SECTION 6

PROJECT REVIEW

SECTION 6

PROJECT REVIEW

As stated in the preceding sections, one of the causes suppressing the demand increase in Kathmandu valley is the shortage of the power supply system including the distribution facilities. In order to increase the generating capacity of the CNPS, the Kulekhani No.1 power station is planned to be completed in 1981, Devigat power station in 1982 and Kulekhani No.2 power station in 1985. Under such circumstances, the improvement and expansion of the distribution system are urgently required to be implemented regardless of economical justification.

The construction plan and cost estimate of the project are detailed in Section 5, based on which the project is economically reviewed taking into account of the planned distribution system.

In the economical review, the following assumptions and conditions are introduced:-

(a) The economical study on the planned improvement and expansion of the distribution system is made based on the assumption that the power to be distributed through the planned system is supplied by the Kulekhani hydroelectric project, while the power from the existing power plants is assumed to be distributed through the existing system.

(b) The power supply capacity of the existing distribution system is assumed to correspond to the energy consumption in 1976/77 and the additional energy demand exceeding the 1976/77 level is to be supplied by the Kulekhani project. During the period of 1981/82 through 1984/85, the energy to the planned system is assumed to be fed from the Kulekhani No.1 power station and shared by the Kulekhani No.1 and No.2 power stations. After 1988/89, the energy supply from these power stations will not be enough and the balance of energy is assumed to be supplied by the other power plants.

(c) The energy rate at the secondary sides of the substations in Kathmandu is assumed as US$0.0262 for the Kulekhani No.1 power station, US$0.0384

for the Kulekhani No.2 power station and US$0.0305 for the combined supply. The energy rate for the supply from the other power plants is assumed to be the same as that of the above combined supply.

(d) Both power projects and distribution network project will be implemented by means of an overseas loan.

(e) The terms of loan will be at the annual interest rate of 4% with repayment of 30 years including 7 years of grace period.

(f) The interest during the grace period is to be paid during the repayment period and is to be included in the uniform amortization.

(g) Although part of the governmental funds will be invested in the project, all local portions of investment are assumed to be repaid on the same conditions as for the overseas loan as stated above.

(h) Operation and maintenance costs for the distribution network are estimated from the actual costs of NEC in 1975/76 stated in the NEC's annual report on the basis of the cost per kWh.

(i) Economic evaluation is made based on the price level in August 1978 and no cost inflation has been accounted, for 5 percent per annum.

The results of economic evaluation are tabulated in Tables 6.1 and 6.2.

As seen in the tables, the average power rate at the consumer end (discounted at the rate of 8% per annum) is US$0.0493. This power rate is much higher than the current average power tariff, however this rate is lower than the generally accepted power rates in the South-East Asian countries, which are US$0.05 to 0.07 per kWh in average.

The actual power tariff should be decided including general expense of NEC and the fare for the combined power supply system of the existing and new power systems.

Table 6.1 ENERGY COST ON SECONDARY SIDES OF SUBSTATIONS

Year	Energy Demand (MWh)	Energy to be Supplied by New D/L System (MWh)	Energy at S/S Secondary Sides (MWh)				Cost of Energy (US$1,000)			
			Total *2	Kulekhani No.1 P/S	Kulekhani No.2 P/S	Other Plants	Kulekhani No.1 P/S *3	Kulekhani No.2 P/S *3	Other Plant *3	Total
1976/77	86,570									
1981/82	155,370	68,800	88,060	88,060	-	-	2,307	-	-	2,307
82/83	179,570	93,000	116,250	116,250	-	-	3,046	-	-	3,046
83/84	206,860	120,290	146,750	146,750	-	-	3,845	-	-	3,845
84/85	239,340	152,770	181,800	181,800	-	-	4,763	-	-	4,763
85/86	275,080	188,510	218,670	138,156	80,514	-	3,620	3,092	-	6,712
86/87	313,160	226,590	260,580	164,634	95,946	-	4,313	3,684	-	7,997
87/88	353,900	267,330	307,430	194,234	113,196	-	5,089	4,347	-	9,436
88/89	399,480	312,910	359,850	206,100	120,100	33,650	5,400	4,612	1,026	11,038
89/90	446,390	359,820	413,790	"	"	87,590	"	"	2,671	12,683
90/91	499,760	413,190	475,170	"	"	148,970	"	"	4,544	14,556
91/92	"	" *1	"	"	"	"	"	"	"	"
92/93	"	"	"	"	"	"	"	"	"	"
93/94	"	"	"	"	"	"	"	"	"	"
94/95	"	"	"	"	"	"	"	"	"	"
95/96	"	"	"	"	"	"	"	"	"	"
96/97	"	"	"	"	"	"	"	"	"	"
97/98	"	"	"	"	"	"	"	"	"	"
98/99	"	"	"	"	"	"	"	"	"	"
99/2000	"	"	"	"	"	"	"	"	"	"
2000/01	"	"	"	"	"	"	"	"	"	"
01/02	"	"	"	"	"	"	"	"	"	"
02/03	"	"	"	"	"	"	"	"	"	"
03/04	"	"	"	"	"	"	"	"	"	"
04/05	"	"	"	"	"	"	"	"	"	"
05/06	"	"	"	"	"	"	"	"	"	"
06/07	"	"	"	"	"	"	"	"	"	"
07/08	"	"	"	"	"	"	"	"	"	"
08/09	"	"	"	"	"	"	"	"	"	"
09/10	"	"	"	"	"	"	"	"	"	"
10/11	"	"	"	"	"	"	"	"	"	"

