

3.5 Data of Geology

Table 1 Microscopic Analysis

Table 2 Laboratory Test Results

Table 3 Micro Fossils from the Limestone Blocks in the Vicinity of Se Kong No.4 Dam Site

Photogeological Maps

Table 1 Microscopic Analysis

Project	Sample Number	Locality	Lithologic Name
Se Kong No.4	SK - 1	Left bank of the dam site	Altered andesite
	SK - 8	River bank on the right bank of the damsite	Calcareous conglomerate
	SK - 9	River bed 500m downstream of the dam axis	Lapilli tuff
Xe Kaman No. 1	KX - 3	River bed downstream of the dam site	Conglomerate
Xe Namnoy Midstream	NH - 1	Right bank near B.Latsasin	Laterite

Table 2 Laboratory Test Results



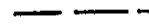

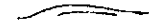

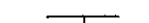




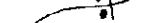

Sample locality		Lithology	Unconfined Compression Strength (Kgf/cm ²)	Splitting Tensile Strength (Kgf/cm ²)
Drill hole	depth (m)			
XN - 1	32.78 - 33.0	Basalt	1,220	147
XN - 1	20.45 - 20.63	Basalt	>2,120	
XN - 1	19.00 - 19.15	Basalt	1,590	
XN - 1	19.25 - 19.40	Basalt	880	
SK - 1	20.25 - 20.40	Tuff	510	173
SK - 1	8.0 - 8.1	Tuff		178
SK - 1	8.65 - 8.75	Tuff	>1,270	
SK - 1	17.10 - 17.20	Tuff	1,400	
SK - 1	51.25 - 51.40	Shale	510	166
SK - 1	7.15 - 7.25	Basalt	100	
SK - 1	20.65 - 20.90	Sandstone	250	159
XN - 1	19.28 - 19.39	Sandstone	1,470	
XN - 1	53.46 - 53.56	Conglomerate	660	

Table 3 Micro Fossils from the Limestone Blocks in the Vicinity of Se Kong No.4 Dam Site



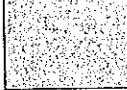
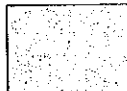



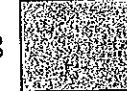
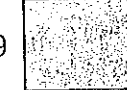

Sample	Micro Fossil	Age
A	Fusulinaceans	Early Permian
	Robustoschwagerina sp. (n. sp. ?)	
	Schwagerinidae gen. et sp. indet.	
	Schubertella sp.	
	Boultoniidae gen. et sp. indet.	
	Smaller foraminifer	
	Neoendothyra sp.	
B	Fusulinaceans	Middle Permian
	Schwagerinidae gen. et sp. indet.	
	Staffella sp.	
	Minojapanella(Russiella)? sp.	
	Schubertella sp.	
	Smaller foraminifers	
	Eotuberitina ex gr. reitlingerae Miklukho-Maklay	
	Tuberitina sp.	
	Tetrataxis sp.	
	Climacammina valvulinoides Lange	
	Endothyra sp.	
	Globivalvulina gracea Reichel	
	Pachyphloia sp.	
	Langella sp.	
	Multidiscus sp.	
D	Smaller foraminifers	Permian
	Globivalvulina sp.	After Early
	Lunucammina? sp.	Permian
E	Fusulinaceans	Permian
	Schwagerinidae gen. et sp. indet.	

PHOTOGEOLOGICAL LEGEND

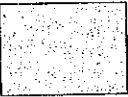
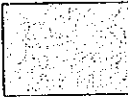
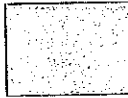
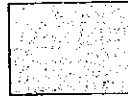

(Common for 3 Projects)

	Litho stratigraphic boundary
	Fault(inferred, high certainty)
	Fault(inferred, low certainty)
	Lineaments
	Bedding trace
	Bedding trace with sign of dip
	Indication of strike and dip
	Syncline with plunge
	Anticline with plunge
	Landslide scarp
	Erosion cliff
	Waterfall
	Photograph center with numbers



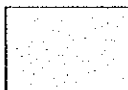



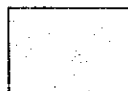
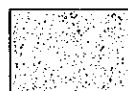
LEGEND FOR XE KAMAN No.1 PROJECT AREA

