Agriculture and irrigation

The beneficial area is in flat area located relatively near the center of the Kalat District. Though the soil is relatively suitable for irrigation, problems in drainage are found in some portion in the area. The main crops are apples, apricots, onion, wheat and barley. The water source of irrigation is spring water and tubewells. Grassland extends around the beneficial area, where the herds of sheep and goats are often observed.

Environment

Typical environmental situation in the area is the following issues:
groundwater depletion, water right for spring and karez, insufficient water supply for irrigation and domestic in the dry season and riverbed and/or riverside utilized as traffic route.

Environmental aspects changed by the construction of the dam include:
changes in surface water hydrology, changes in groundwater hydrology and apartness of traffic route by dam and related facilities.

Environmental impacts caused by the construction of the dam include:
Positive; reduction of ground water level decline, sustainable use of groundwater resource, and while
Negative ; loss of traffic approach for social life and economic activities.

The results of IEE revealed that there were no residual negative impacts because the potential negative impacts of minor level could be mitigated by means of conservation and alternative measures in the development plans established in the Study. Therefore, EIA was not required.

Table 4.1.1 Dam Features of Existing Delay Action Dams

	Dam Name	Division	Completion	Dam Type	Crest Length (m)	Dam Height (m)	Spillway Length (m)	Spillway Crest Length (m)	Design Flood Discharge (m3/sec)	Total Storage Volume (m3)	Embankment Volume (m3)	Catchment Area (km2)	Construction Cost (M. Rs.)
1	Khora Manda DAD	Quetta	1993	Earth dam	238	10.4	33.3	22.94	129.4	144,261	45,653	12.2	3.104
2	Marium Manda DAD	Quetta	1994	Earth dam	122	14.51	30	11.6	52.71	43,547	42,263	0.5	3.000
3	Bostan DAD	Pishin	1990	Earth dam	272	16	60	20	114	210,000	164,000	23.4	6.000
4	Khushab DAD	Pishin	1986	Earth dam	164	15.38	96.3	18.35	75.12	392,883	52,179	15.2	2.020
5	Tirkha DAD	Pishin	1993	Earth dam	411	10.5	94.5	18	84	257,760	53,652	13.7	3.200
6	Amach DAD	Mastung	1987	Earth dam	762	15.2	18.35	18.28	83.27	1,050,000	136,040	25.7	3.130
7	Kad Kocha I DAD	Mastung	1984	Earth dam	636	15.24	30.48	15.28	35.22	522,792	198,160	21.0	3.600
8	Gorpad I DAD	Kalat	1982	Earth dam	244	9.75	30.48	27.43	39.67	181,251	38,763	0.9	0.500
	Gorpad II DAD	Kalat	1993	Earth dam	160	6.73	n.a.	15.3	47.52	n.a.	23,230	n.a.	0.253
9	Laghmgir DAD	Kalat	1993	Earth dam	135	12.19	30.48	18.28	153.02	254,450	77,417	29.2	2.500
10	Sarbund DAD	Kalat	1993	Earth dam	412	12.8	39.63	39.7	145.6	n.a.	60,770	34.8	2.800
A	Wali Dad DAD	Quetta	1973	Earth dam	31.5	7.65	4.33	7.65	14	n.a.	n.a.	5.4	0.159
B	Murgi Kotal DAD	Quetta	1969	Earth dam	88.7	11.62	24.26	9.79	n.a.	124,000	n.a.	19.7	0.400
C	Kach DAD	Quetta	1968	Earth dam	190.5	26.2	400	30	n.a.	494,000	n.a.	56.5	n.a.

Source: PC-1, Irrigation Department, Quetta
Note: Design flood discharge of Laghamgir dam is estimated by JICA Study Team

Table 4.1.2 Observations of Existing Delay Action Dams

	Dam Name	Year Comp.	Dam Type	Catchment Area (sq.km)	Dam Height (m)	Planning	Design	Construction	O&M	Others
1	Khora Manda	1993	Earth	12.23	10.40	Spillway canal is susceptible to erosion because of its unconsoli-dated talus core deposits foundation. Flood flow through the spillway caused flood damages at the left side alluvial fan concentrately.	Spillway forms step configuration in longitudinal section to dissipate water energy. Masonry protection thorough canal surface shall be attained to prevent erosion of scouring by flood.	Rehabilitation of the spillway has been carrying out by the Irrigation Department. Gabion protection of the spillway channel is susceptible to scouring during floods, so that concrete protection is preferable to prevent scouring.	It is suggested to remove siltation which has been accumulated in 0.6m thick in the reservoir.	Flood flow through the spillway located left side abutment caused flood damages at the left side area of alluvial fan concentrately.
2	Marium Manda	1994	Earth	0.45	14.51	Inadequate inflow due to small catchment area has not contributed to the groundwater recharge.	Widening of the canal downstream of the spillway is required to improve flow capacity.	A few borrow materials of river deposits was available at the dam site. Weathered soil which had prominent clayey gradation on the hillside was utilized for embank- ment. Breakout of seepage line may observed on the downstream slope of embankment.	Water quality becomes worse due to long time stagnancy of the water. Water treatment is required for the domestic use.	In planning, diverted water from adjacent catchment area was supplied to the reservoir through conduits. Few water was storaged in the reservoir due to shortly diverted through conduits.
3	Bostan	1990	Earth	23.4	16.00	Inadequate inflow due to small catchment area has not sufficiently contributed to the groundwater recharge.	Large amount of sediment is expected because of steep river gradient. Sediment control device, e.g. detention bund should be constructed.	Spillway is located on the rock foundation composed of limestone. It is however necessary to protect spillway at the inflow portion and downstream with certain materials at where weathered soil is exposed.		
4	Khushab	1986	Earth	15.2	15.00	Recharge ability through the reservoir is insufficient. In addition, no intake device was installed to drain the water in the reservoir. Spillway was eroded by flood due to its unconsolidated talus core deposits foundation.	Spillway was constructed on the unconsolidated talus core deposits. Canal surface should be completely protected with stone riprap to prevent erosion and scouring by flood.	Temporary rehabilitation work for spillway is being carried out at present. Further protection shall be completed through the spillway canal.	Small slope collapse of natural soil was observed in around the impounding area. Siltation composed of fine materials has been deposited at the upstream of the impounding area because the water level of the dam was kept in full water level of the dam.	It is expected that the natural groundwater levels at the dam site and the catchment area are relatively high.
5	Tirkha		Earth	6.7	10.50	Inadequate groundwater recharge was expected due to siltation composed of fine materials in the reservoir. Recharge through recharge pit was not effective owing to its poor recharge capacity.	Dam axis is curved perpendicularly. Curved portion may have defect on stability of the embankment against water pressure. Poor recharge capacity of the pit installed at the downstream of the embankment shall be improved.	It was assumed that the embankment materials were composed of fine gradation materials, e.g. silt, sand. Drain was not installed. Because of low permeability of the dam foundation, periodical observation for piping is required.	Existing recharge pit shall be improved to accelerate recharge capacity. Due to poor permeability of the foundation, groundwater recharge from the river deposits is proposed.	Water conveyance by conduits or open canal is effective to supply irrigation water from dam to beneficial area due to low permeability of the aquifer.
6	Amach	1987	Earth	25.65	15.20	Full water level storage is attained once in 40 years because of its excessively large storage volume of 1.05 million cu.m. Less run-off is expected from ordinary rainfall.	Downstream of the spillway canal is located closing to the dam embankment. Guide wall or retention wall should be constructed to prevent inundation at the toe of the downstream slope of the embankment.	High groundwater recharge is expected through 500m crest length of dam. Ground surface upstream of dam has an inclination to the right abutment corres- ponding to natural terrain. Proper excavation of borrow material contributes effective recharge.	Constant monitoring of karezes is required to evaluate a quantitative effect of the groundwater recharge along with dam construction.	Accumulation of siltation in the storage area is less expected because rivers extend radially, accordingly flood flows down in small creeks distributed in the catchment area.

	Dam Name	Year Comp.	Dam Type	Catchment Area (sq.km)	Dam Height (m)	Planning	Design	Construction	O&M	Others
7	Kad Kocha I	1984	Earth	20.95	15.24	Efficiency of dam storage is low as same that as Amach dam.	Spillway was constructed by the use of a natural undulation. Insufficient leveling of the spillway canal extremely harms flow capacity of the spillway. Guide wall or retention wall should be constructed to prevent inundation downstream of embankment.	Leveling of the spillway canal is required to ensure smooth flow during flood.	Excessive infiltration is observed in particular area in the reservoir during floods. Piping of the embankment materials may cause dam failure.	Accumulation of siltation in the storage area is less expected because rivers extend radially, accordingly flood flows down in small creeks and distributed in the catchment areas.
8	Gorpad I	1982	Earth	0.93	9.75	Impounding water has been contaminated with salinity, accordingly the water is not suitable for irrigation purpose. Salinity accumulation in the impounding area and downstream of the dam embankment shall be worked out. Catchment area is small.	Intake conduit should have been installed to drain storaged water.	Poor compaction of spall layer accelerates gully erosion on the downstream slope of the dam.	Salinity accumulation may be accelerated because of inflow of saline water to the reservoir. Drainage device shall be installed.	
9	Laghmgir	1993	Earth	29.2	12.19	Because spillway was constructed on the unconsolidated talus core deposits, canal base is susceptible to erosion by flood.	Considerable scouring of spillway canal has occurred because of poor protection of the canal. Canal must be completely protected with stone riprap or concrete lining.	Downstream of the embankment forms steep gradient of 1:2. Additional earth work is required to reshape coinciding to specified gradient.	Lowering of spillway canal bed is being carried out to enlarge flow capacity of the spillway. Guideline to determine free board of the dam should be observed.	
10	Sarbund	1993	Earth	34.79	12.80	Because spillway was constructed on the unconsolidated talus core deposits, canal base is susceptible to erosion by flood.	A free board between dam crest and spillway is too deep. Regulation regarding free board shall be required.	Crest elevation is insufficient at the left side abutment. Crest width and downstream gradient of the embankment also dose not satisfy the requirement in specification.	Gully erosion is observed on the downstream slope of the embankment. Spewl layer shall be rehabilitated.	
A	Wali Dad	1973	Earth	5.35	10.50	Siltation has been developed because the narrow and deep valley was selected for the dam site. Gravity dam was also recommended from the geo-topographical points of view. Overflow of dam embankment caused dam collapse.	Concentration of flood flow and increase of flow velocity are induced in the case that the dam is located at a narrow portion of the river. Relatively wider portion of the river be selected for the dam construction.	Concentration of seepage line might be observed at the boundary of clayey and sandy materials in th embankment.	Storage area has been completely filled up with siltation. Embankment was also washed out by flood.	Siltation is composed fine materials. These materials has been consolidated, so not be completely washed out toward downstream during flood flows.
B	Murgi Kotal	1969	Earth	19.65	11.62	Alluvial fans were widely developed at the south and east of the dam site. From this observation, there is abundant sediments production from the catchment area. Sediment control device should be constructed during the planning.	Insufficient flow capacity of the spillway was obtained due to a difficulty of widening of the spillway owing to steep and massive rock abutment at the dam site. Concentration of the seepage line along gravel layers might induce piping in embankment.	Collapse located at the center of the embankment has not rehabilitated. Rehabilitation is urgently required to eliminate further damages. Supplemental embankment of 1.5m was made corresponding to siltation development.	Storage area has been completely filled up with siltation. Embankment was also damaged at the center of the dam crest by flood. Recharge ability was lost due to siltation.	Proposed dam is planned to be located at the same position or 100m upstream of the existing dam. Removal of siltation in the existing reservoir is inevitable either dam site be selected at upstream or downstream of existing dam.
C	Kach	1968	Earth	56.45	26.20	Soil of the catchment area is composed of sand stone, shale and limestone strata. The reservoir has been totally silted up by excessive sediment production at the catchment area. Sufficient sediment capacity should be ensured during the dam planning.	Concrete cut-off wall was heavily damaged by mud pressure of sediment. Poor reinforcement of the wall did not tolerate the pressure. Heavy erosion is observed in the spillway canal.	Assuming that compaction was carried out by roller, an anisotropy of permeability might observed and consequently caused piping.	Storage area has been completely filled up with siltation. Embankment was also heavily damaged at the center of the dam crest by flood. Recharge ability was lost due to siltation. Spillway canal was also heavily eroded by flood.	Existing dam crest was elevated with stone materials to prevent overflow of flood water.

Table 4.2.1 The Result of In Situ Permeability Test at Drilling Sites

Test Method; Falling Head Method by Casing

Name of Drilling Site	Test Depth (GL.-m)	Depth to Water Table (GL.-m)	Depth (m) to Bedrocks or Aquitard	Name or Compo - sition of Bedrocks or Aquifer	Lithology at Testing Section	Coefficient of Permeability (cm/sec)
Khushab	8.10	6.40	12.5	Limetone & Shale (Parh Gr.)	Silt,Sand,Gravel	1.42E-03
Tirkha	2.00	0.20	2.0	Bostan Clay	Gravel Sand (River dep.) / Bostan Clay	8.50E-04
Brewary	6.24	1.82	12.0	Brewary Limestone	Boulder Gravels	2.50E-03
Ghutai Shela	2.77	5.33	11.0	Sandy Silt (Subrecent dep.)	Silty Sand	9.50E-03
Wali Dad	2.00	Nil	30.0	Clayey Silt (Subrecent dep.)	Cobble/Gravel	1.26E-04
Dara	3.00	Nil	20.0	Silt with Clay (Subrecent dep.)	Gravel	1.49E-03
Murgi Kotal	2.60	Nil	40+	-	Siltation Material	7.82E-04
Kach	2.50	1.05	1.0	Gazij Shale	Gazij Shale	3.50E-07
Jigda	8.00	6.10	9.5	Murgha Faqirzai Shale	Gravel,Sand	1.50E-03
Sanzali	20.00	2.50	2.5	Bostan Clay	Bostan Fm.	1.54E-04
Arambi	9.00	7.75	17.0	Shaigalu Sandstone	Creyey Gravel	2.07E-04
Sakhol	3.70	Nil	40+	-	Gravel,Sand,Silt	3.06E-04
Mangi	3.00	Nil	27.0	Murgha Faqirzai Shale	Cobble,Gravel,Silt	1.06E-04
Kad Kocha II	2.55	Nil	40+	-	Gravel,Sand,Silt	3.18E-05
Iskalkoo	16.00	2.60	6.5	Gazij Shale	Gazij Shale	1.03E-04

Table 4.2.2 **Topo-Scale and Hydrogeological Properties of Aquifers Distributing In the Downstream of Priority DADs**