Note: *1 Energy to be supplied through the new distribution system is to increase upto 1900/91 and remain at same thereafter.

*2 The loss factor of energy is assumed as given in Table 4.

*3 The power rates at the secondary sides of the substation are assumed as follows:-

From Kulekhani No.1 power station ..... US$0.0262/kWh.
From Kulekhani No.2 power station ..... US$0.0384/kWh.
From other power plants ..... US$0.0305/kWh.

Table 6.2 ECONOMIC EVALUATION OF DISTRIBUTION SYSTEM

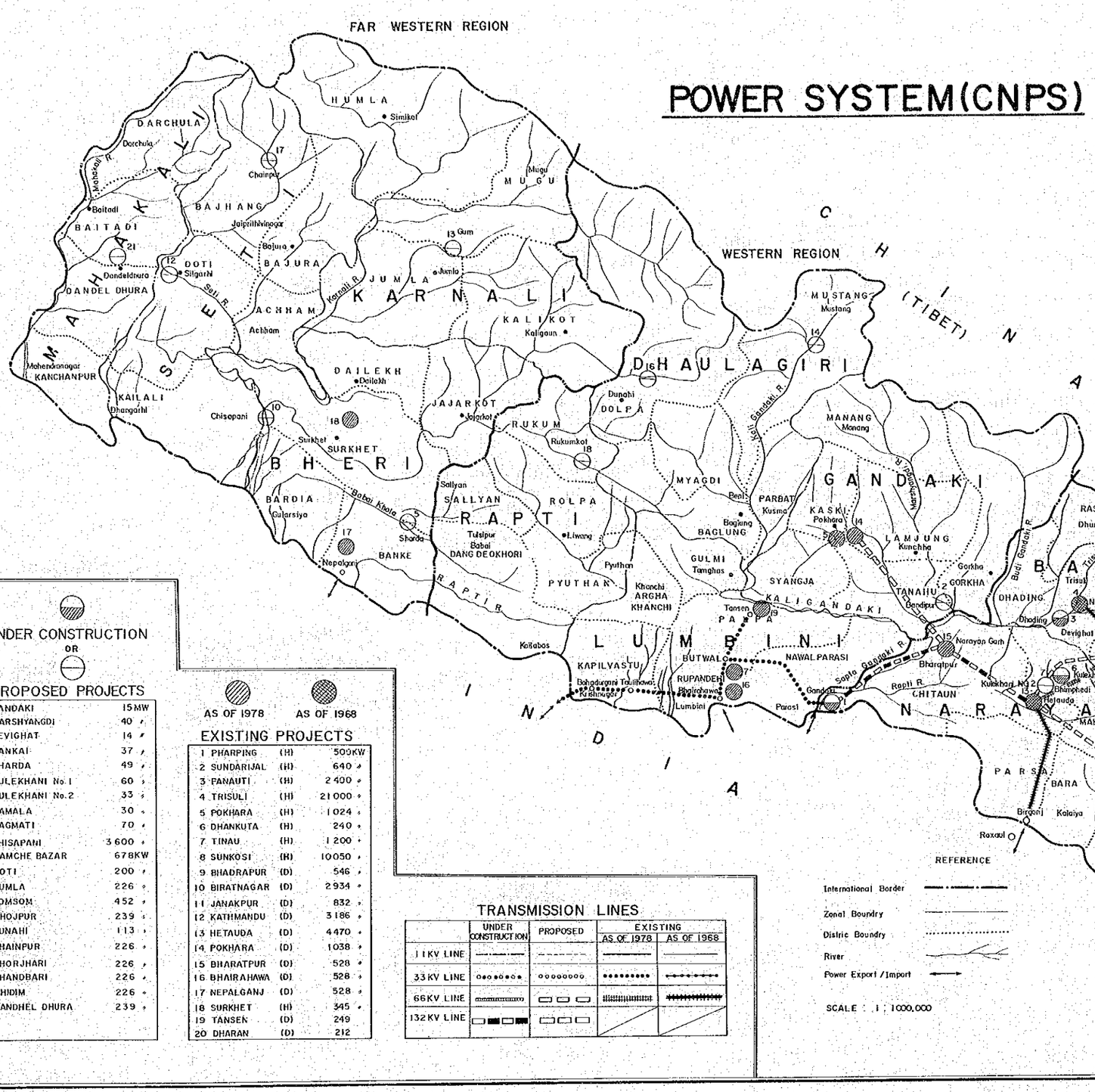
Year	Consumed Energy (MWh)	Cost (US$ 1,000)				Present Worth at 1978/79		
		Cost of consumed energy (MWh)	Loan Repayment for D/L system	O & M	Total	Discount Rate *1	Consumed Energy (MWh)	Energy Cost (US$1,000)
1981/82	68,800	2,307		577	2,884	0.794	54,627	2,290
82/83	93,000	3,046		762	3,808	0.735	68,355	2,799
83/84	120,290	3,845		961	4,806	0.681	81,917	3,273
84/85	152,770	4,763		1,191	5,954	0.630	96,245	3,751
85/86	188,510	6,712		1,700	8,412	0.583	109,901	4,904
86/87	226,590	7,997	2,499	2,026	12,522	0.540	122,359	6,762
87/88	267,330	9,436	"	2,390	14,325	0.500	133,665	7,163
88/89	312,910	11,038	"	2,796	16,333	0.463	144,877	7,562
89/90	359,820	12,683	"	3,213	18,395	0.429	154,363	7,891
90/91	413,190	14,556	"	3,687	20,742	0.397	164,036	8,235
91/92	"	"	"	"	"	0.368	152,054	7,633
92/93	"	"	"	"	""	0.340	140,485	7,052
93/94	"	"	"	"	"	0.315	130,155	6,534
94/95	"	"	"	"	"	0.292	120,651	6,057
95/96	"	"	"	"	"	0.270	111,561	5,600
96/97	"	"	"	"	"	0.250	103,298	5,186
97/98	"	"	"	"	"	0.232	95,860	4,812
98/99	"	"	"	"	"	0.215	88,836	4,460
99/2000	"	"	"	"	"	0.199	82,225	4,128
2000/01	"	"	"	"	"	0.184	76,027	3,817
01/02	"	"	"	"	"	0.170	70,242	3,526
02/03	"	"	"	"	"	0.158	65,284	3,277
03/04	"	"	"	"	"	0.146	60,326	3,028
04/05	"	"	"	"	"	0.135	55,781	2,800
05/06	"	"	"	"	"	0.125	51,649	2,593
06/07	"	"	"	"	"	0.116	47,930	2,406
07/08	"	"	"	"	"	0.107	44,211	2,219
08/09	"	"	2,491	"	20,734	0.099	40,906	2,053
09/10	"	"	-	"	18,243	0.092	38,013	1,678
10/11	"	"	-	"	"	0.085	35,121	1,551
Total	10,467,010	367,503	57,469	93,043	518,015		2,740,960	135,040