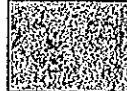



Photo-geological Units	Characteristics
1	 Unit 1 is distributed along by rivers and valleys, forming flat and smooth surfaces of the terrain including terrace. This Unit may consist of alluvial deposits.
2	 Unit 2 appears at the foot of mountains and at the mouth of a valley, covering a small area. It has gentle and rounded relief with moderate to nearly horizontal slopes. The drainage density is low. This Unit may consist of talus deposits and alluvial deposits.
3	 Unit 3 is distributed in the basen located in the northeastern part of the study area, spreading at the both sides of the Xe Kaman river. The sedimentary structure is not observed. The vegetation cover is dense. The Unit 3 may mainly composed of argillaceous rocks.
4	 The topography is moderate, presenting flat lands in places. As the thickness of the overburden, which may consist of alluvial deposits, is thin the layers of the Unit 4 with high resistance against whethereing show linear alignment of outcrops. They are recongnized as bedding traces. The layers are inclined to the southwest, and locally microfolded.
5	 Unit 5 forms continuous mountain ridges. The layers with high resistance are exposed on the slope of the mountainside. The sedimentary structure is obvious. Unit 5 may conprise alternating beds of arenaceous to rudaceous rocks and argillaceous rocks. Probably, the arenaceous to rudaceous rocks are predominant. The attitude of dip and strike of the layers are consistent with those of the Unit 4.
6	 Unit 6 is widely distributed in the basen situated on the east of the Unit 5. Linearments in the direction of NE-SW are prevalent. Drainage density is high. Bedding structure is not observed. The low resistance against weathering of the Unit 6 suggests that the Unit comprises predominant argillaceous rocks.
7	 Unit 7 forms an isolated hill with thin ridges. On the whole, it presents massive features excepting local bedding traces. Resistance against weathering is high. Although the Unit 7 shows similar characteristics to those of the Unit 8, they are not definitely identified.
8	 Unit 8 has thin and high ridges comprising high resistant layers with white bands. As the Unit is massive, The sedimentary structure of the Unit is not observed. Drainage density is relatively high. This Unit probably comprises alternating beds of arenaceous and rudaceous rocks and argillaceous rocks.
9	 Unit 9 forms thin ridges including white-coloured outcrops of layers. White-coloured mottled pattern are observed in places. Bedding traces are obviously recognised along by the fault striking NW-SE in the valley. This Unit may comprise alternating beds of sedimentary rocks mainly composed of arenaceous rocks and/or limestone. The karst topography is not observed.
10	 Unit 10, forming moderate slopes, is situated at the foot of the mountain composed of the Unit 7, 8. The drainage density is high and the resistance against weathering is low. This Unit may consist of argillaceous rocks and/or talus deposits.