Name of DAD Sites	Topo Type of Aquifers	Topo Scale of Aquifers: Horizontal Dimensions (Ar; Radial Angle Rd; Radius A; Area Wd; Widness of Riverbed)	Topo Scale of Aquifers: Topo Gradient (Gr) & Thickness (Th)	Hydrogeological Properties: Coefficient of Permeability	Hydrogeological Properties: Others (T: Transmissivity, Sy: Specific Yield)	Basement Rocks
Brewary	Alluvial Fan deposits	Ar; app 100deg Ra; app. 3km A; app. 8km2	Gr; app. 1/50 Th; more than 100 m	Uppermost Stream; 2.5E-3cm/sec Mid Fan; 1.2 to 1.9E-3cm/sec	T : 60 to 120m2/d Sy : 18 to 25%	Brewary Limestone
Dara	Alluvial Fan deposits	Ar; app 60deg Ra; 2 to 3km A; 5 to 6km2	Gr; 1/20 to 1/40 Th; 150 to 200 m	Uppermost Stream, 1.5E-3cm/sec	T : 40 to 80m2/d Sy ; more than 20%	Chiltan Limestone
Murgi Kotal	Alluvial Fan deposits (Kuchlagh Side)	Ar; app 100deg Ra; 1.5 to 2km A; app 2km2	Gr; app. 1/25 Th; 150 to 200 m	In the order of E-3cm/sec	T : 90 to 100m2/d Sy ; a little more than 20%	Chiltan Limestone
	Alluvial Fan deposits (Quetta Side)	Ar; app 60deg Ra; app 3km A; app 6km2	Gr; app 1/25 Th; app. 150m	In the order of E-3cm/sec	T : 90 to 100m2/d Sy ; a little more than 20%	Chiltan Limestone
Kach	River dep & Fan dep.	Ar; app 30deg Ra; app. 5km A; 4 to 5km2	Gr; less than 1/50 Th; up to 200m	1 to 2E-3cm/sec	T : 40 to 80m2/d Sy ; more than 20%	Gazij Shale
Jegda	River dep. & Fan dep.	Ra; 5 to 6km A; 12 to 13km2	Gr; app. 1/45 Th; up to 200m	Uppermost Stream Riverbed; 1.5E-3cm/sec Alluvial Fan; 6 to 7E-3cm/sec	T : 160 to 70m2/d Sy ; 23%	Murgha Faqirzai Shale
Sanzali	River deposits	Wd; Some Tens to Hundred & Some Tens of Meters	Gr; 1/40 to 1/80 Th; 2.5 to 10m	approximately 1E-3cm/sec	T ; 3 to 5m2/d Sy ; 15 to 20%	Bostan Formation
	Fan dep & Valley Floor dep.	Influenced Ra, app 3km * 3km	Gr; 1/50 to 1/60 Th; up to 80m (Silty Sands), up to 150m (Silts & Clay)	a little less than 1E-3cm/sec	T : 70 to 80m2/d Sy ; app 15%	Bostan Formation
Sakhol	Sand Dune deposits	Influenced Wd, 2 to 3 km Length; app 7 km	Gr; app. 1/100 Th; 20 to 30m	In the order of E-4cm/sec	T : 2 to 3m2/d Sy ; 10 to 15%	Chiltan Limestone
Mangi	Alluvial Fan deposits	Ar; 50 to 60 deg Ra; 4～5km A; 14 to 15km2	Gr; app. 1/100 Th; 70 to 80m	In the order of E-3 to E-4cm/sec	T : 5 to 500m2/d Sy ; more than 20%	Shirinab Formation Murgha Faqirzai Shale
Kad Kocha II	Alluvial Fan deposits	Ar; app. 80 deg Ra; app 3 km A; 3 to 4km2	Gr; 1/30 to 1/40 Th; up to 200m	approximately 1E-3cm/sec	T : 90m2/d Sy ; 15%	Chiltan Limestone
Ghazlona	River deposits	Wd; 40 to 200m	Gr; 1/50 to 1/60 Th; 10 to 30m	In the order of E-3cm/sec	T : app. 5m2/d	Murgha Faqirzai Shale
Ghutai Shera	Alluvial Fan deposits	Wd; app 2 km	Gr; app. 1/40 Th; 30 to 50m	6 to 9E-3cm/sec	T : app. 45m2/d Sy ; a little more than 20%	Subrecent Deposits
Walidad	Alluvial Fan to Fan Bay deposits	Ar; app 120 deg Ra; 3 to 4 km A; app 6 km2	Gr; average app 1/25 Th; 50 to 150m	2 to 3E-3cm/sec	T : 20 to 60m2/d Sy ; 15 to 20%	Chiltan Limestone
Samaki (Arambi)	River, Fan, or Talus deposits	Wd; 1 to 2 km	Gr; 1/50 to 1/100 Th; 20 to 30m	In the order of E-3 to E-4cm/sec	T : 2 to 5 m2/d Sy ; app. 15%	Sha'galo Sandstone
Iskalkoo	Alluvial Fan deposits & Fissure to Cave	Wd; 1 to 1.5 km	Th; maximum app. 30 m	In the order of E-2 to E-3cm/sec	T : 20 to 100m2/d Sy ; app 20%	(Spintangi Limestone) Gazij Shale
Khora Manda	Alluvial Fan deposits	Ar; app 120 deg Ra; 2 to 3 km A; app. 3 km2	Gr; upstream side app. 1/20, downstream side app 1/25 Th; maximum 150m	Higher side in the order of E-3cm/sec	Sy ; more than 20%	Subrecent Deposits
Marium	Alluvial Cone deposits	Influenced Area Wd; hundreds of meters, Length; app. 1 km	Gr; average app 1/10 Th; maximum 30m	In the order of E-2 to E-3cm/sec	Sy ; more than 20%	Urak Conglomerate
Bostan	Alluvial Fan deposits	Ar; app. 180 deg Ra; app. 3 km A; app 16 km2	Gr; average app 1/20 Th; more than 150m	4 to 8E-3cm/sec	T ; 300 to 500 m2/d Sy ; more than 20%	Alozai Group, Chiltan Limestone
Khushab	Alluvial Fan to Fan Bay deposits	Ar; app. 180 deg Ra; 1 to 2 km A; app. 4 km2	Gr; average app 1/25 Th; more than 150m	Higher side in the order of E-3cm/sec	Sy ; more than 20%	Parh Group, Chiltan Limestone, Hindbagh Intrusives
Tirkha	River deposits (Fan deposits)	Wd of River dep. tens of meters, Ar; app. 60 deg Ra; app 2 km A; app 3 km2	Gr; 1/80 to100 Th; River dep several meters, Fan dep. max. 50 m	In the order of E-3cm/sec	Sy ; 10 to 15%	Bostan Formation
Amach	Alluvial Fan deposits	Ar; app 180 deg Ra; 2 to 3 km A; app 4 km2	Gr; 1/20 to 100 Th; max. 150 to 200 m	In the order of E-3cm/sec	T : app. 150m2/d Sy ; app 20%	Chiltan Limestone
Kad Kocha I	Fan Bay deposits	Wd. of Valley, 0.5 to 0.7 km	Gr; app 1/30 Th; max. 50 to100m	In the order of E-3cm/sec	T : 300 to 500m2/d Sy ; more than 20%	Chiltan Limestone
Gorpad	Rock Fan to River deposits	directly continueing to Kasi Jhal	Gr; app. 1/30 Th; max. 70 to 80m	In the order of E-3 to E-4cm/sec	Sy ; 10 to more than 20%	Parh Series
Lagmgir	River to Fan deposits	Ar; app. 130 deg Ra; 3 to 4 km	Gr; 1/60 to 60 Th; max. 100 to 150 m	In the order of E-3cm/sec	T : 50 to 100m2/d Sy ; more than 20%	Shirinab Formation
Sarbund	River to Fan deposits	Rock is exposing in the downstream river bed and continueing to [illegible]	-	-	-	Nimragh Limestone, Wakabi Limestone, Shirinab Formation

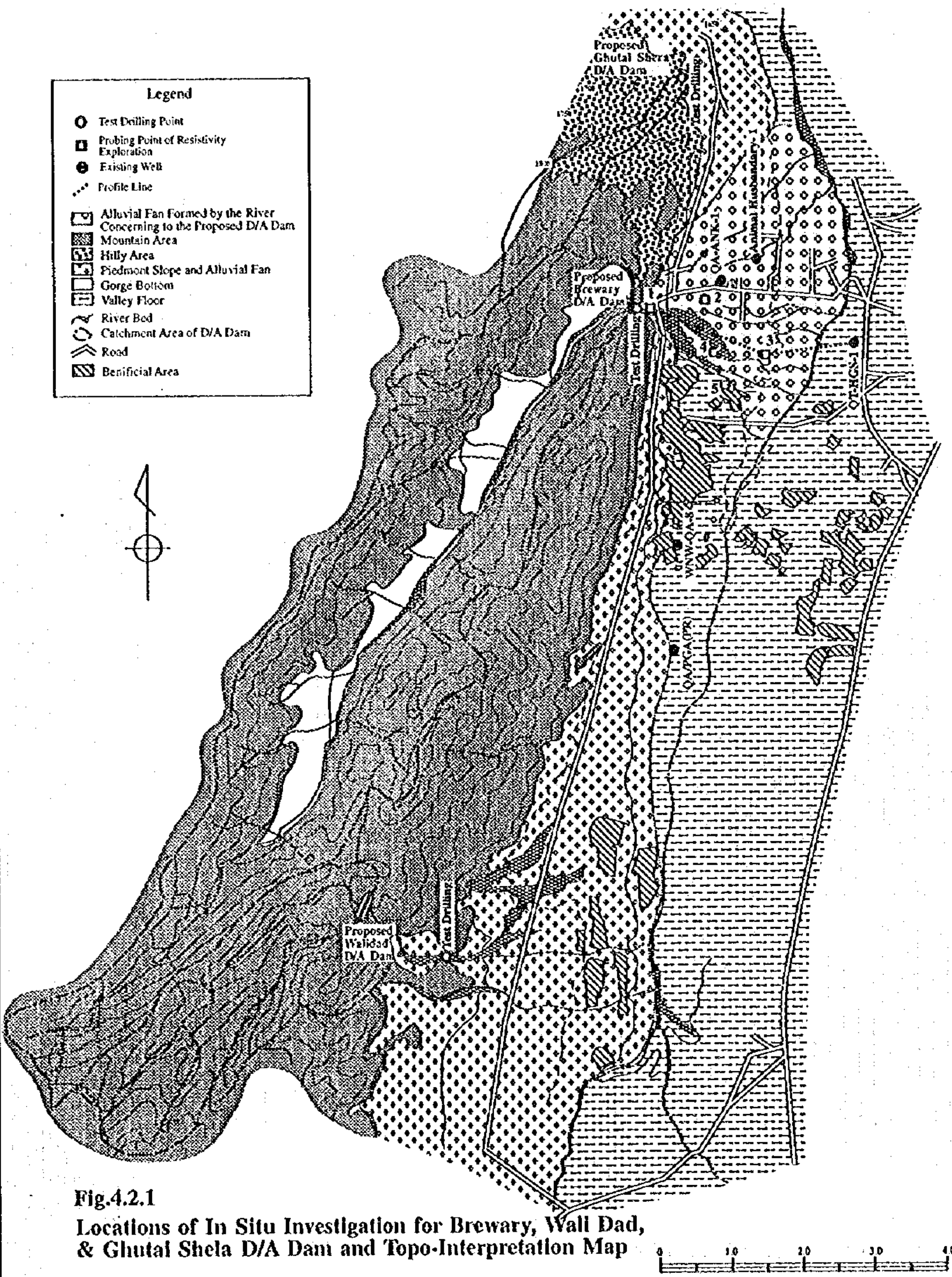


Fig.4.2.1
Locations of In Situ Investigation for Brewary, Wali Dad, & Ghutal Shela D/A Dam and Topo-Interpretation Map

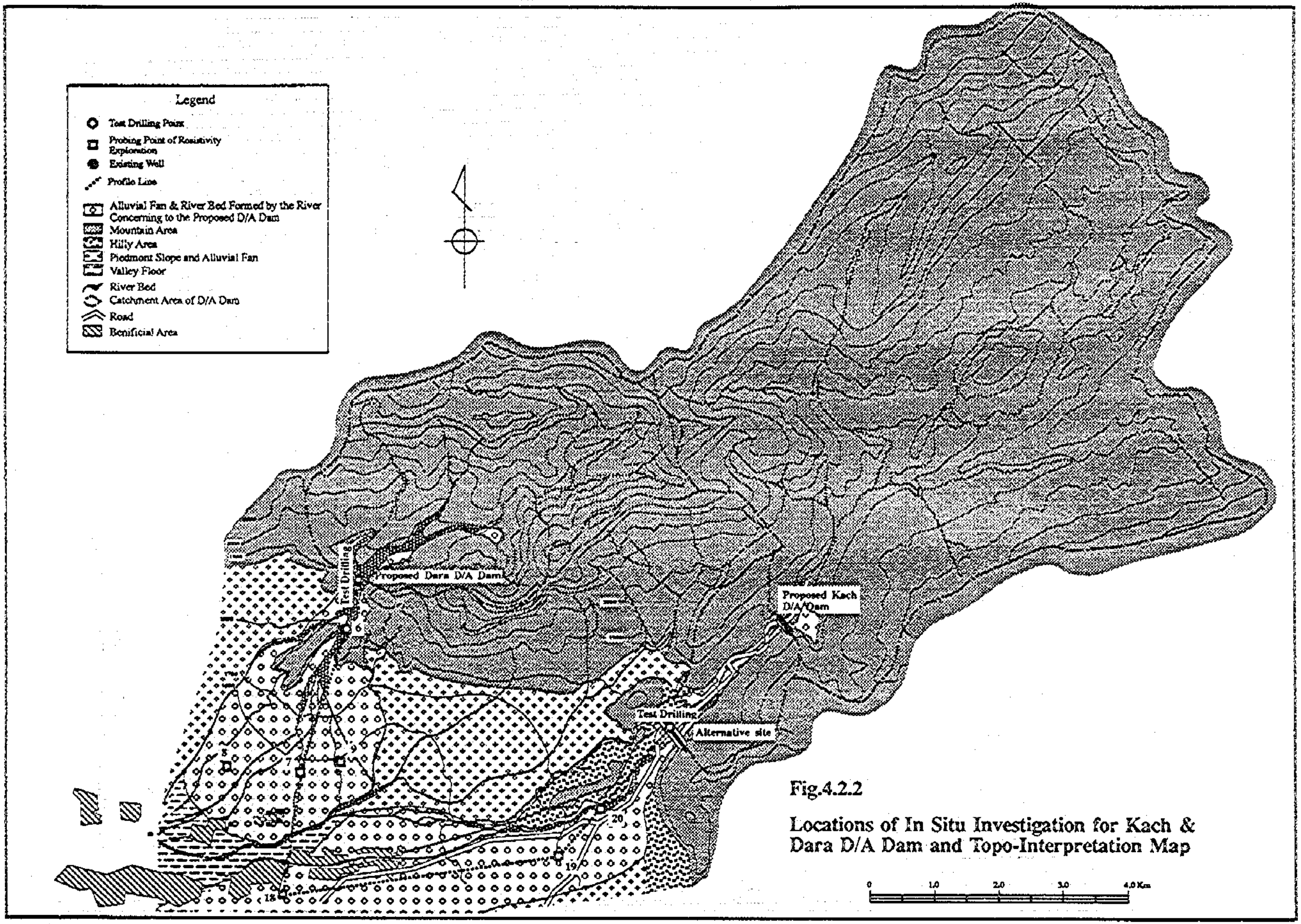


Fig.4.2.2

Locations of In Situ Investigation for Kach & Dara D/A Dam and Topo-Interpretation Map