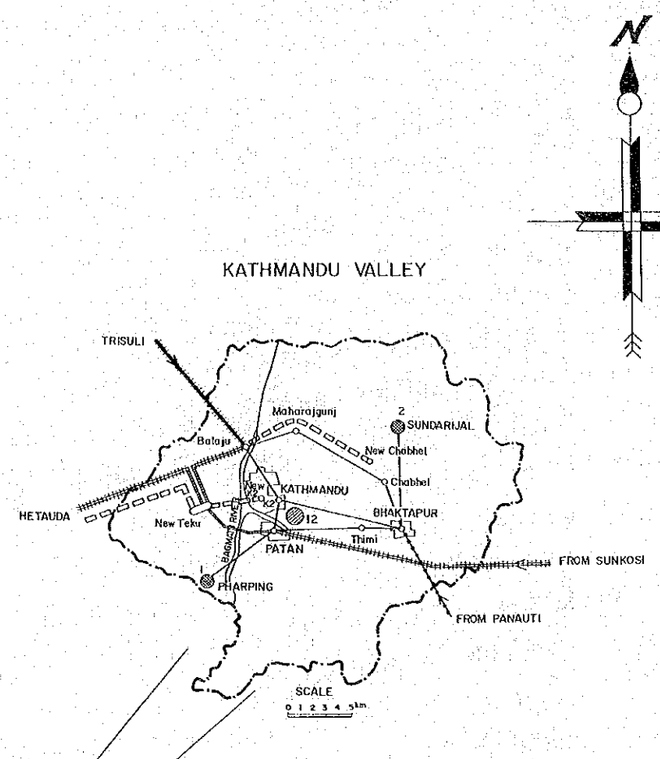
Evaluated average power rate is US$0.0493/kWh

Note: *1 The consumed energy and energy cost are discounted at the rate of 8 % per annum.