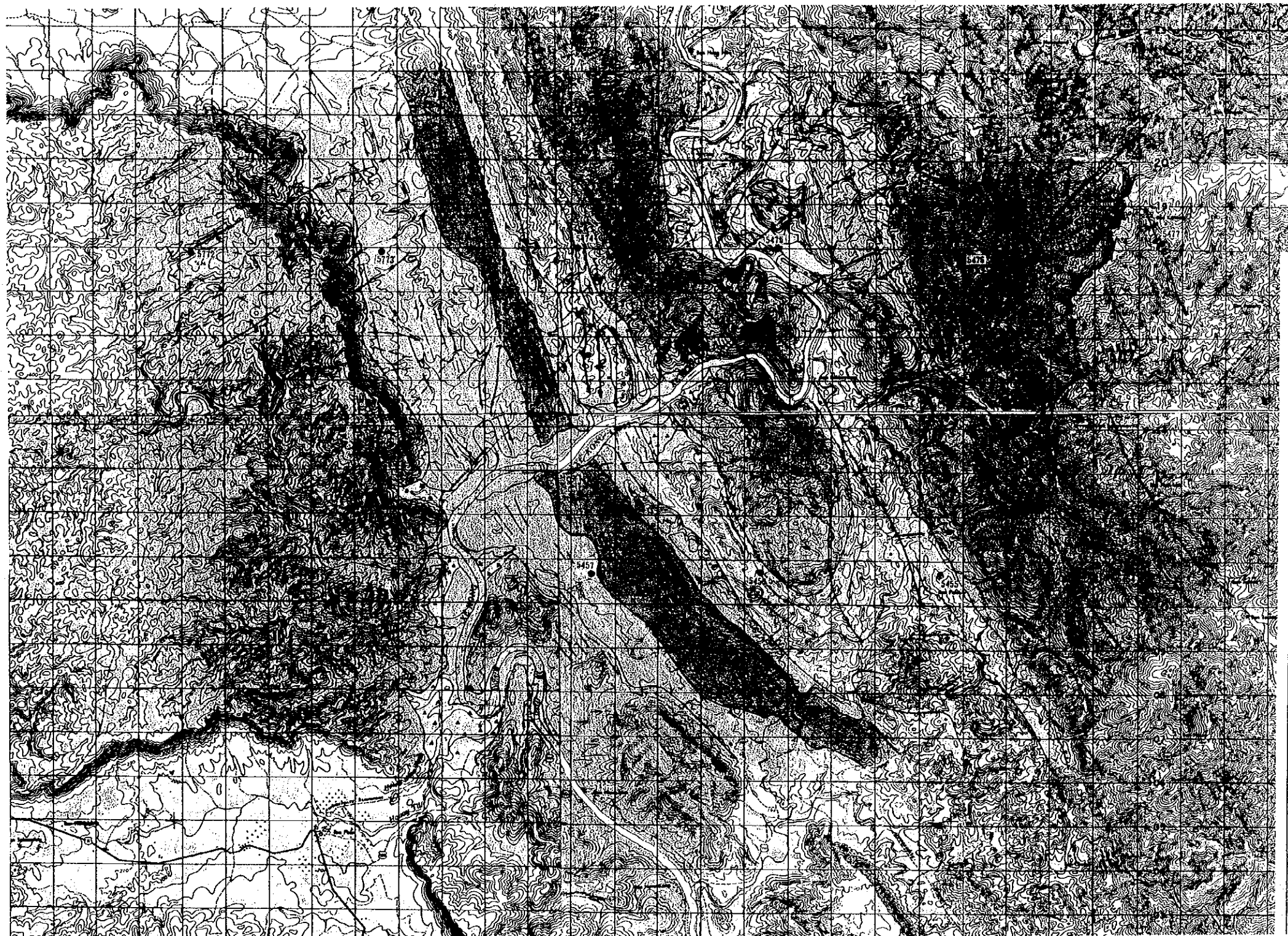
LEGEND FOR XENAMNOY MIDSTREAM PROJECT AREA

Photo-geological Units	Characteristics
1 	Unit 1 forms terraces with flat or gently inclined slopes, showing smooth geomorphic surfaces. This Unit forms escarpments on the marginal sides to the river. The levels of the terraces are slightly different in different localities. Unit 1 may consists of terrace deposits.
2 	Unit 2 forms hills overlying the Unit 3. Valleys are shallow whereas the undulation of the terrain is slightly high. Dense vegetation covers the area, and the cultivated lands are scarce. Unit 2 is massive in general. Sedimentary structure is not observed. The drainage density is low.
3 	The topography shows gentle undulation and many flat lands. Many settlements are recognised. Cultivated lands are widely developed. Unit 3 overlies the Unit 4 almost horizontally. As the thickness of this Unit is thin the layers have been eroded to form hills studded in places. The Unit 3 is massive, and sedimentary structure is not observed.
4 	Unit 4, conformably overlying the Unit 5, comprises horizontally layered or gently inclined sedimentary rocks. The outcrops, forming scarps along valleys, show high resistance against weathering. The sedimentary structure of this Unit 4 is clearly observed. Unit 4 may comprise alternating beds of arenaceous to rudaceous rocks and argillaceous rocks. Probably, the arenaceous and/or rudaceous rocks are predominant.
5 	Unit 5 comprises horizontally layered or gently inclined sedimentary rocks, forming scarps along the valley with rather moderate slopes than that of the Unit 4. The Unit 5 may comprise thick alternating beds of arenaceous to rudaceous rocks and argillaceous rocks. Probably, the arenaceous and/or rudaceous rocks are predominant in the upper part whereas the argillaceous rocks are predominant in the lower part.