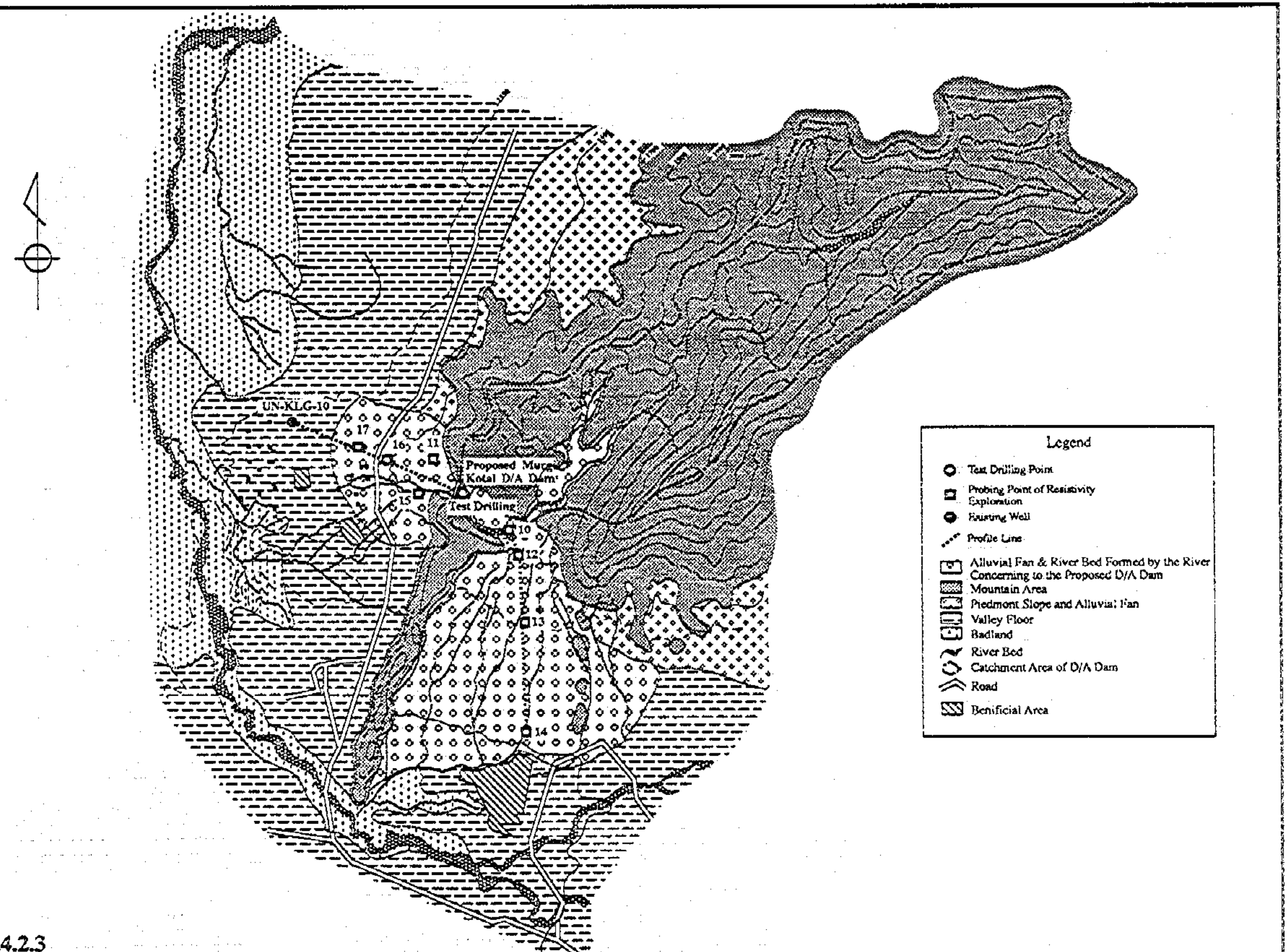


Fig.4.2.3
Locations of In Situ Investigation for Murgi Kotal D/A Dam and Topo-Interpretation Map

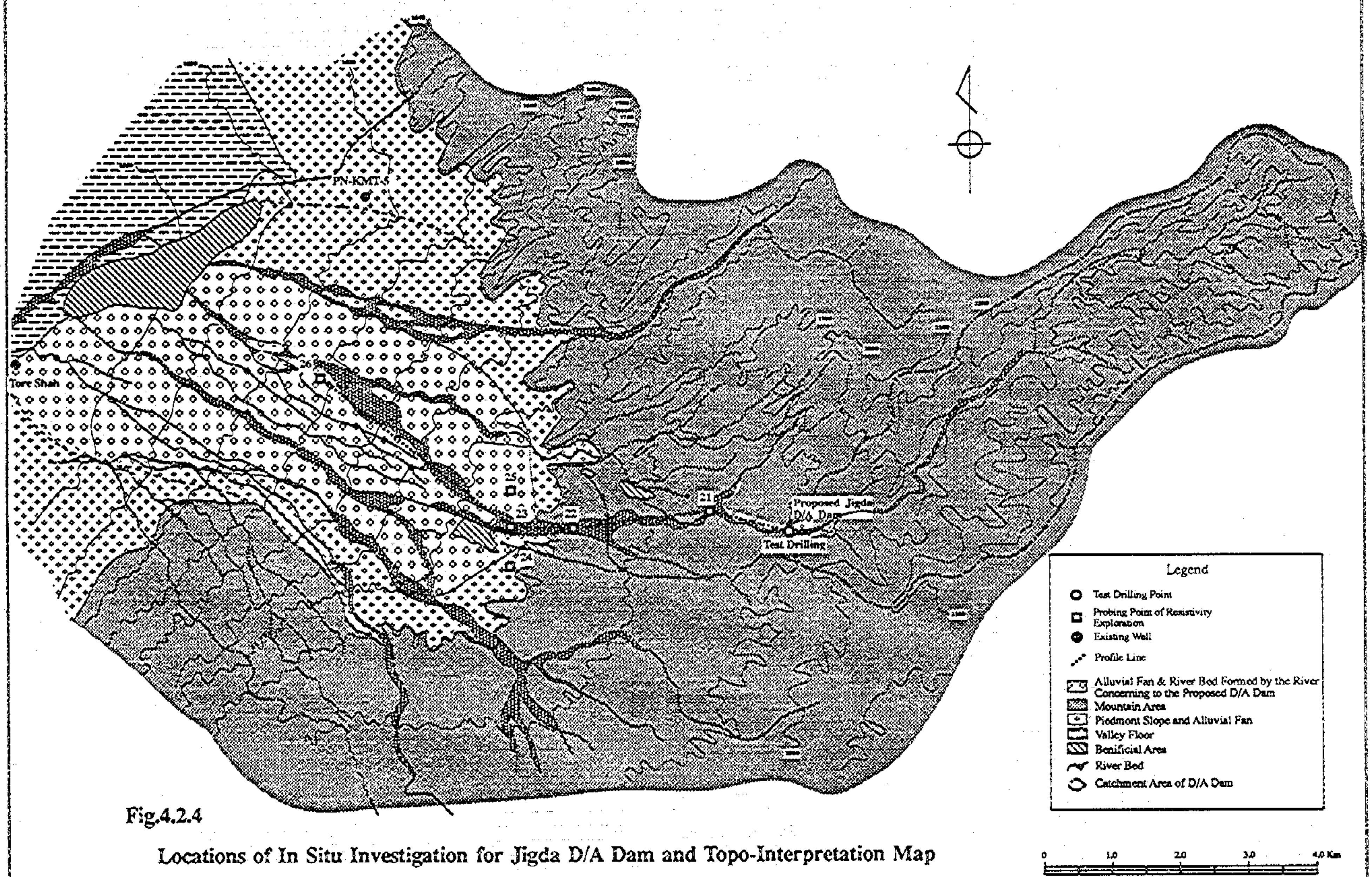


Fig.4.2.4

Locations of In Situ Investigation for Jigda D/A Dam and Topo-Interpretation Map

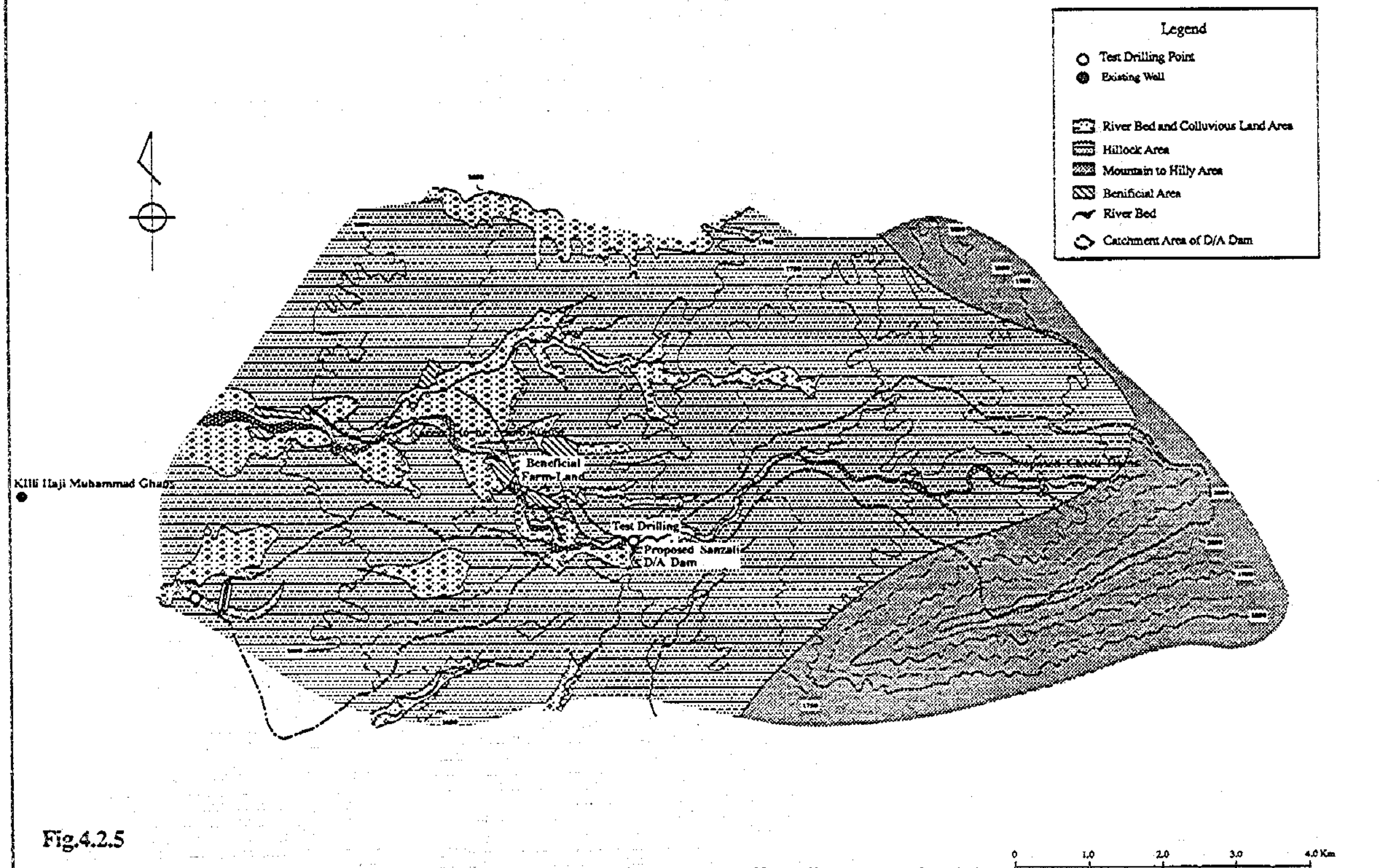


Fig.4.2.5

Locations of In Situ Investigation for Sanzali & Tirkha D/A Dam and Topo-Interpretation Map