DRAWINGS

POWER SYSTEM(CNPS)





UNDER CONSTRUCTION
OR
PROPOSED PROJECTS

1 GANDAKI	15MW
2 MARSHYANGDI	40 〃
3 DEVIGHAT	14 〃
4 KANKAI	37 〃
5 SHARDA	49 〃
6 KULEKHANI No.1	60 〃
7 KULEKHANI No.2	33 〃
8 KAMALA	30 〃
9 BAGMATI	70 〃
10 CHISAPANI	3600 〃
11 NAMCHE BAZAR	678KW
12 DOTI	200 〃
13 JUMLA	226 〃
14 JOMSOM	452 〃
15 BHOJPUR	239 〃
16 DUNAHI	113 〃
17 CHAINPUR	226 〃
18 CHORJHARI	226 〃
19 KHANDBARI	226 〃
20 PHIDIM	226 〃
21 DANDHEL DHURA	239 〃

AS OF 1978 AS OF 1968

EXISTING PROJECTS

1 PHARPING	(H)	500KW
2 SUNDARIJAL	(H)	640 〃
3 PANAUTI	(H)	2400 〃
4 TRISULI	(H)	21000 〃
5 POKHARA	(H)	1024 〃
6 DHANKUTA	(H)	240 〃
7 TINAU	(H)	1200 〃
8 SUNKOSI	(H)	10050 〃
9 BHADRAPUR	(D)	546 〃
10 BIRATNAGAR	(D)	2934 〃
11 JANAKPUR	(D)	832 〃
12 KATHMANDU	(D)	3186 〃
13 HETAUDA	(D)	4470 〃
14 POKHARA	(D)	1038 〃
15 BHARATPUR	(D)	528 〃
16 BHAIRAHAWA	(D)	528 〃
17 NEPALGANJ	(D)	528 〃
18 SURKHET	(H)	345 〃
19 TANSEN	(D)	249
20 DHARAN	(D)	212

TRANSMISSION LINES

	UNDER CONSTRUCTION	PROPOSED	EXISTING AS OF 1978	EXISTING AS OF 1968
11KV LINE				
33KV LINE				
66KV LINE				
132KV LINE				

REFERENCE

- International Border
- Zonal Boundry
- Distric Boundry
- River
- Power Export / Import

SCALE : 1 : 1,000,000

HIS MAJESTY'S GOVERNMENT OF NEPAL	POWER SYSTEM
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. KD-1
	JAPAN INTERNATIONAL COOPERATION AGENCY

UNDER CONSTRUCTION
KULEKHANI NO.2 PROJECT
THIS PROJECT
UNDER PLANNING
H.G. HYDROELECTRIC TURBINE GENERATOR
D.G. DIESEL GENERATOR

TRISULI P.S.
11,250kVA 6.6/66kV
11,250kVA 6.6/66kV
H.G. 3000kW x 7
66kV T/L 2CCT ACSR 0.1 SQIN 28km

POKHARA
H.G. 256kW x 4
11kV BUS
D.G. 346kW x3
11kV BUS
132/11kV 5000kVA

DEVIGHAT P.S.
H.G. 6000kVA x 3
66kV

BALAJU S.S.
11,250kVA 66/11kV
11,250kVA 66/11kV
66kV T/L 2CCT ACSR 0.15 SQIN 7 km
66kV T/L 1CCT ACSR 8 km

NEW CHABHEL S.S.
CHABHEL S.S.
H.W
BHAKTAPUR S.S.
11kV
11kV T/L 1CCT 9.7km ACSR 0.04 SQIN
500kVA x 2 2.75/11kV
H.G. 320kW x2
SUNDARIJAL P.S.
11kV T/L 9.6km ACSR 0.0225 SQIN
33kV T/L 1CCT 12.5km ACSR 50mm²
156.0kVA x2 6.3/33kV
H.G. 800kW x 3
6.3kV
33kV
PANAUTI P.S.

