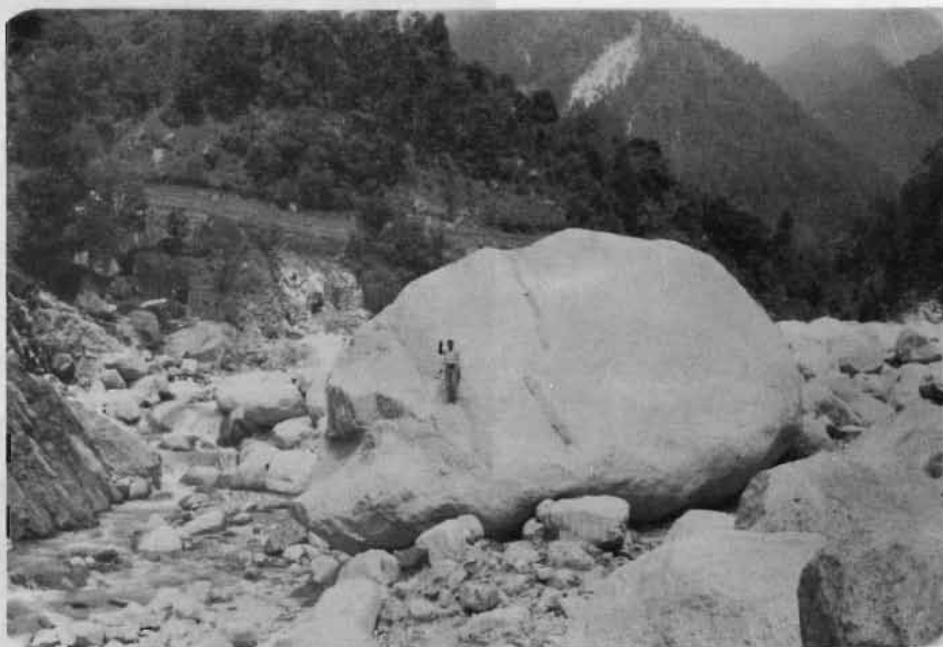


Plate 63:

The huge 'Indreni' boulder in the Mandu *Khola*, about 25m upstream from the intake canal of the Kulekhani II. It is about 15m long and 10m high. View towards the north-west



Plate 64:

Downstream view of the Mandu *Khola* from Dhorsing. Notice the damaged road on the right bank. The white boulders are of granite. View towards the south



Plate 65: The breached dykes on the right bank of the Manohari Khola. The river shifted to the west and destroyed the cultivated land of the Chitwan Valley