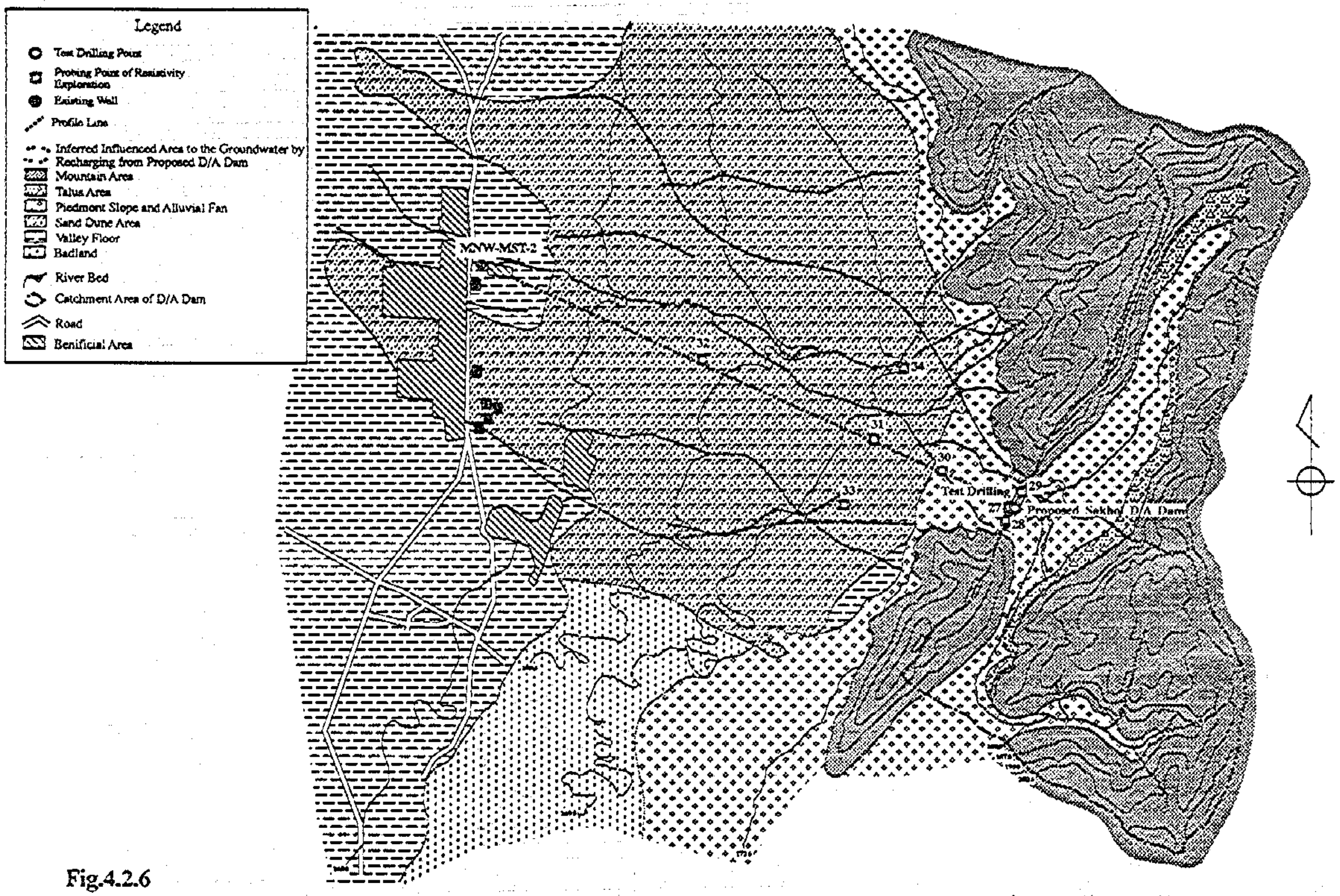


Fig.4.2.6

Locations of In Situ Investigation for Sakhol D/A Dam and Topo-Interpretation Map

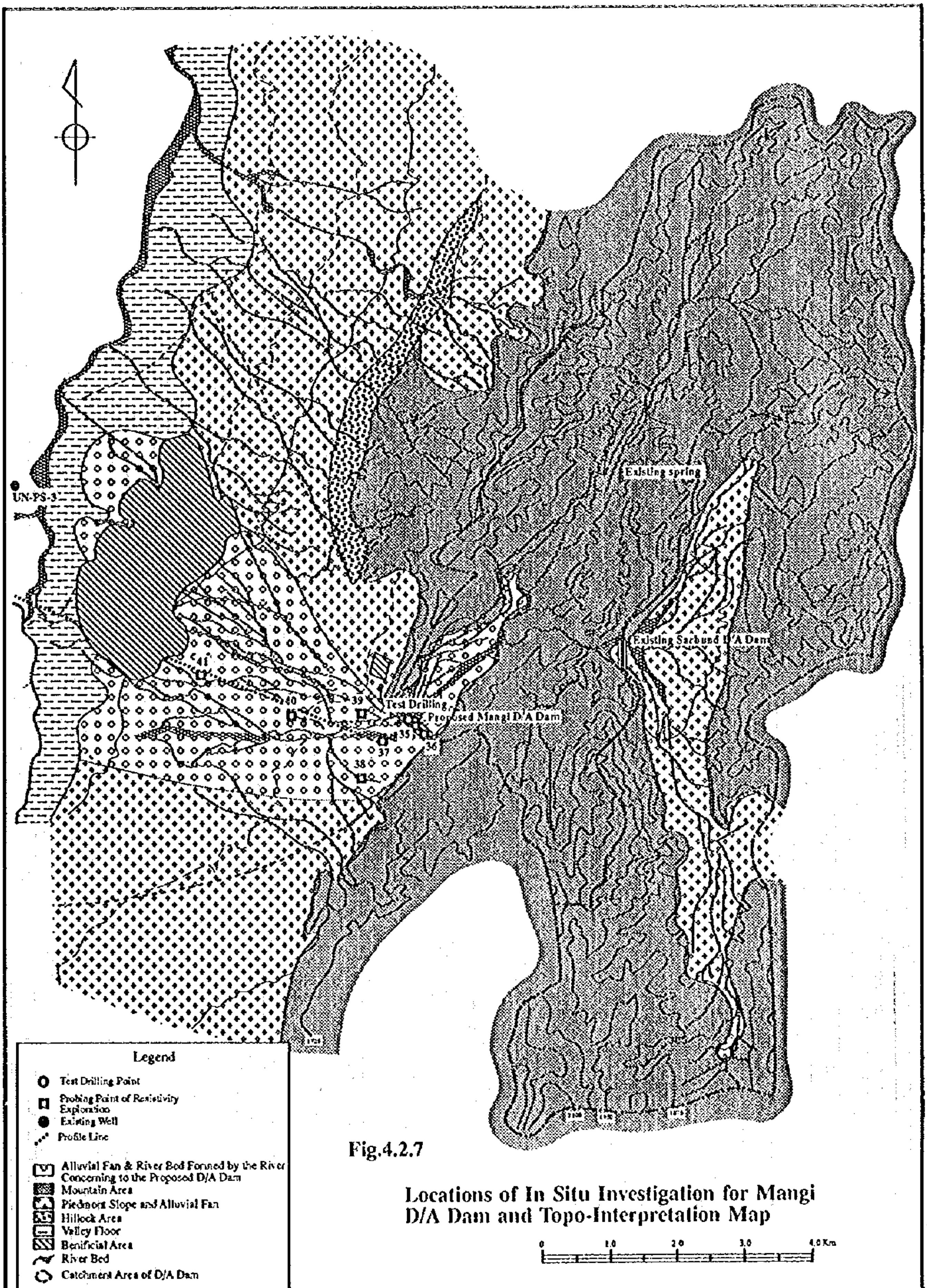


Fig.4.2.7

Locations of In Situ Investigation for Mangi D/A Dam and Topo-Interpretation Map

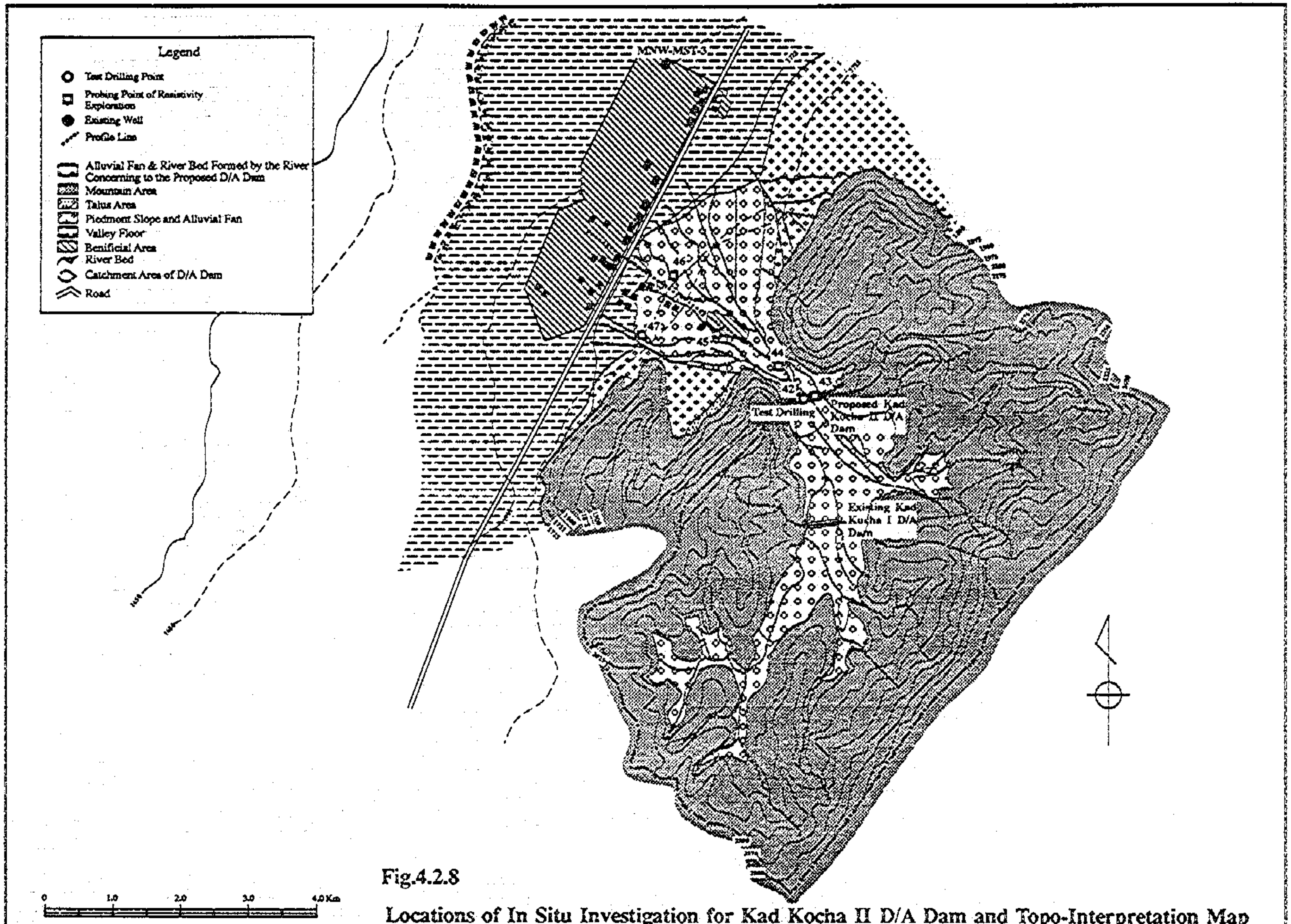


Fig.4.2.8

Locations of In Situ Investigation for Kad Kocha II D/A Dam and Topo-Interpretation Map

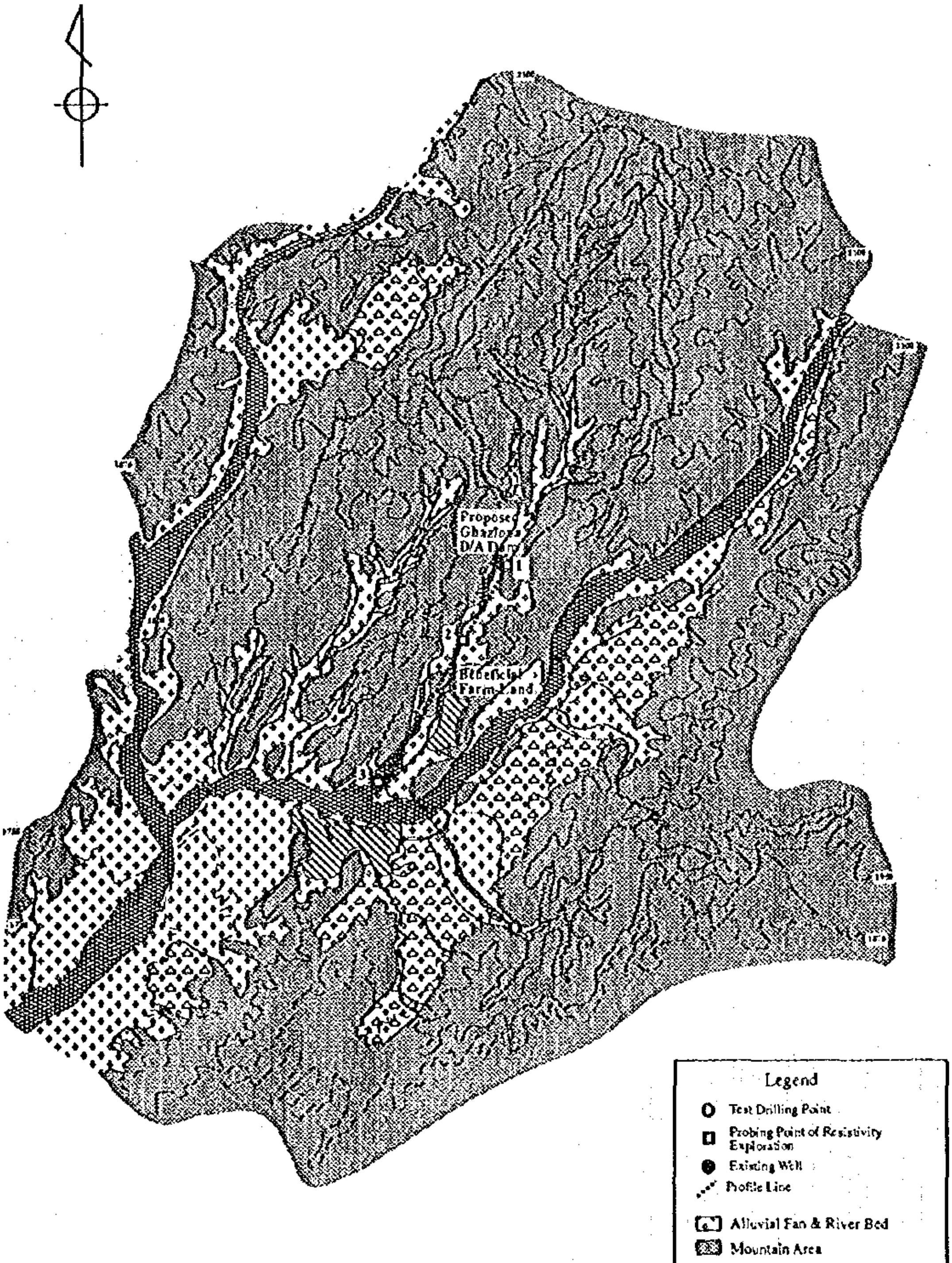


Fig.4.2.9
Locations of In Situ Investigation for Ghazlona (Arambi) D/A Dam and Topo-Interpretation Map