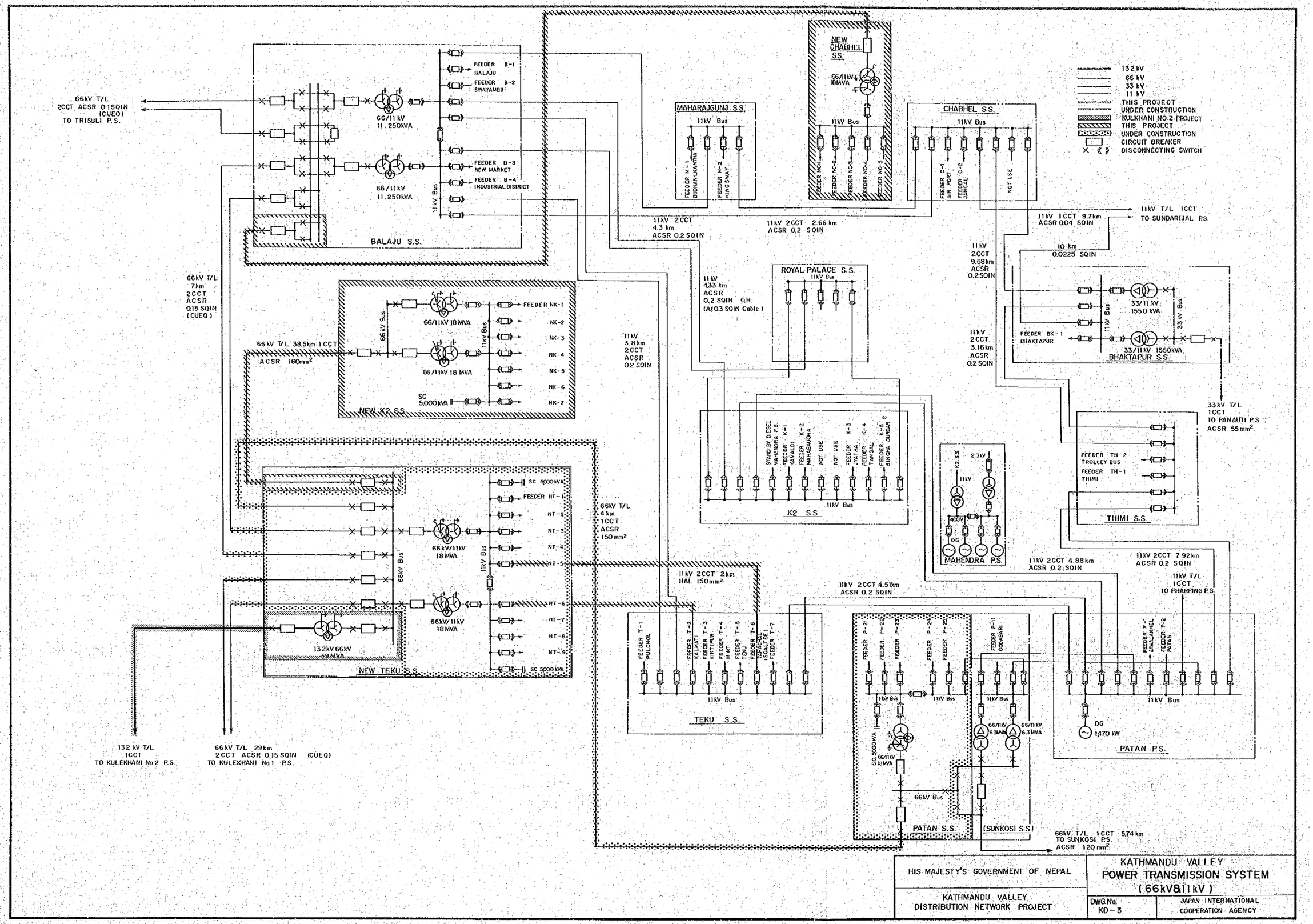
66kV T/L 1CCT ACSR 6.4km
66/11kV 18MVA
66/11kV 18MVA
NEW K2 S.S.
66kV T/L 1CCT 4km ACSR 150mm²
18,000kVA 66/11kV
18,000kVA 66/11kV
39,000kVA 132/66kV
NEW TEKU S.S.
66/11kV 18 MVA
PATAN S.S.
11kV T/L 8.32km ACSR 0.0225 SQIN
H.G. 250kW x2
PHARPING P.S.
66kV T/L 1CCT 57.4km ACSR 120mm²
5,000kVA 11/6.6kV
6,300kVA 11/66kV
H.G. 335.0kW x3
SUNKOSI P.S.

132kV T/L 1CCT ACSR 240 mm² 36 km
66kV T/L 2CCT ACSR 0.15 SQIN 29km
H.G. 15,000kW x2
H.G. 3,000kW
39,000kVA 11/132kV
3,600kVA 66/13.2kV
KULEKHANI No.2 P.S.
132kV T/L 1CCT ACSR 240 mm² 7km
35,000kVA 6.3/66kV
35,000kVA 6.3/66kV
H.G. 30,000kW x2
KULEKHANI No.1 P.S.

132kV T/L TO INDIA
132kV T/L 1CCT ACSR 0.2 SQIN 84km
132kV T/L 1CCT ACSR 0.2 SQIN (CUED) 70km
132kV T/L TO JANAKAPUR
66kV T/L 2CCT ACSR 0.15 SQIN 16 km
132kV
10,000kVA 6.6/132kV
10,000kVA 6.6/132kV
3000 kVA 6.6/33 kV
6.6kV
N.G. 5000kW x 3
GANDAKI P.S.
132kV
6,000kVA 132/11kV
BHARATPUR S.S.
10,000kVA 132/66kV
D.G. 1,450kVA x 3
HETAUDA S.S.
66kV T/L 2CCT ACSR 0.15 SQIN 16 km
66kV T/L 2CCT ACSR 0.15 SQIN
10km
9km
9km
1,500kVA 66/11kV
1,500kVA 66/11kV
1,500kVA x 2 66/11kV
AMLEKHGUNI S.S.
SIMJRA S.S.
PARWANIPUR S.S.
3000 kVA 66/11kV
1500kVA 66/11kV
11kV BUS
11kV T/L TO INDIA
BIRGUNJ S.S.