LEGEND FOR SE KONG NO. 4 PROJECT AREA

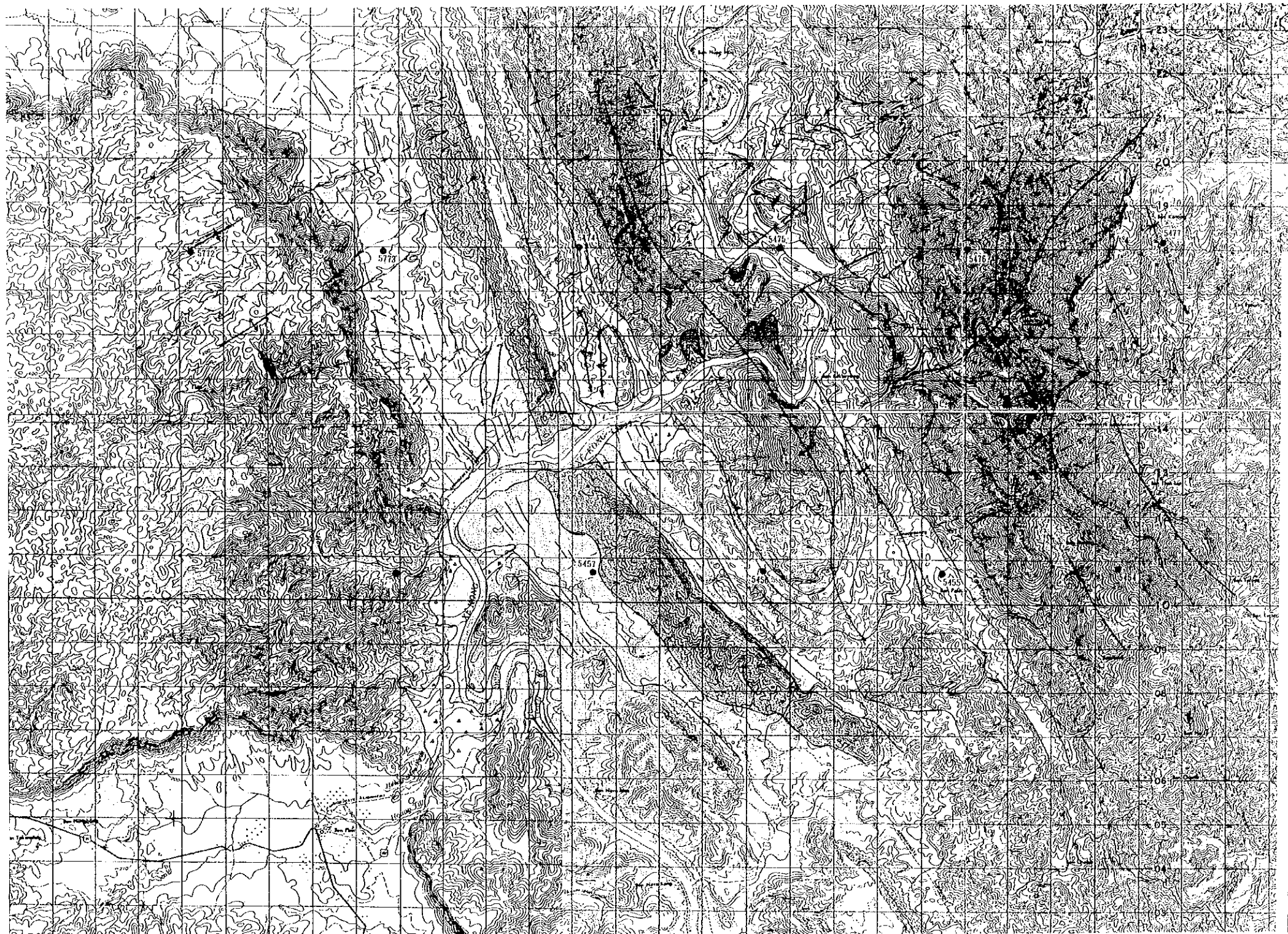
Photo-geological Units	Characteristics
1 	Unit 1 is distributed along by rivers and valleys, forming flat and smooth surface of the terrain including terraces. It may consist of alluvial deposits.
2 	Unit 2 appears locally at the foot of mountains and at the mouth of valleys. It has gentle and rounded relief with moderate to nearly horizontal slopes. The drainage density is low. It may consist of talus deposits.
3 	Unit 3 is distributed to the south of Ban Palai Vil. located in the southeastern part of the study area. Sedimentary structure is not observed. The Unit horizontally overlies the lower layers which show distinct bedding traces. It may consist of sedimentary rocks mainly composed of argillaceous rocks.
4 	The topography is moderate with flat lands. As the thickness of the overburden, consisting of alluvial deposits, is thin the resistant layers of the Unit against weathering show linear alignment of the outcrops as bedding traces. The layers, generally dipping southwest, show locally microfolded structures.
5 	Unit 5 is distributed in the western part of the study area. It may comprise alternating beds of sedimentary rocks composed of arenaceous and ruddaceous rocks and argillaceous rocks. This Unit is horizontal or gently dips west in general whereas it shows a microfolded structure with the axis in ENE-WSW direction.
6 	Unit 6 forms continuous mountain ridges. The layers with high resistance against weathering are exposed on the slopes of the mountainside. The sedimentary structure is obvious. Unit 5 may comprise alternating beds of arenaceous to rudaceous rocks and argillaceous rocks. Probably, the arenaceous to rudaceous rocks are predominant. The attitude (dips and strikes) of the layers are consistent with those of the Unit 4.
7 	Unit 7 is distributed in the long and narrow basen situated to the east of the Unit 6. This Unit is horizontal in attitude or gently dips west in general whereas it shows a microfolded structure with an axis in N-S direction in the right bank area of the Xe Kong River. Unit 7 may comprise alternating beds of arenaceous and rudaceous rocks and argillaceous rocks. Probably, the arenaceous rocks are predominant.
8 	Unit 8 forms long and thin ridges, showing clear bedding traces. The Unit forms outside rims of the wings of the anticlinal and synclinal structures with the axes in NWN-SES direction. The resistance against weathering is high. Slope failures are not observed. The Unit may comprise alternating beds of sedimentary rocks mainly composed of arenaceous and rudaceous rocks.