0 1.0 2.0 3.0 4.0 Km

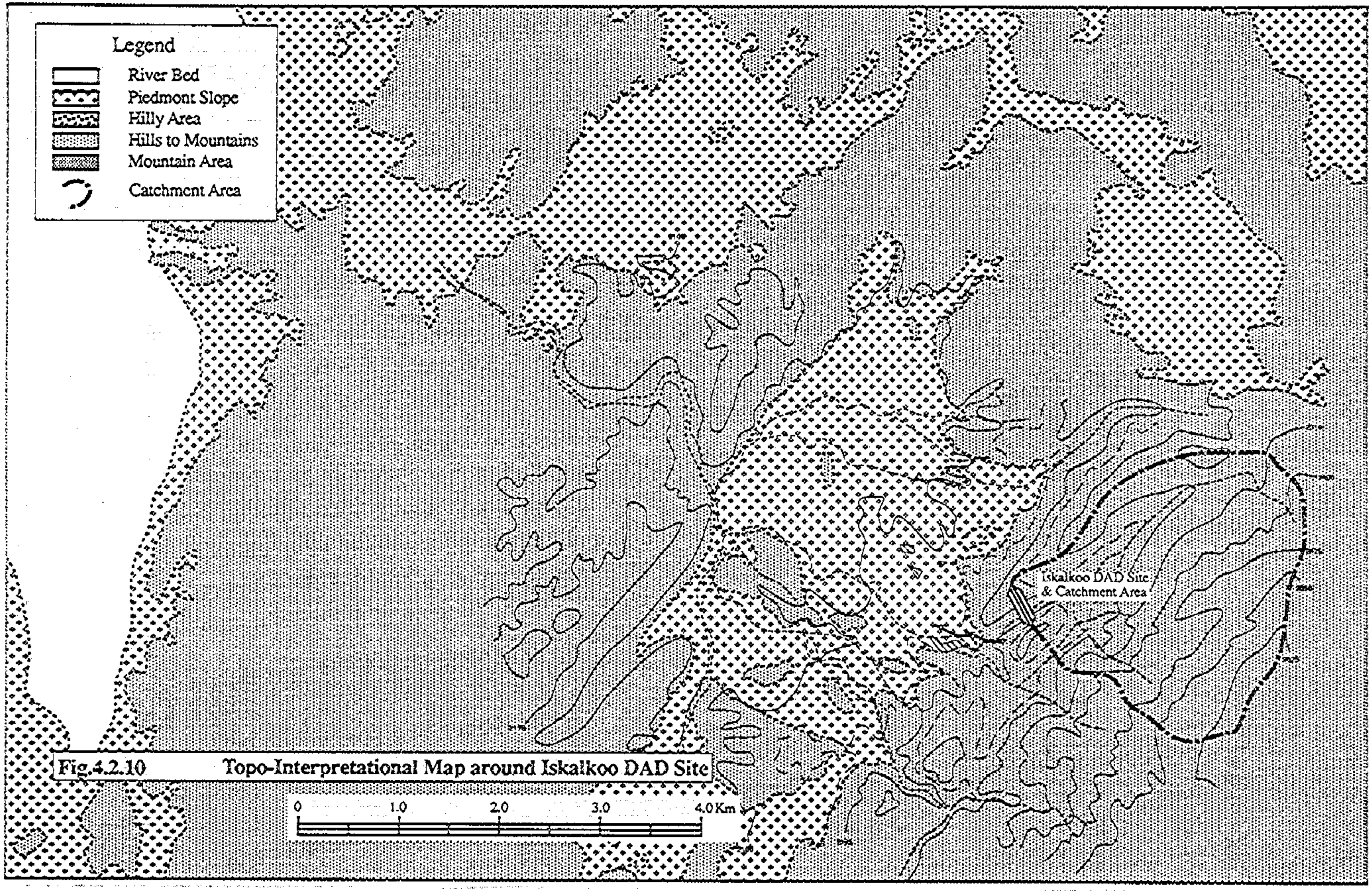


Fig.4.2.10 Topo-Interpretational Map around Iskalkoo DAD Site

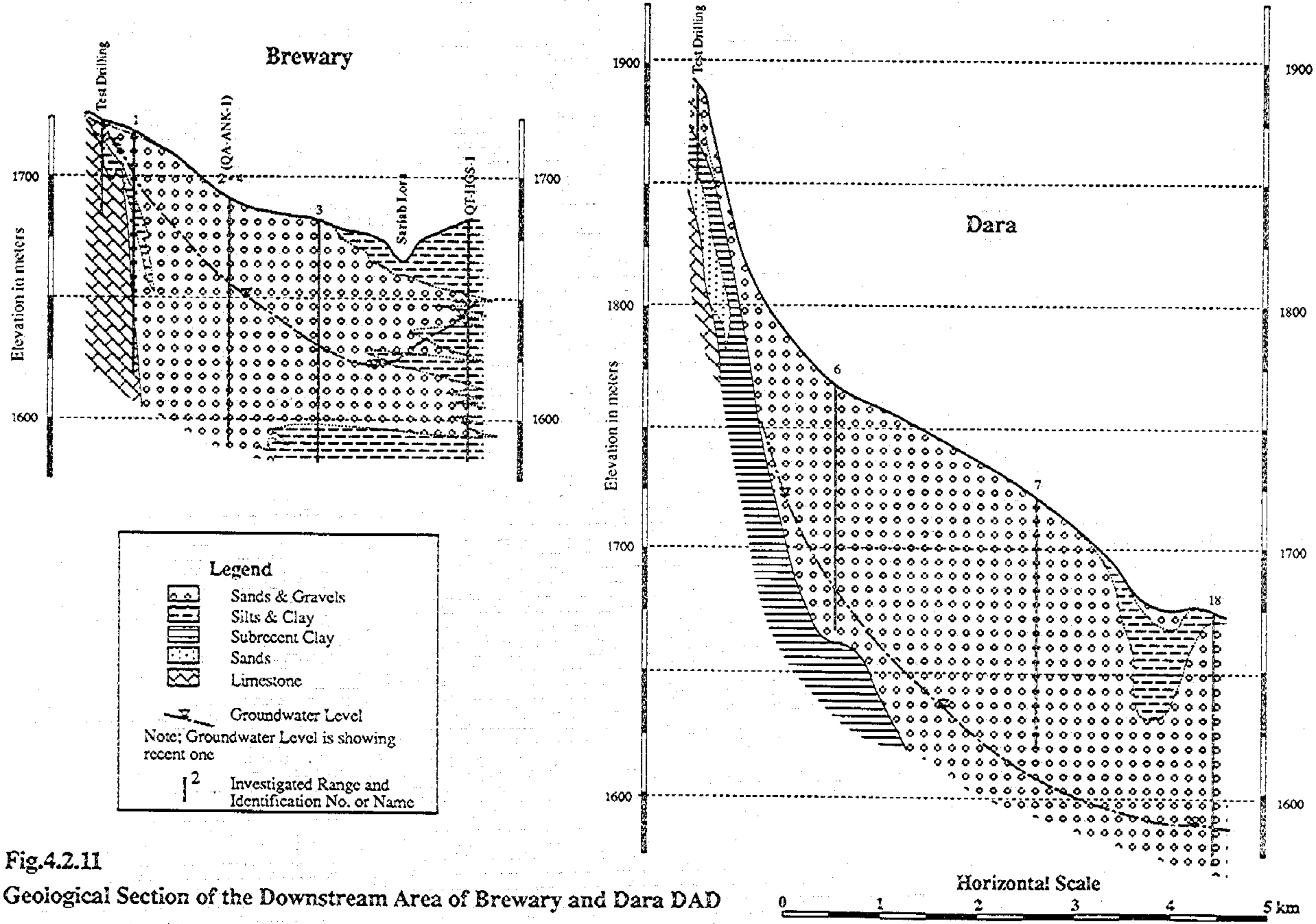


Fig.4.2.11
Geological Section of the Downstream Area of Brewary and Dara DAD

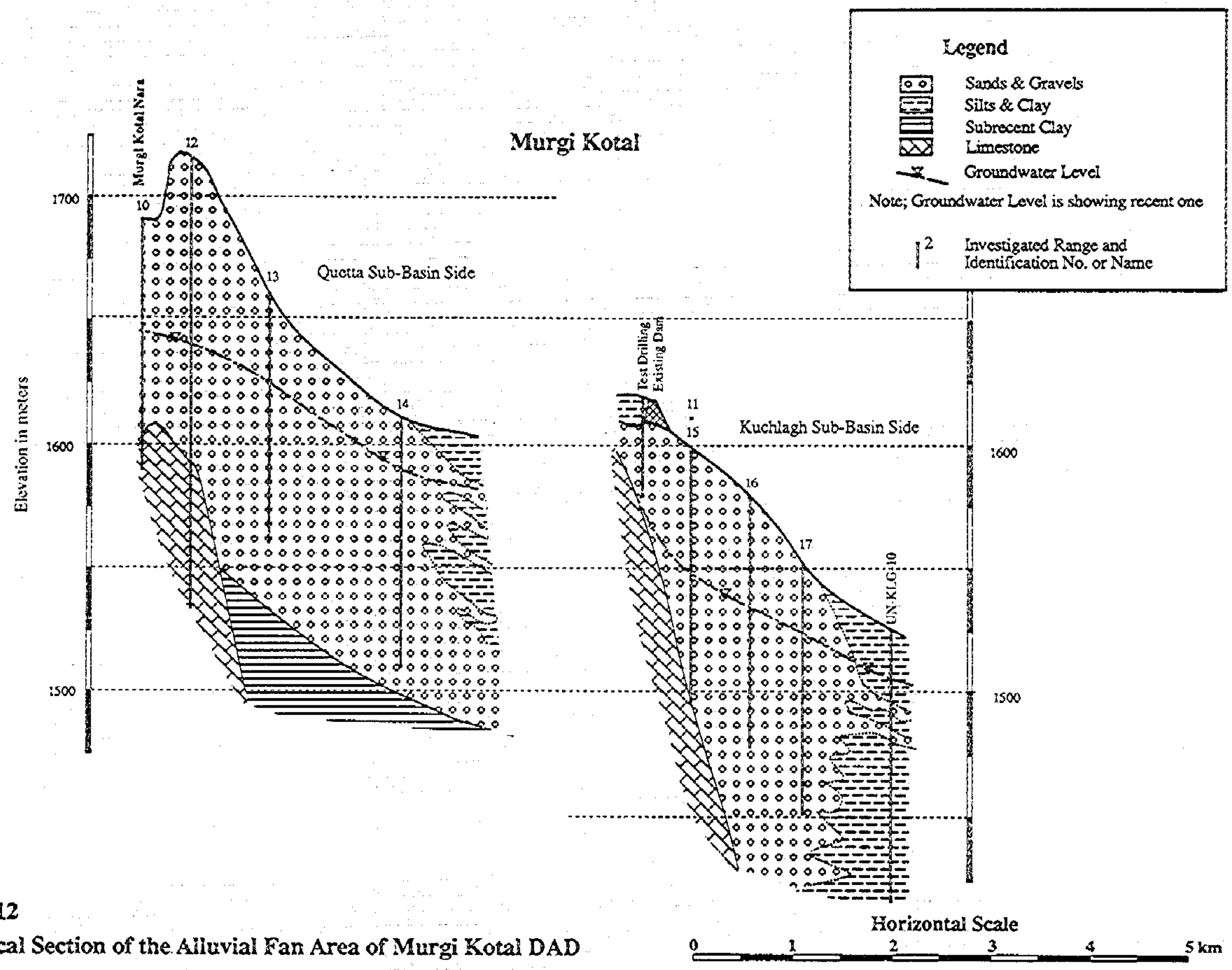


Fig.4.2.12
Geological Section of the Alluvial Fan Area of Murgi Kotal DAD

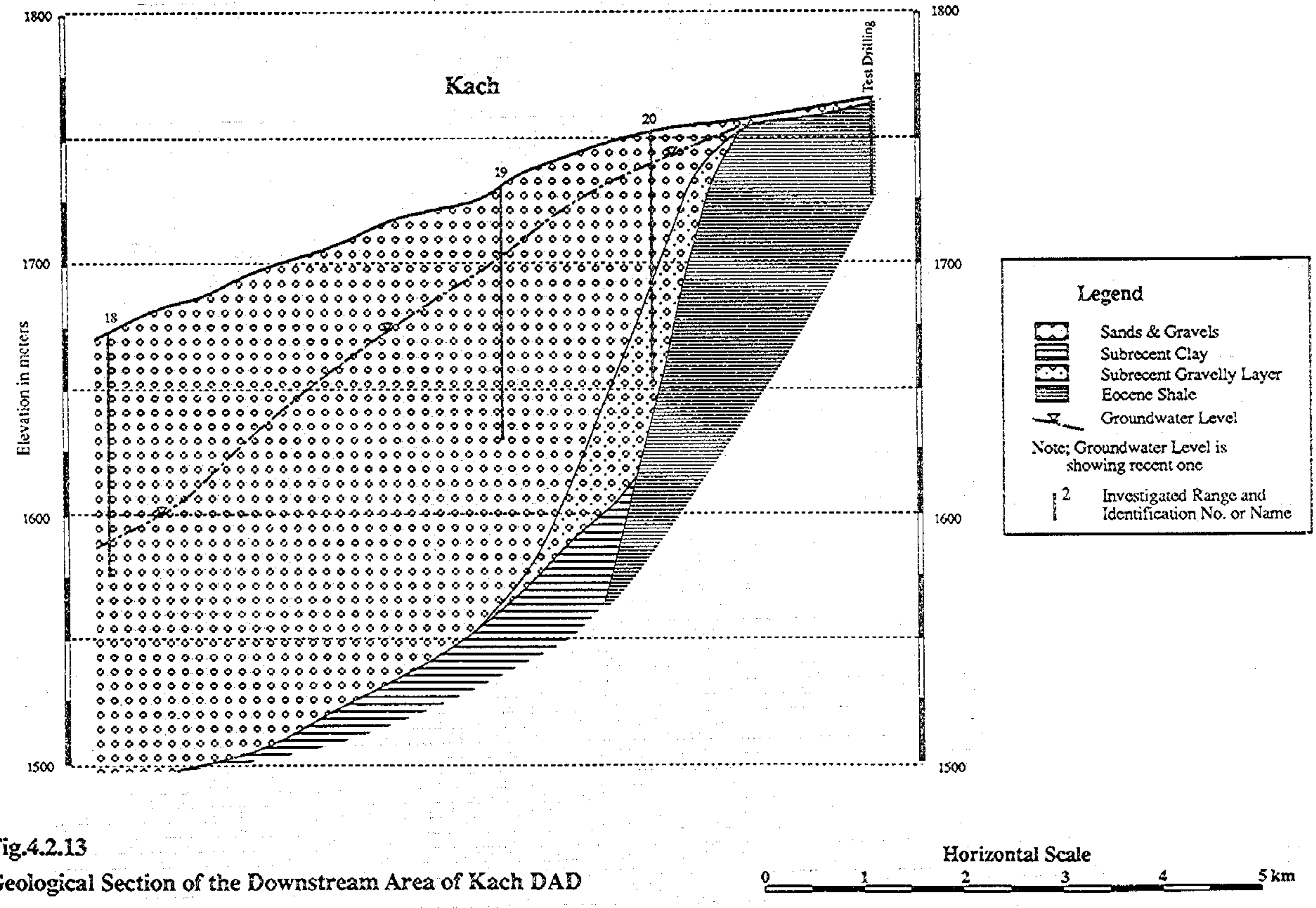


Fig.4.2.13