TANSEN S.S.
33 kV T/L
BUTWAL S.S.
33kV T/L
BHAIRAHAWA S.S.
33kV T/L
TAULIHAWA S.S.
33kV T/L
KRISHNAGAR S.S.
TO INDIA 33kV T/L

HIS MAJESTY'S GOVERNMENT OF NEPAL	NEPAL CNPS POWER TRANSMISSION SYSTEM (132kV & 66kV)
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG.No. KD-2 / JAPAN INTERNATIONAL COOPERATION AGENCY



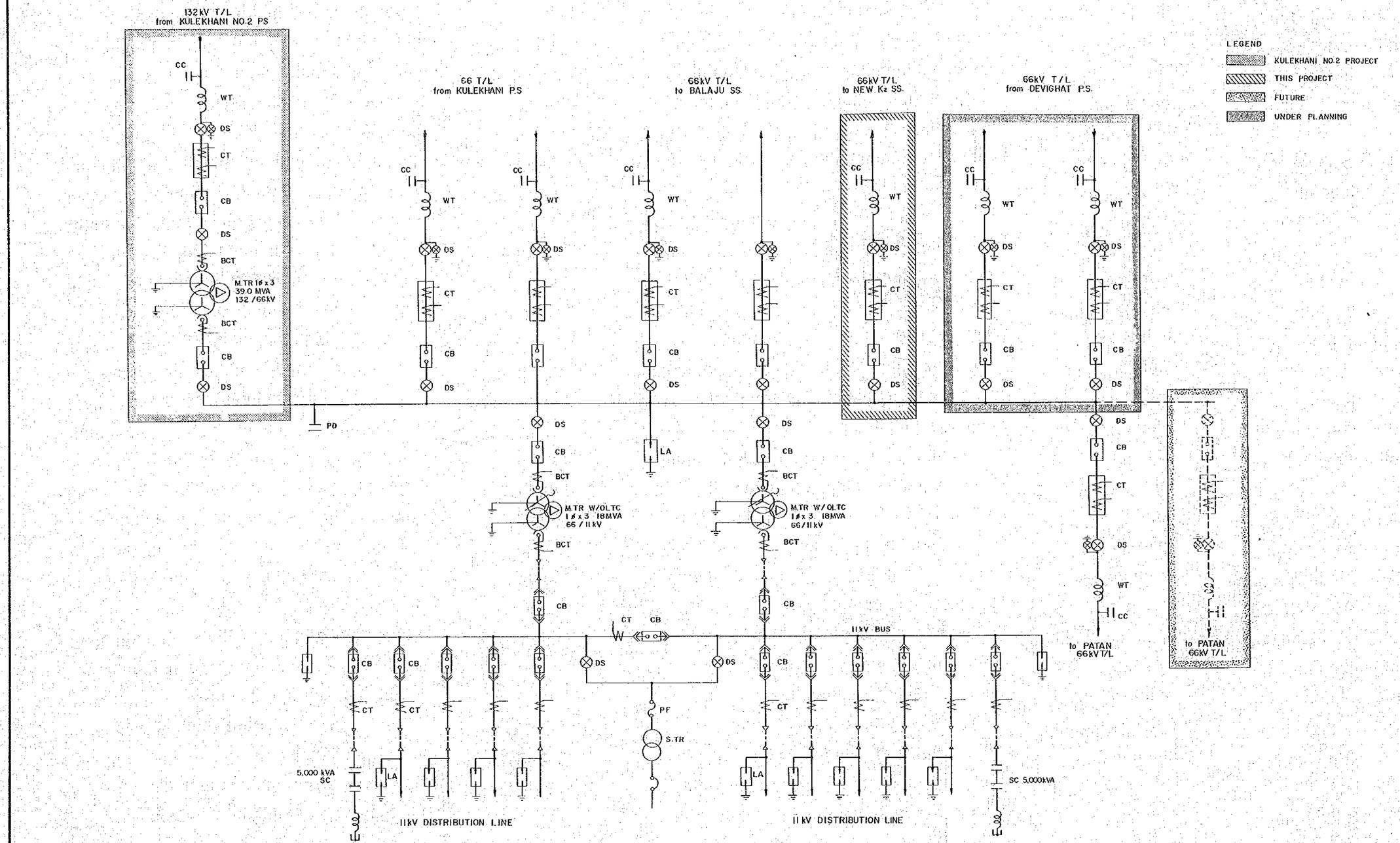
HIS MAJESTY'S GOVERNMENT OF NEPAL

KATHMANDU VALLEY
DISTRIBUTION NETWORK PROJECT

KATHMANDU VALLEY POWER TRANSMISSION SYSTEM (66kV&11kV)