9 	Unit 9 is overlain by the Unit 8, forming the cores of the anticlinal folds. The resistance against weathering is relatively low. As it is massive, sedimentary structure is not observed. Drainage density is relatively high. Many slope failures are observed. This Unit may comprise prevalent argillaceous rocks.
10 	Unit 10 is a member of the Unit 9. Bedding plains, horizontal or gently dipping to the W-WSW direction, are clearly observed. Gentle topographic relief of the Unit and its occurrence in the lowlands area lead to assume that this Unit may comprise alternating beds of arenaceous rocks and predominant argillaceous rocks.
11 	Unit 11 is a member of the Unit 9. Bedding plains are clearly observed, striking NWN-NW, dipping 20-30 degrees in the northern part and steeply in the southern part. The unit 11 may comprise of alternating beds of dominant arenaceous rocks to ruddaceous rocks.
12 	Unit 12 is distributed in the northern central part of the study area. It dips W or SW in general. The bedding plains, which are ambiguously observed at the isolated hills forming scarps, show incoherent strikes and dips respectively. The geological structure of this Unit is so complicated that faults are inferred and that the relationship with other Units is not defined.

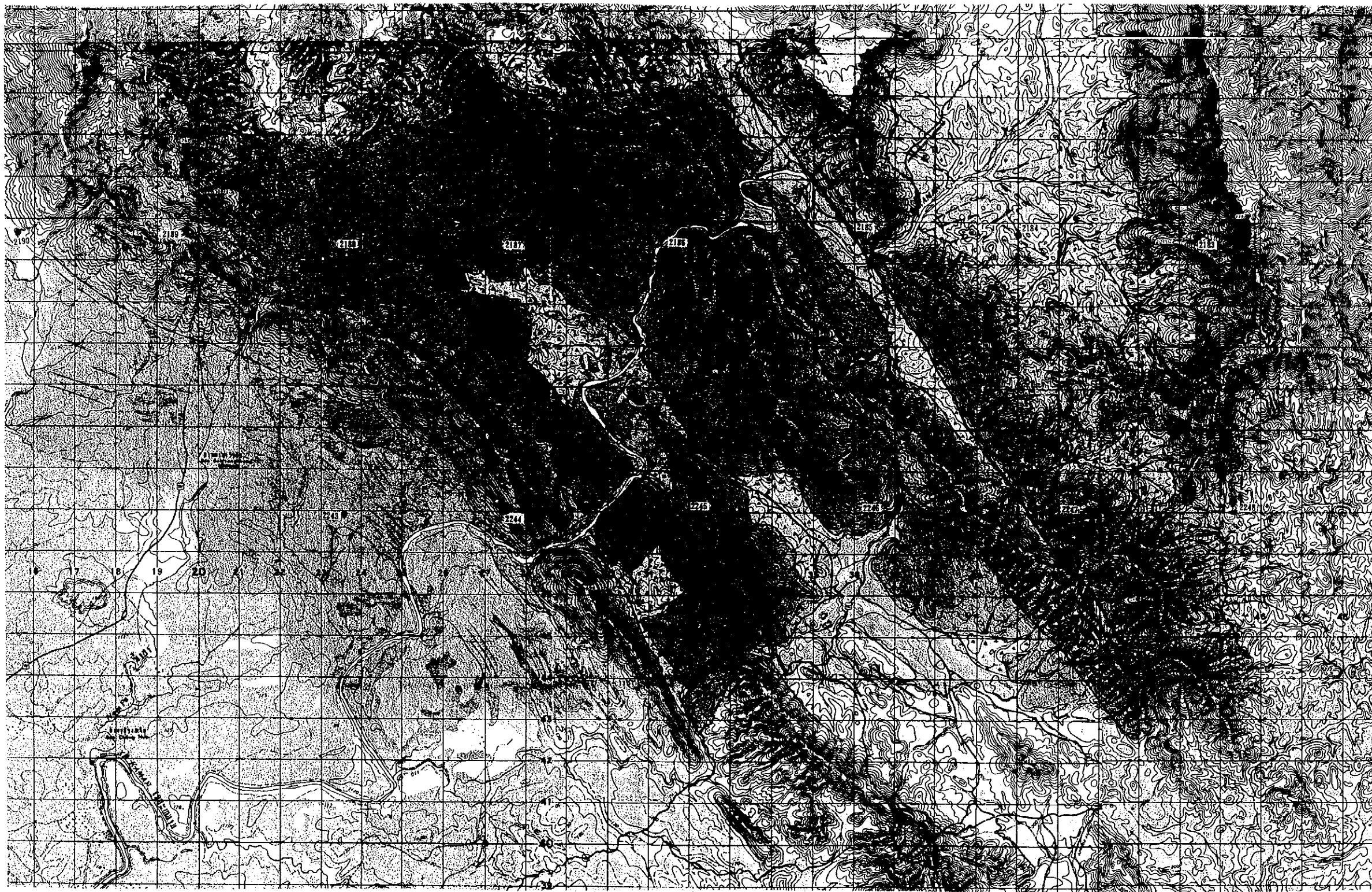


0 5 km

PHOTOGEOLOGICAL MAP