Geological Section of the Downstream Area of Kach DAD

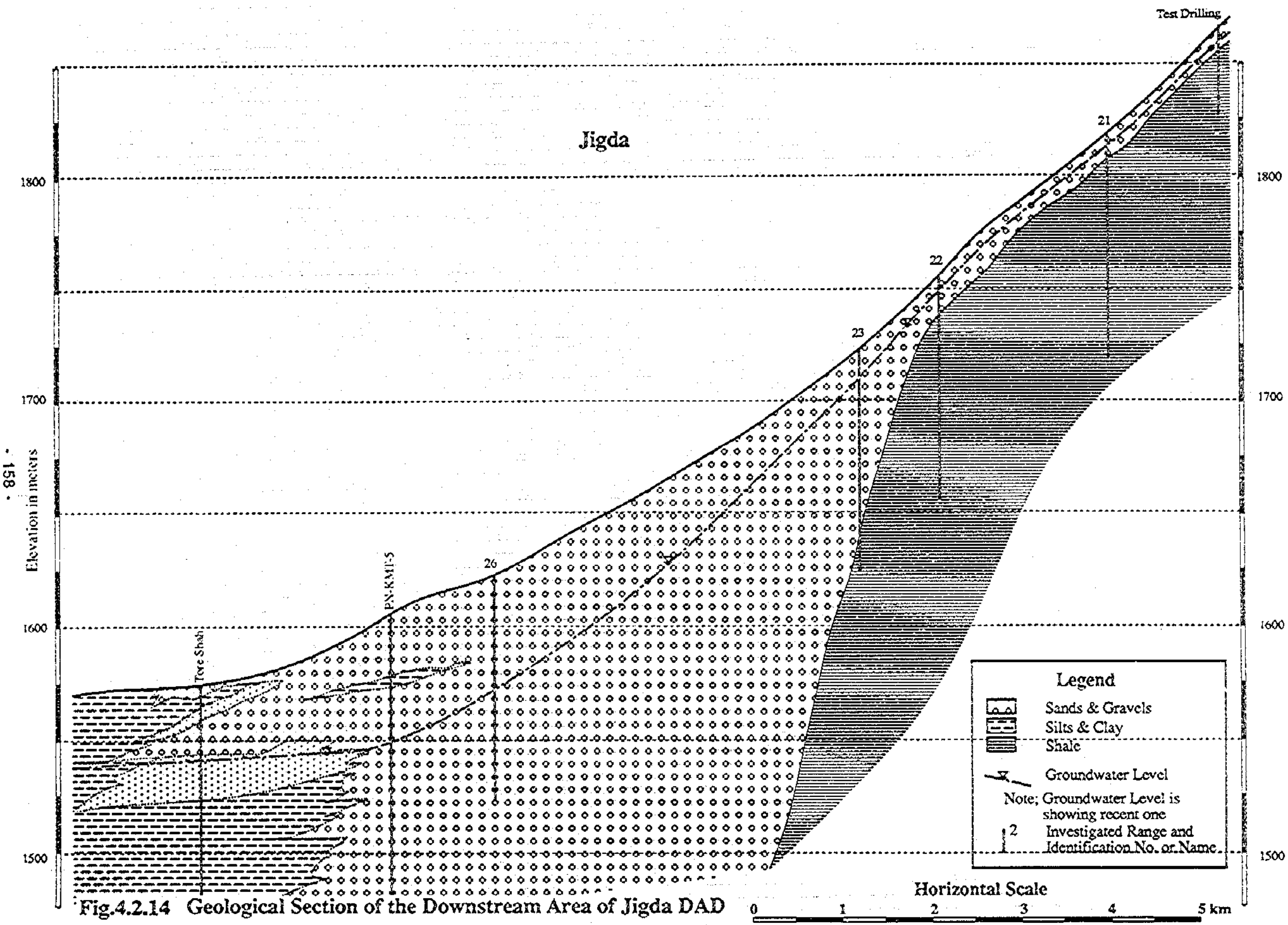


Fig.4.2.14 Geological Section of the Downstream Area of Jigda DAD

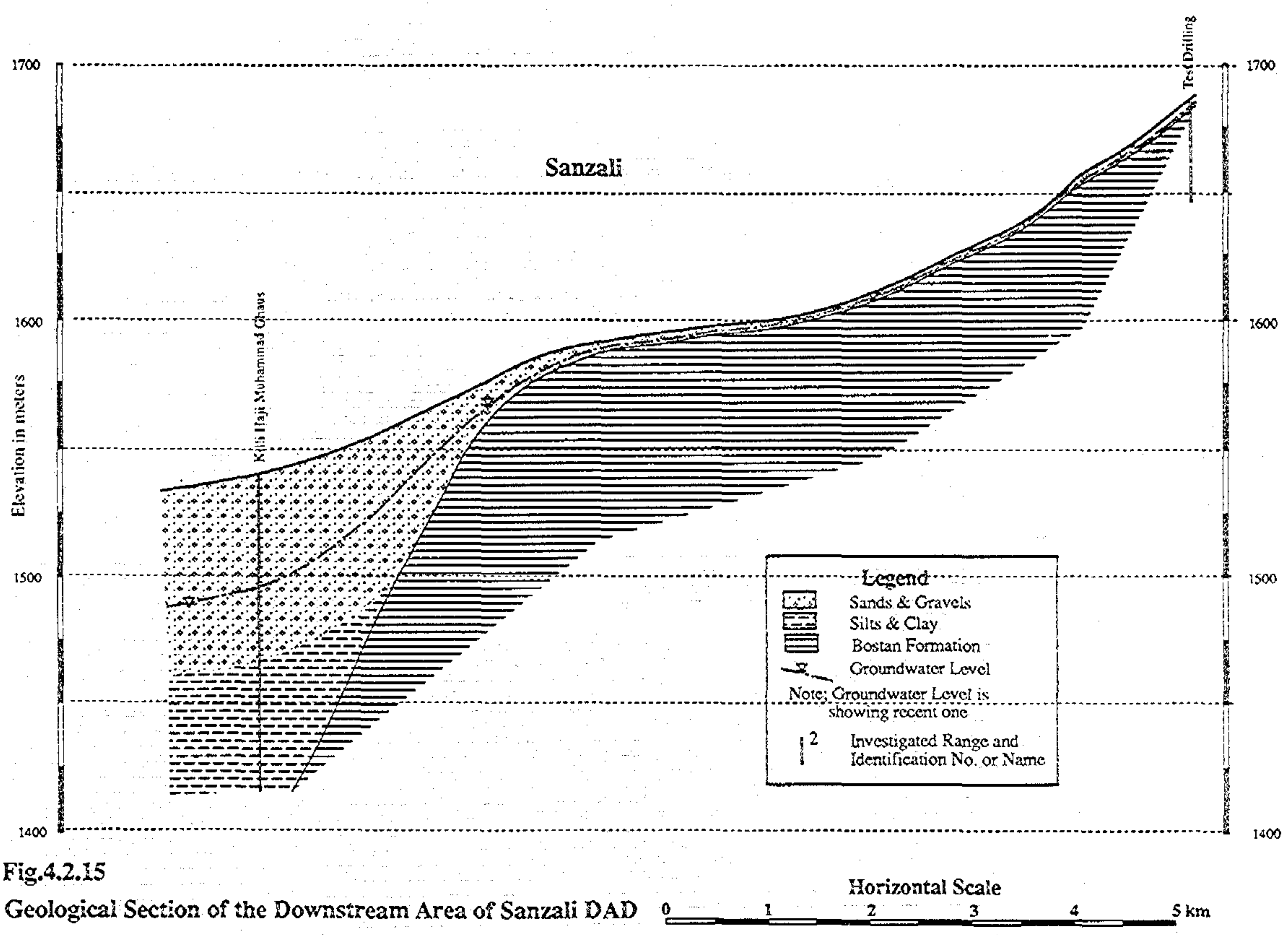


Fig.4.2.15
Geological Section of the Downstream Area of Sanzali DAD

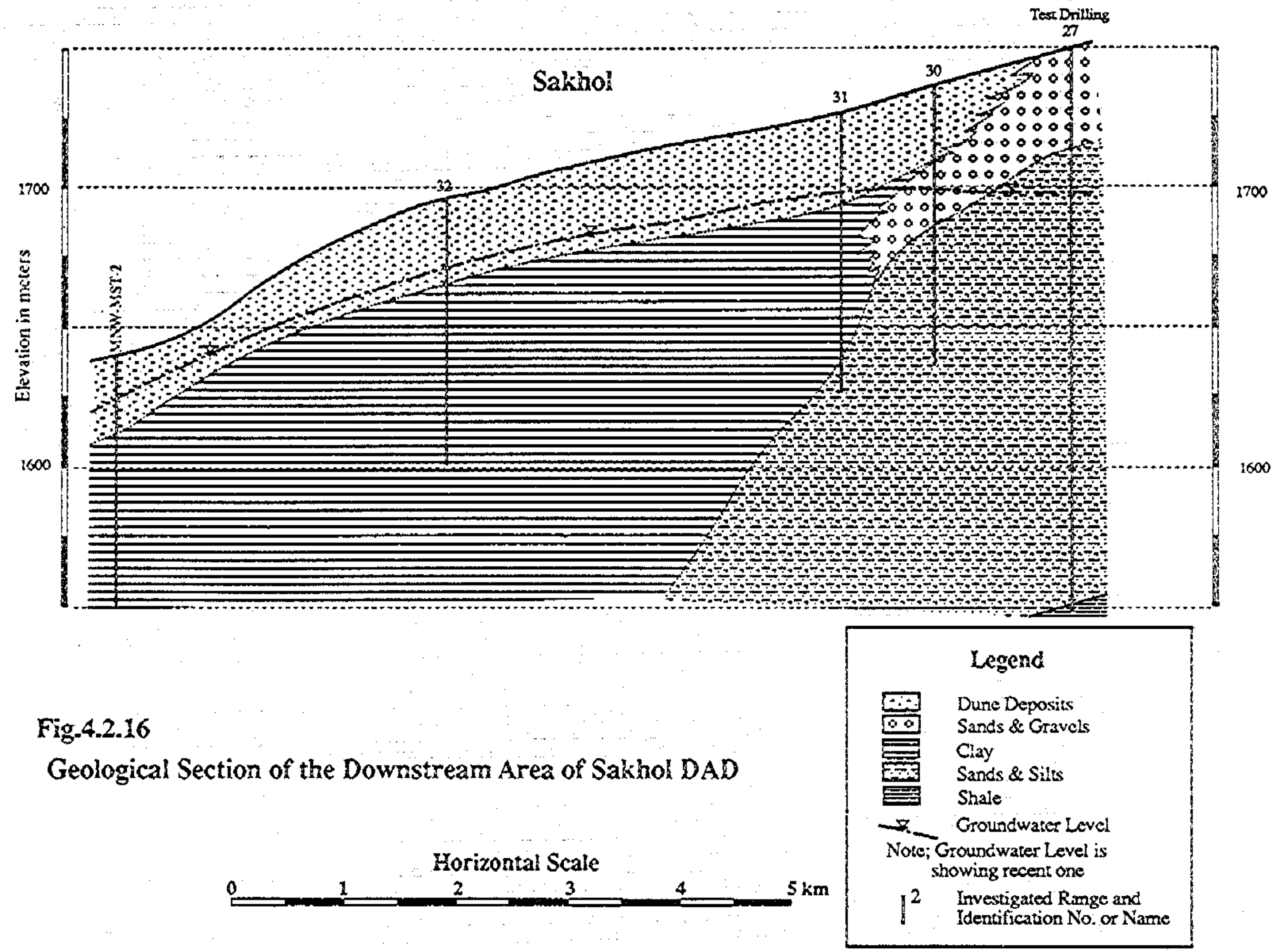


Fig.4.2.16
Geological Section of the Downstream Area of Sakhol DAD

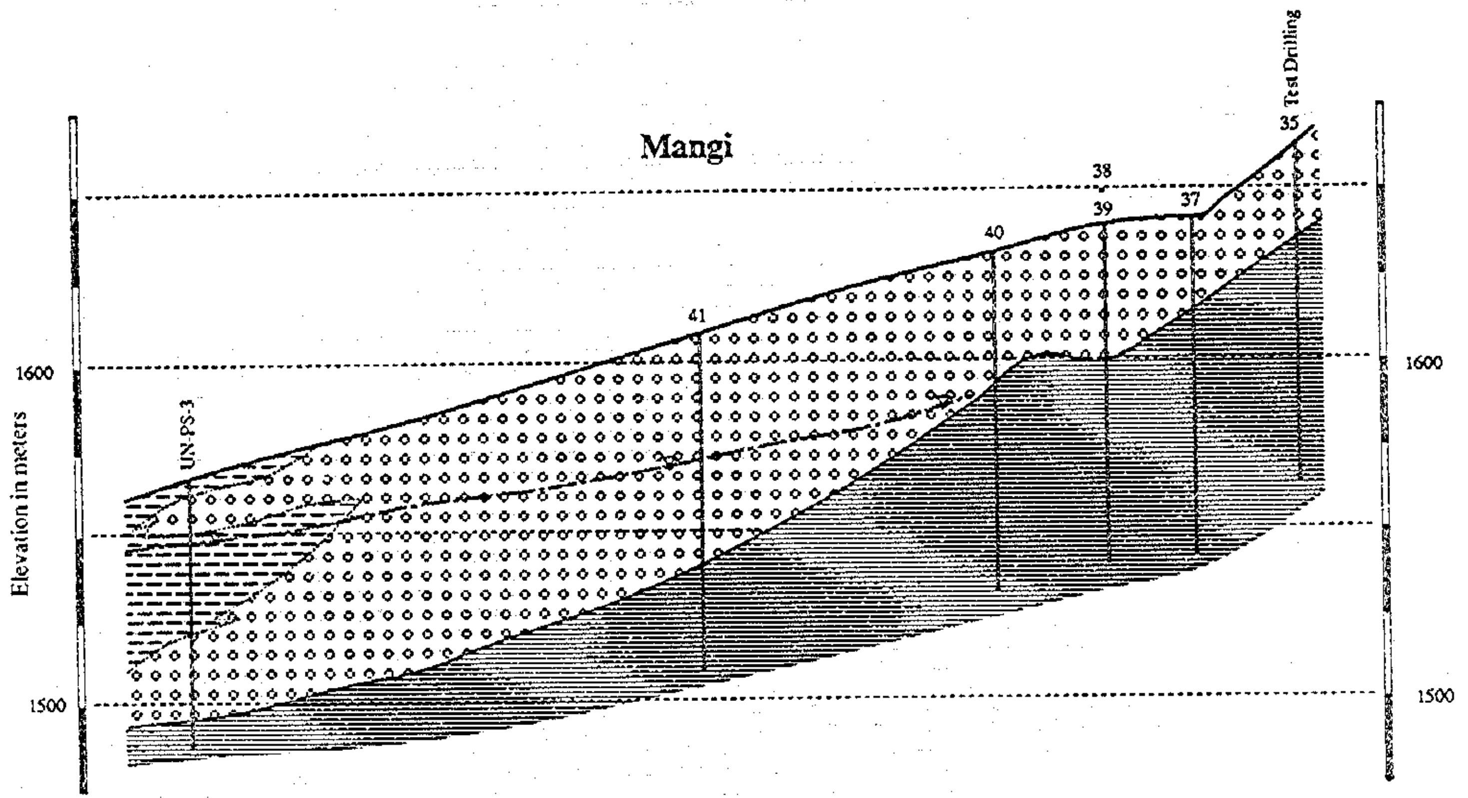
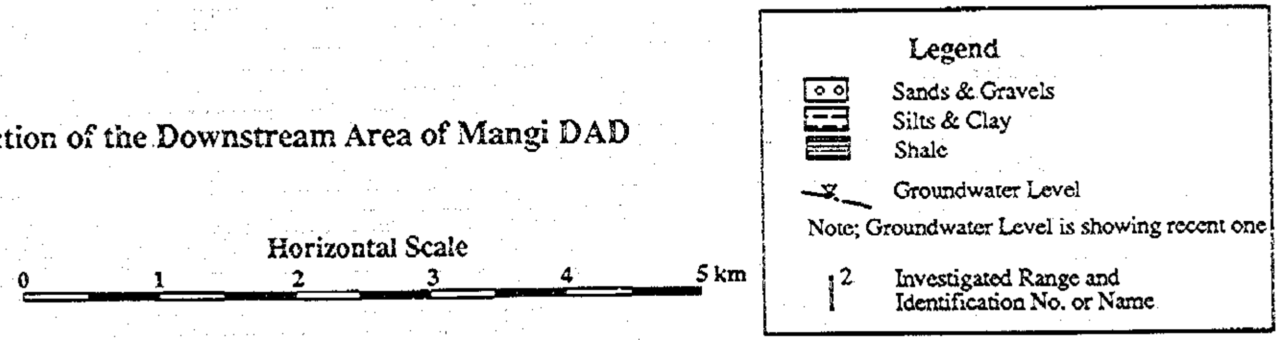