DWG.No. KD-3

JAPAN INTERNATIONAL COOPERATION AGENCY

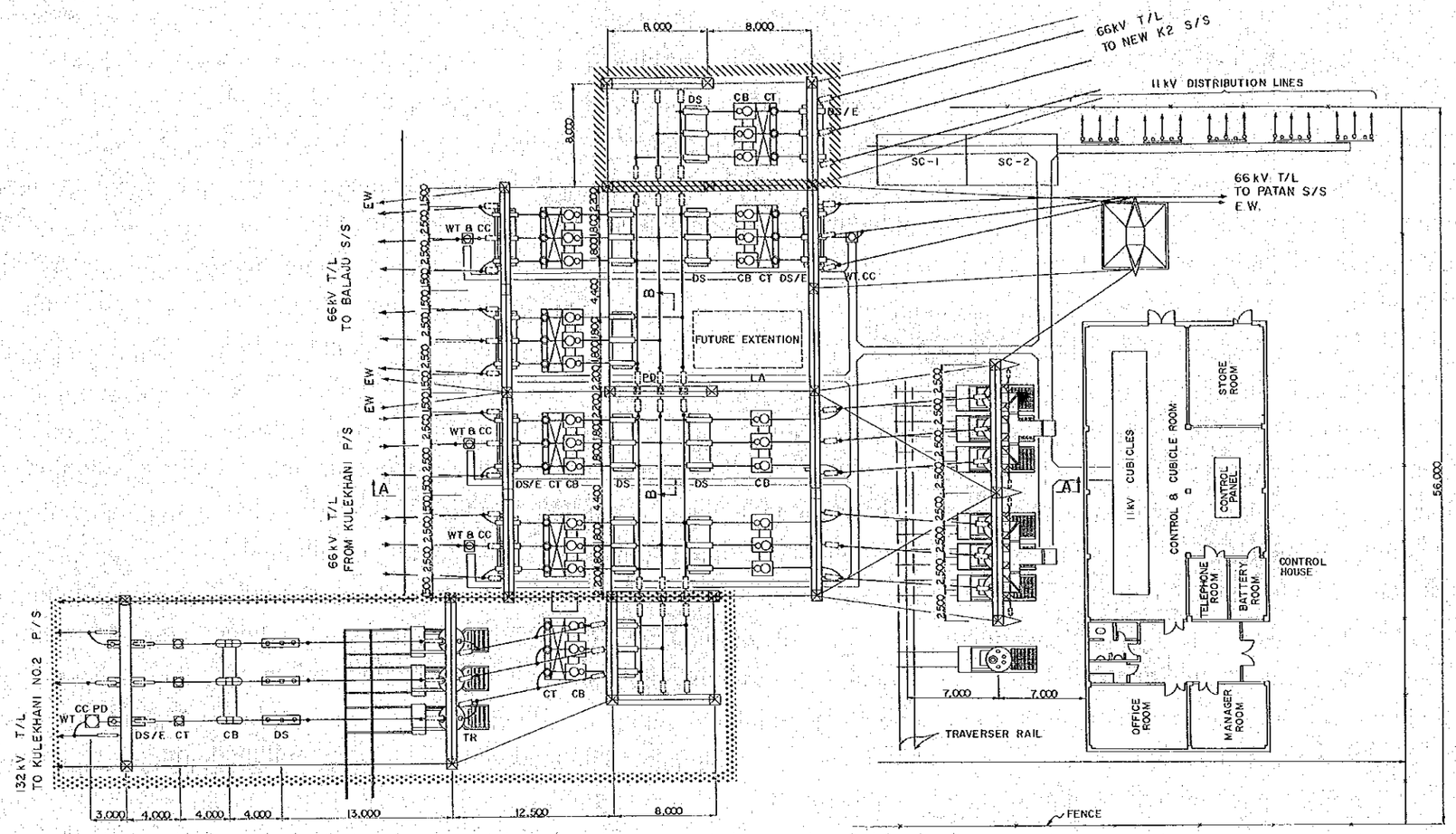


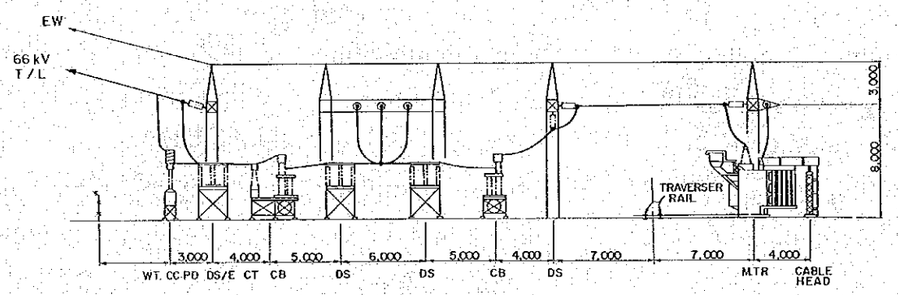
HIS MAJESTY'S GOVERNMENT OF NEPAL	SINGLE LINE DIAGRM EXTENSION OF NEW TEKU S/S
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG.NO. KD – 4 / JAPAN INTERNATIONAL COOPERATION AGENCY