OF XE KONG NO. 4 PROJECT AREA

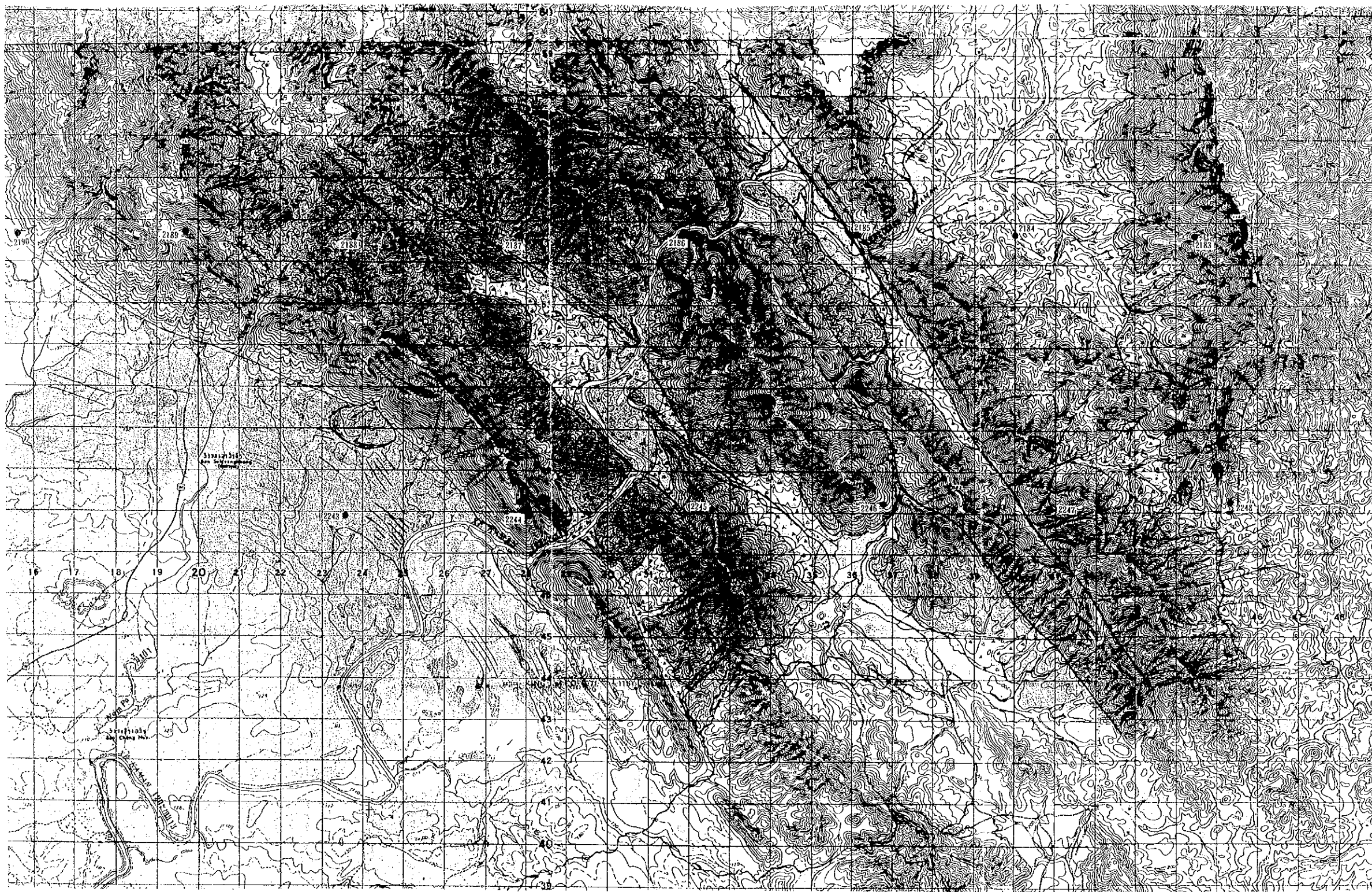


PHOTOGEOLOGICAL MAP
OF XE KONG NO.4 PROJECT AREA



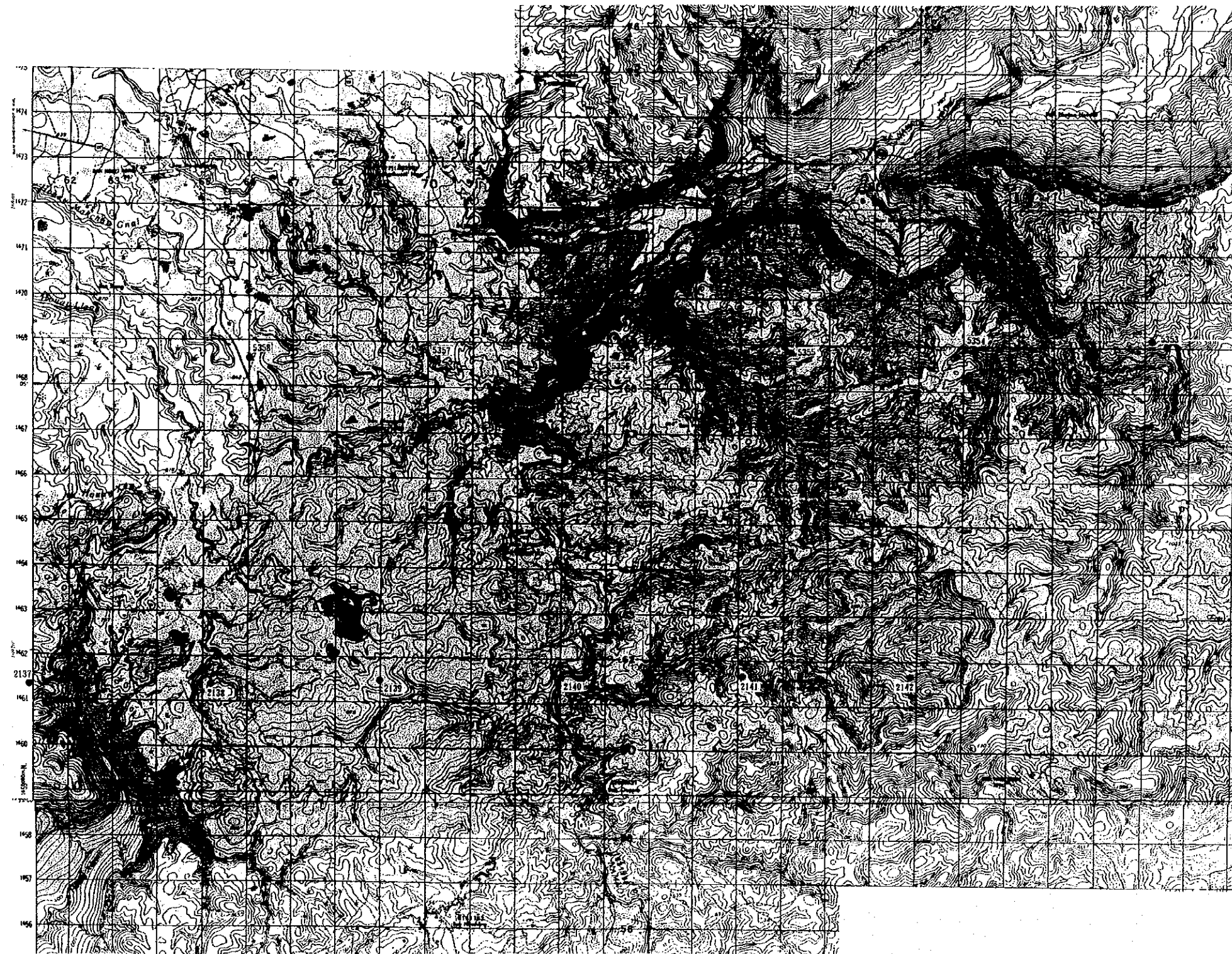
0 5 km

PHOTO GEOLOGICAL MAP
OF XE KAMAN NO. 1 PROJECT AREA

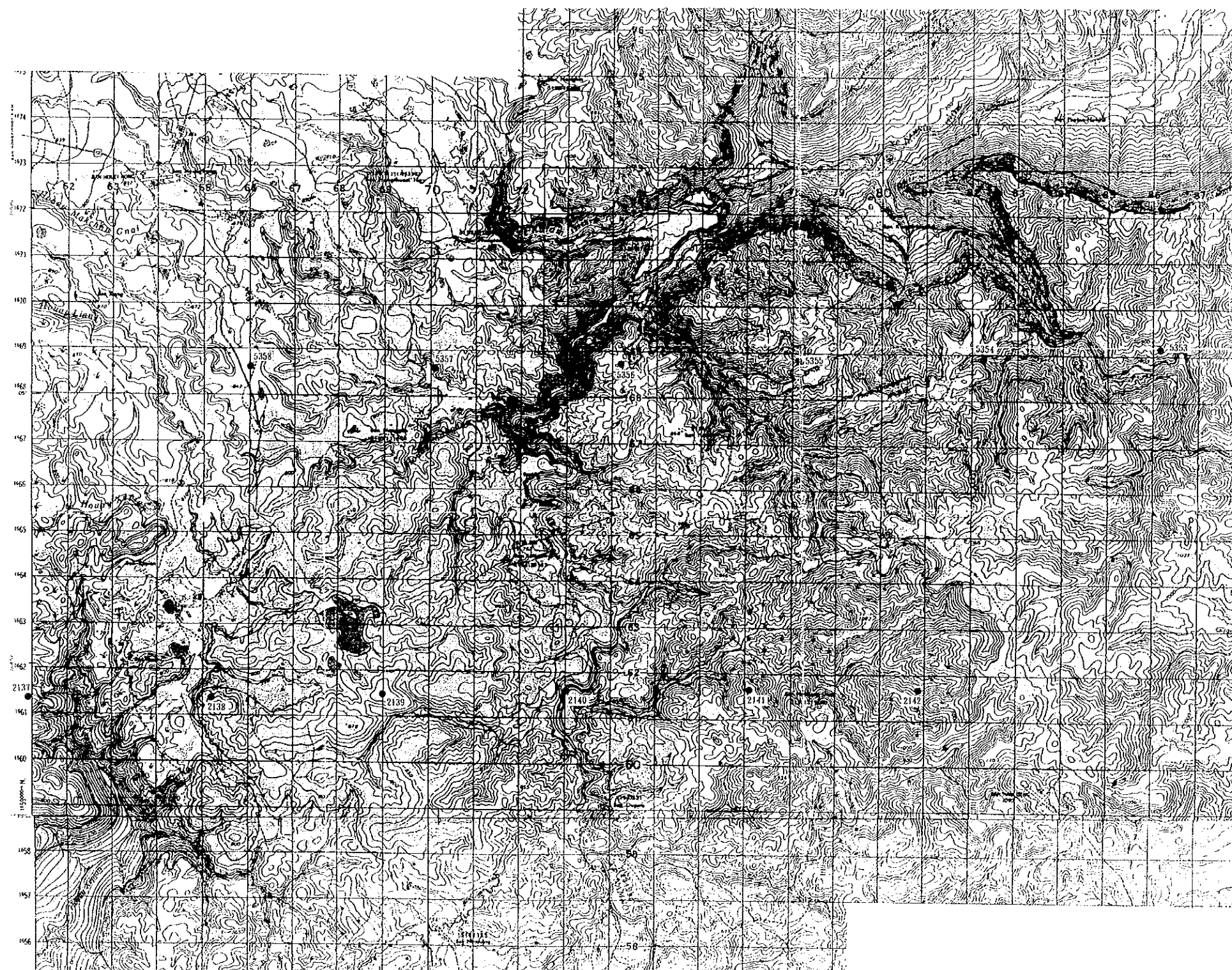


0 5 km

PHOTO GEOLOGICAL MAP
OF XE KAMAN NO. 1 PROJECT AREA



PHOTOGEOLOGICAL MAP
OF XE NAMNOY MIDSTREAM PROJECT AREA



PHOTOGEOLOGICAL MAP
OF XE NAMNOY MIDSTREAM PROJECT AREA