Fig.4.2.17
Geological Section of the Downstream Area of Mangi DAD



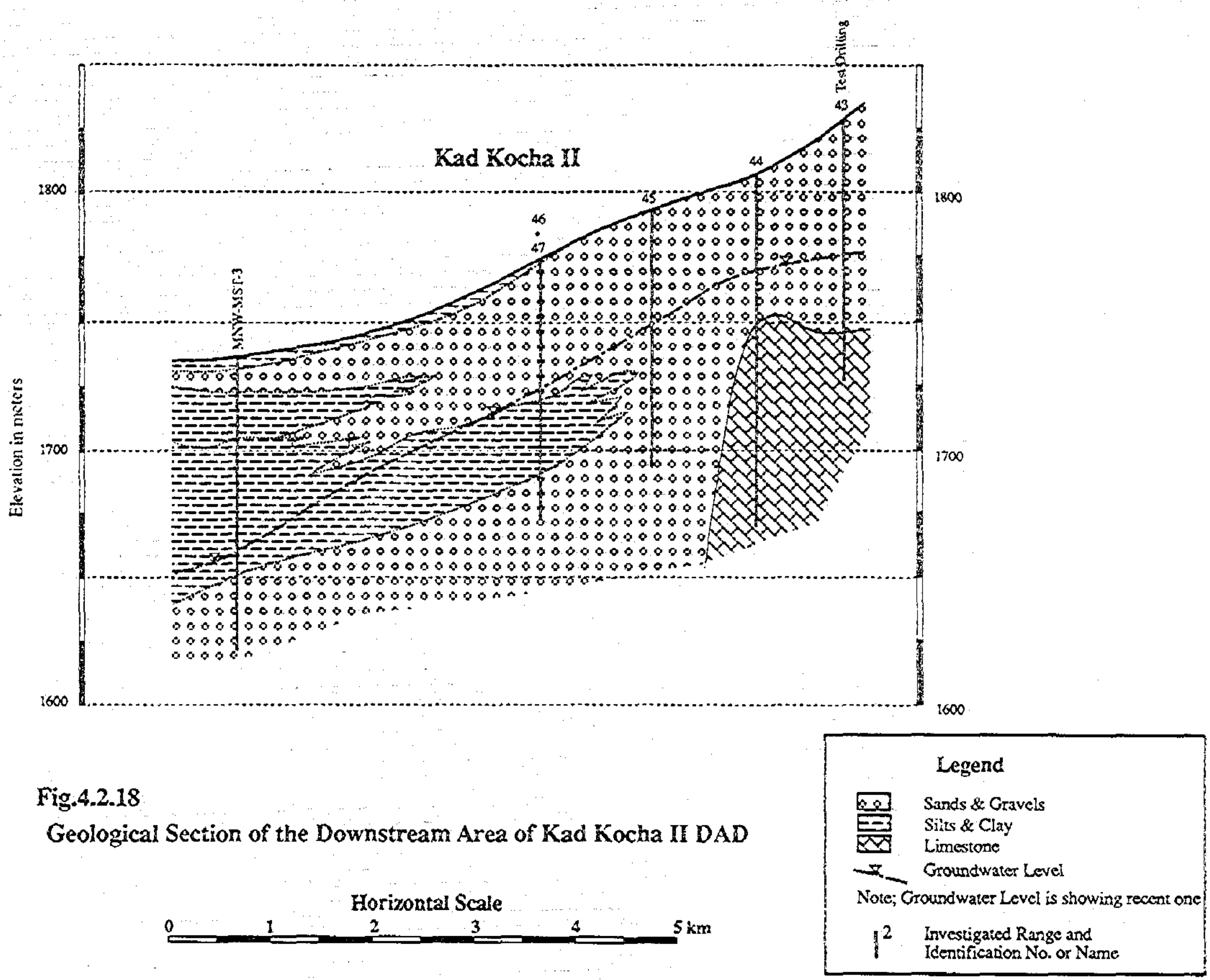


Fig.4.2.18
Geological Section of the Downstream Area of Kad Kocha II DAD

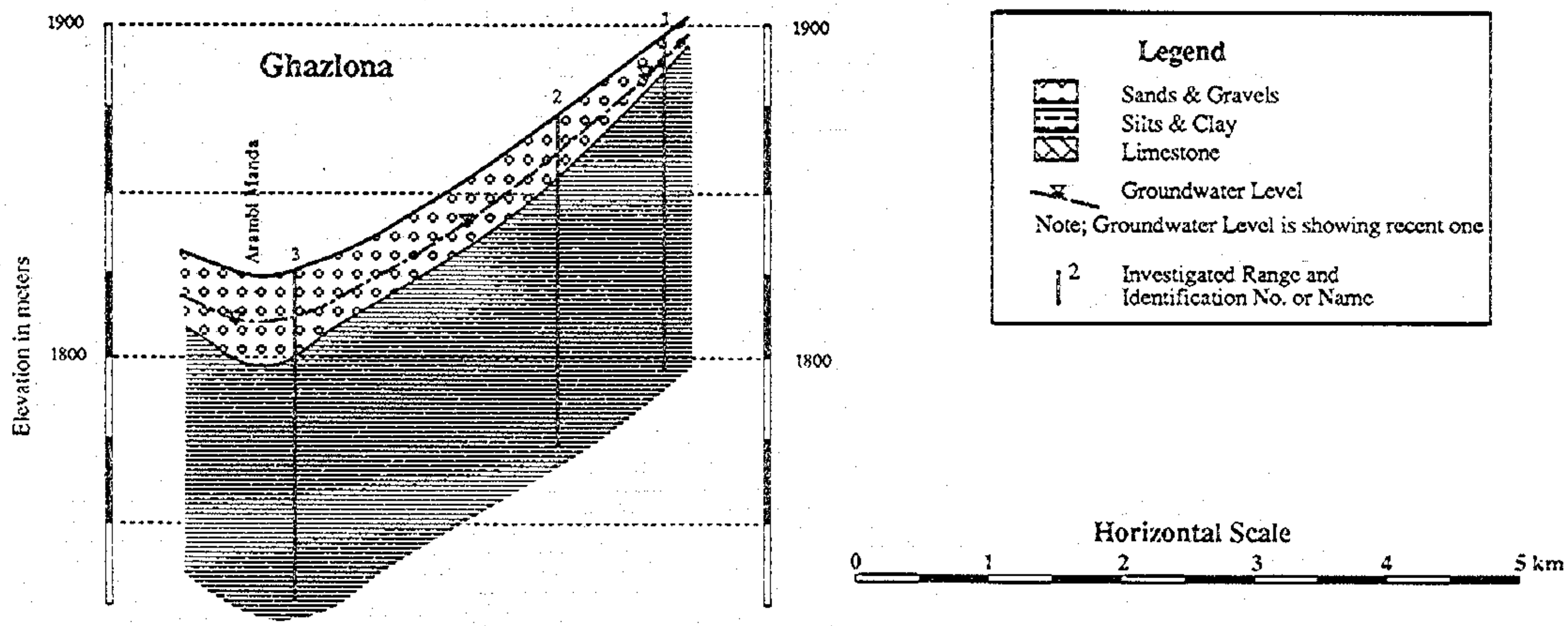


Fig.4.2.19 Geological Section of the Downstream Area of Ghazlona DAD

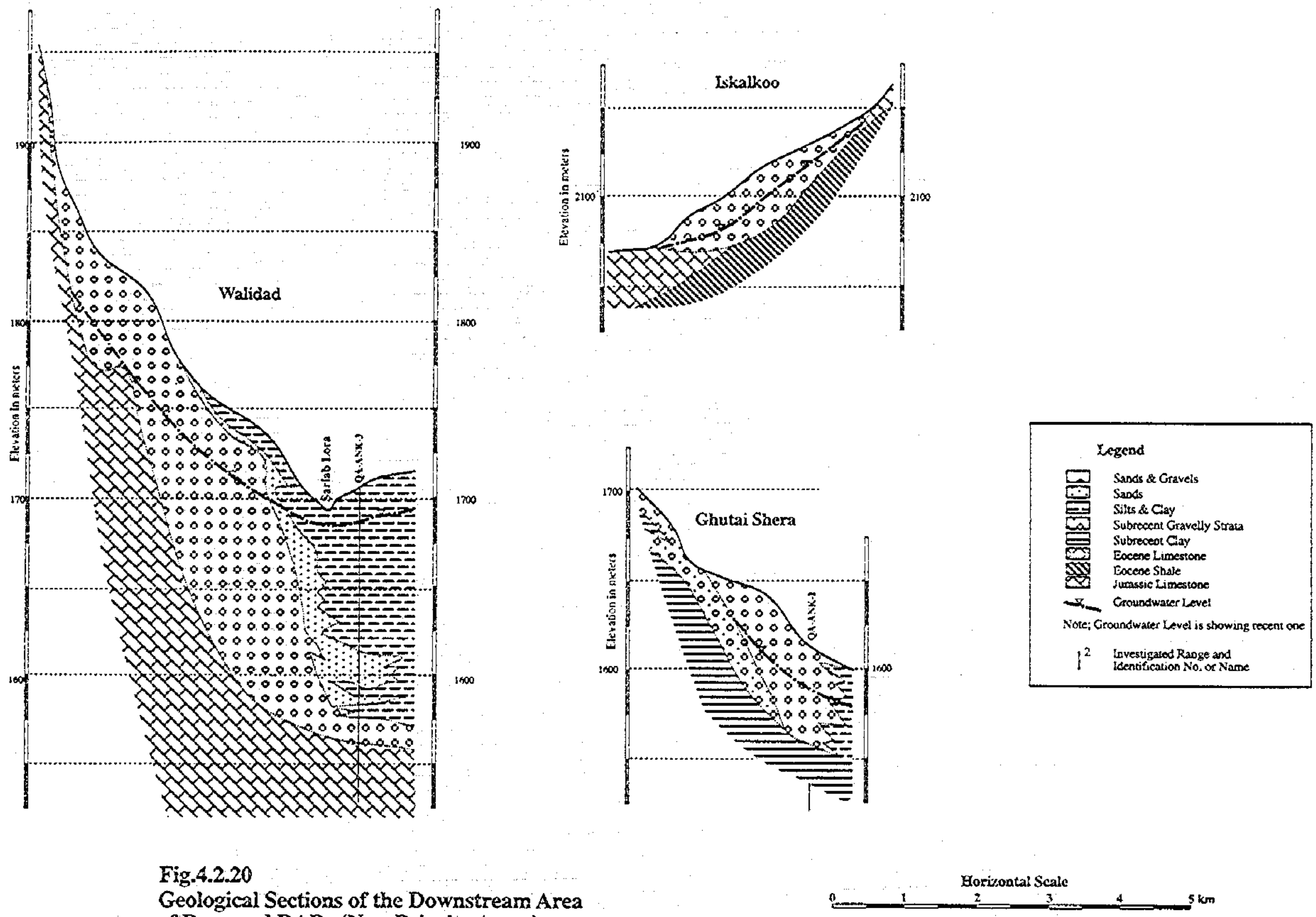


Fig.4.2.20
Geological Sections of the Downstream Area of Proposed DADs (Non-Priority Areas)

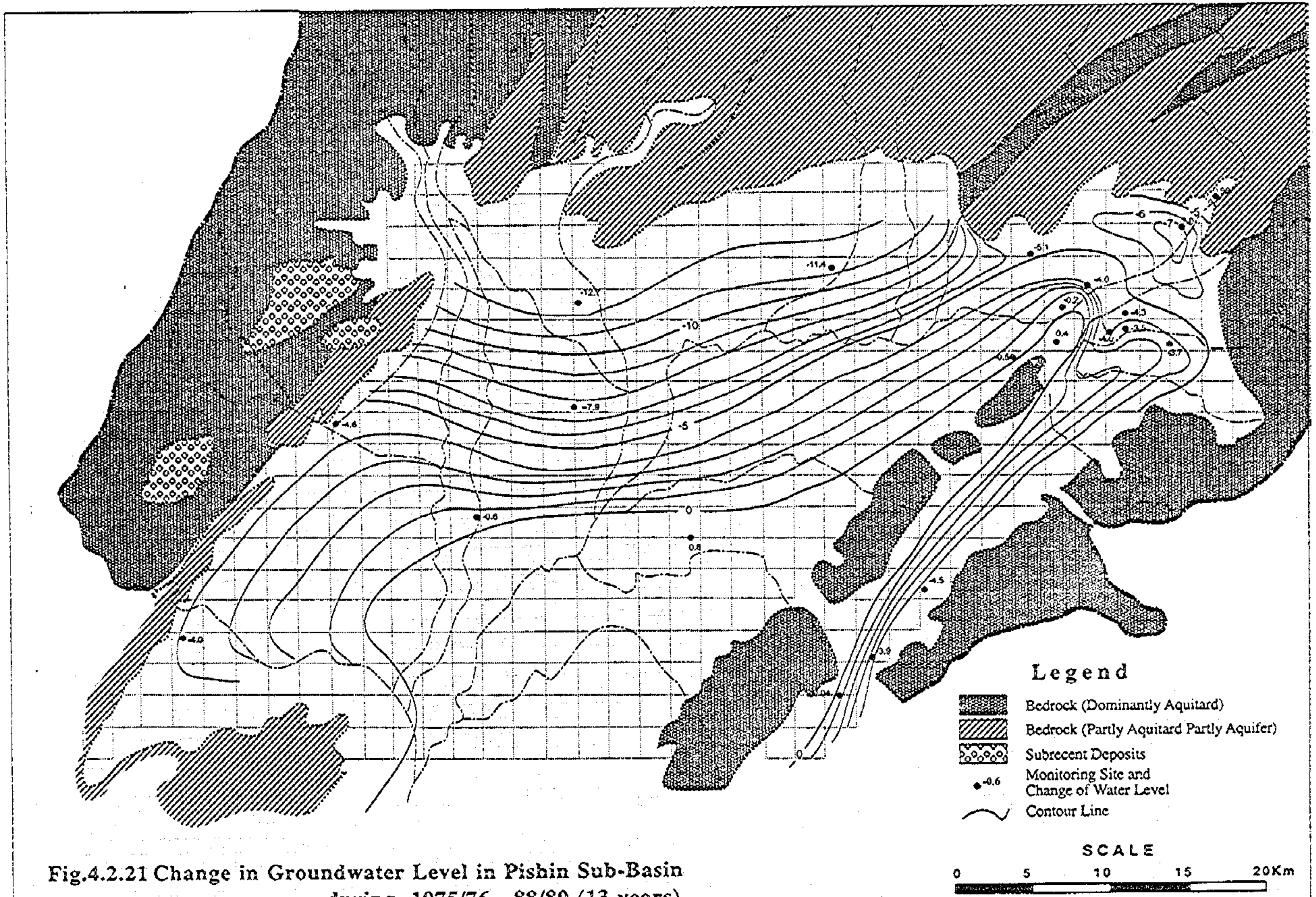


Fig.4.2.21 Change in Groundwater Level in Pishin Sub-Basin during 1975/76 - 88/89 (13 years)

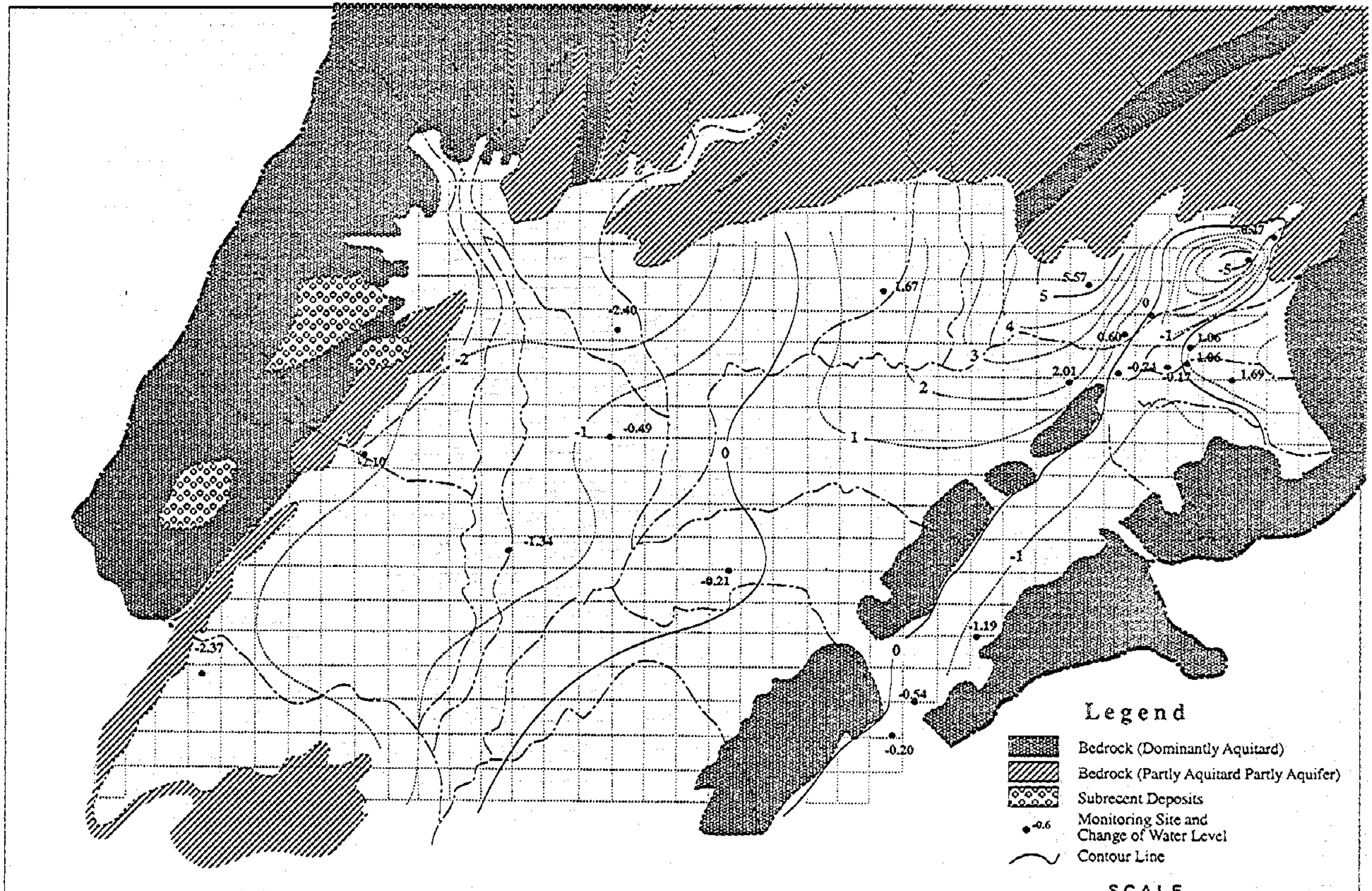


Fig.4.2.22 Change in Groundwater Level in Pishin Sub-basin during 1992/93 - 94/95 (2Years)

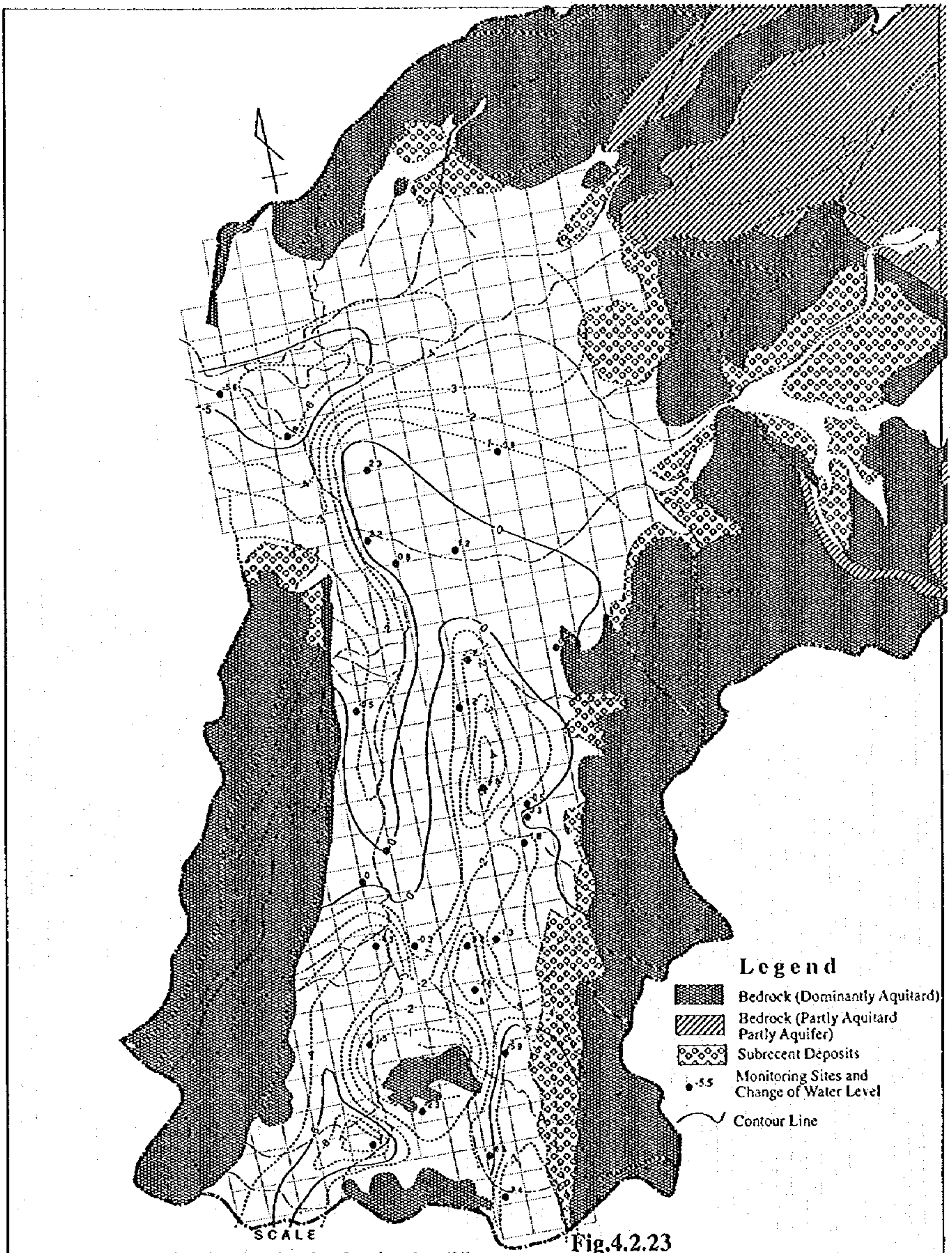


Fig.4.2.23
Recent Change in Groundwater Levels in Quetta Northern Sub-Basin during 1991/92 - 94/95 (3 years)

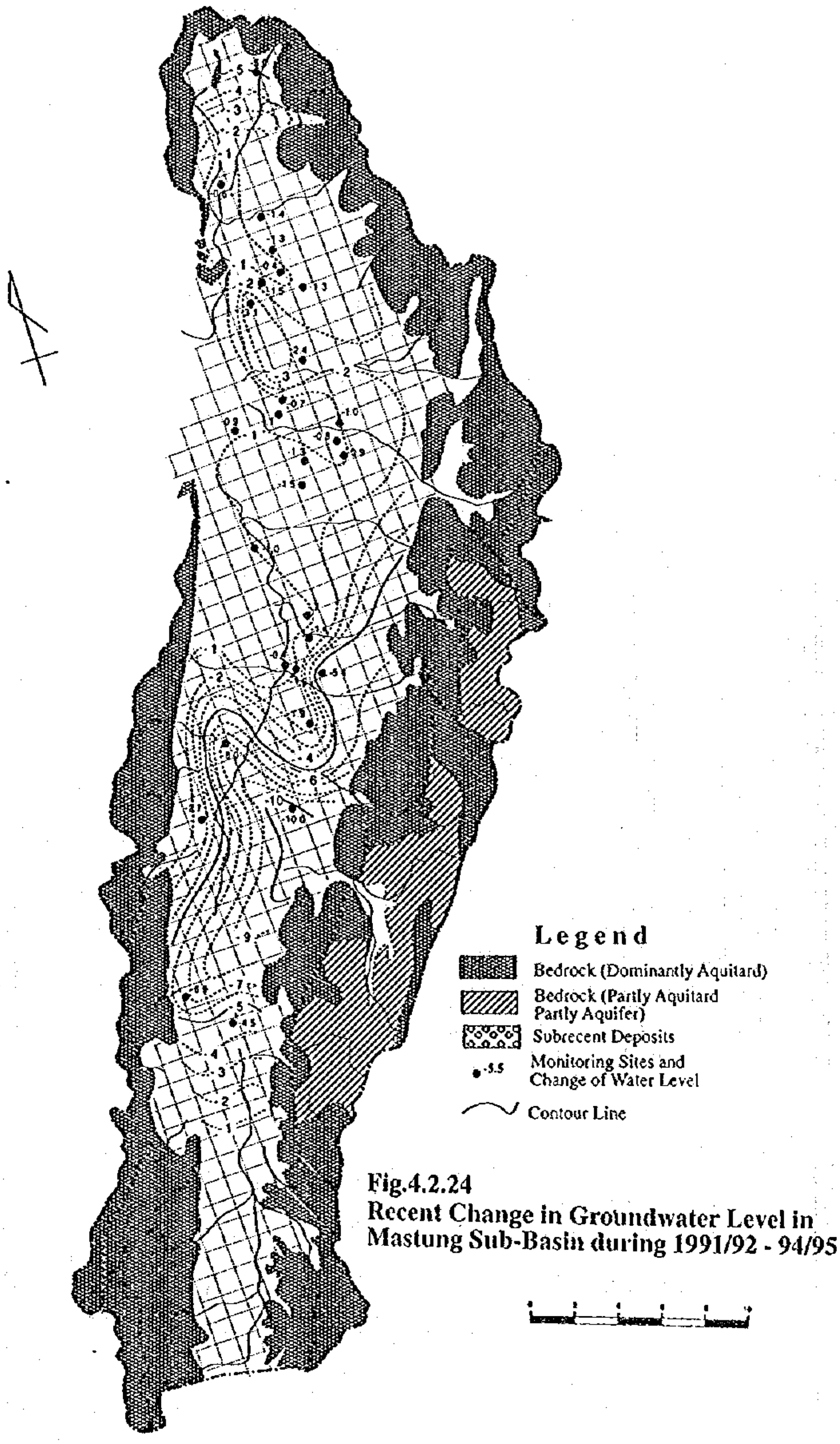


Fig.4.2.24
Recent Change in Groundwater Level in Mastung Sub-Basin during 1991/92 - 94/95