MARK	LEGEND
CB	CIRCUIT BREAKER
CC	COUPLING CAPACITOR
CT	CURRENT TRANSFORMER
DS	DISCONNECTING SWITCH
DS/E	DS WITH EARTHING SWITCH
EW	EARTHING WIRE
LA	LIGHTNING ARRESTOR
M.TR.	MAIN TRANSFORMER
PD	POTENTIAL DEVICE
SC	STATIC CONDENSER
ST.TR	STATION TRANSFORMER
WT	WAVE TRAP
C.H.	11kV CABLE HEAD

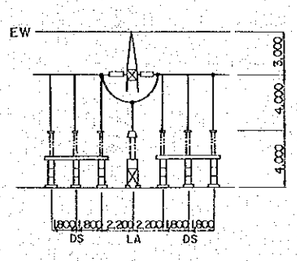
KULEKHANI NO.2 PROJECT

THIS PROJECT





SECTION A-A

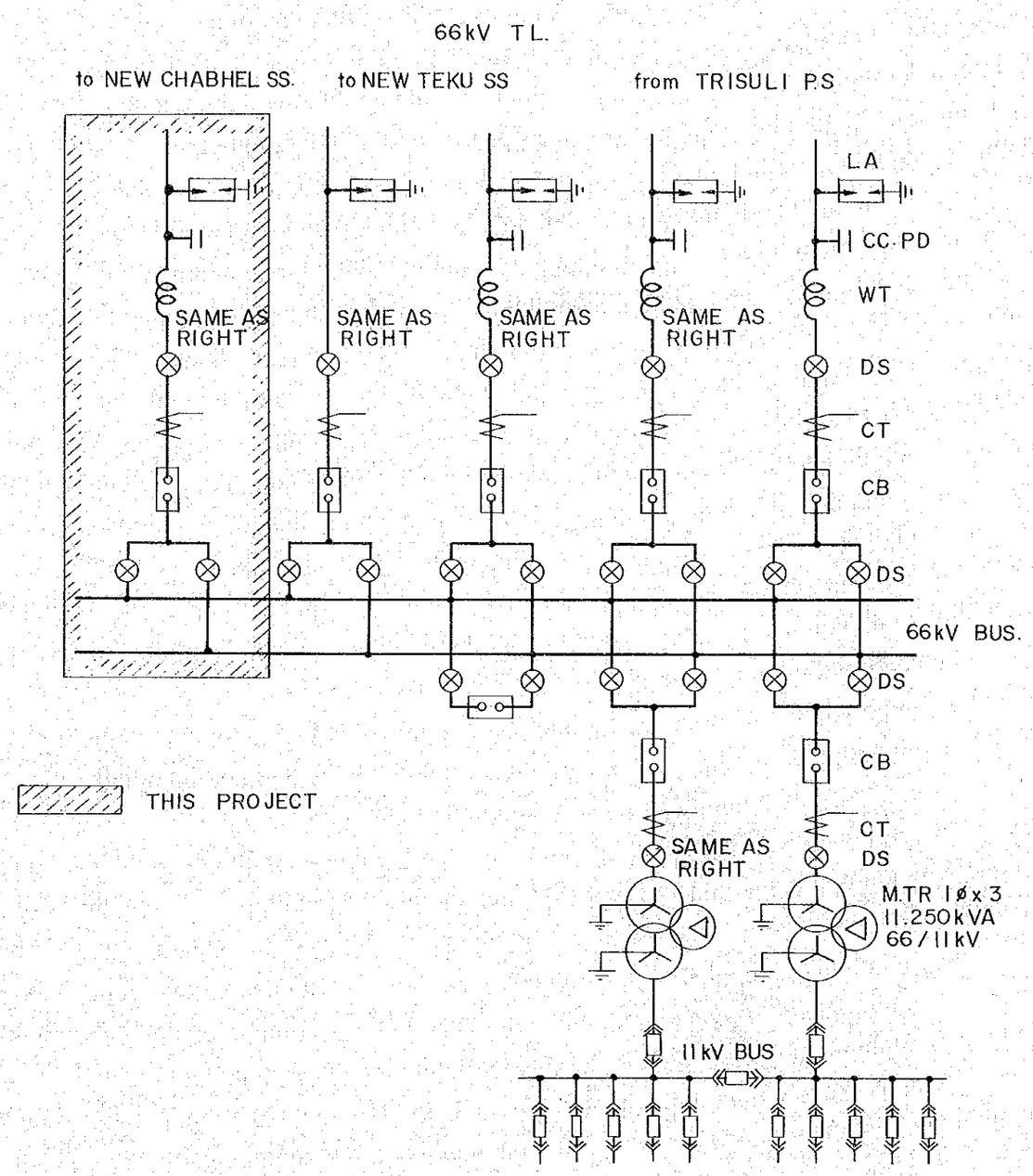


SECTION B-B

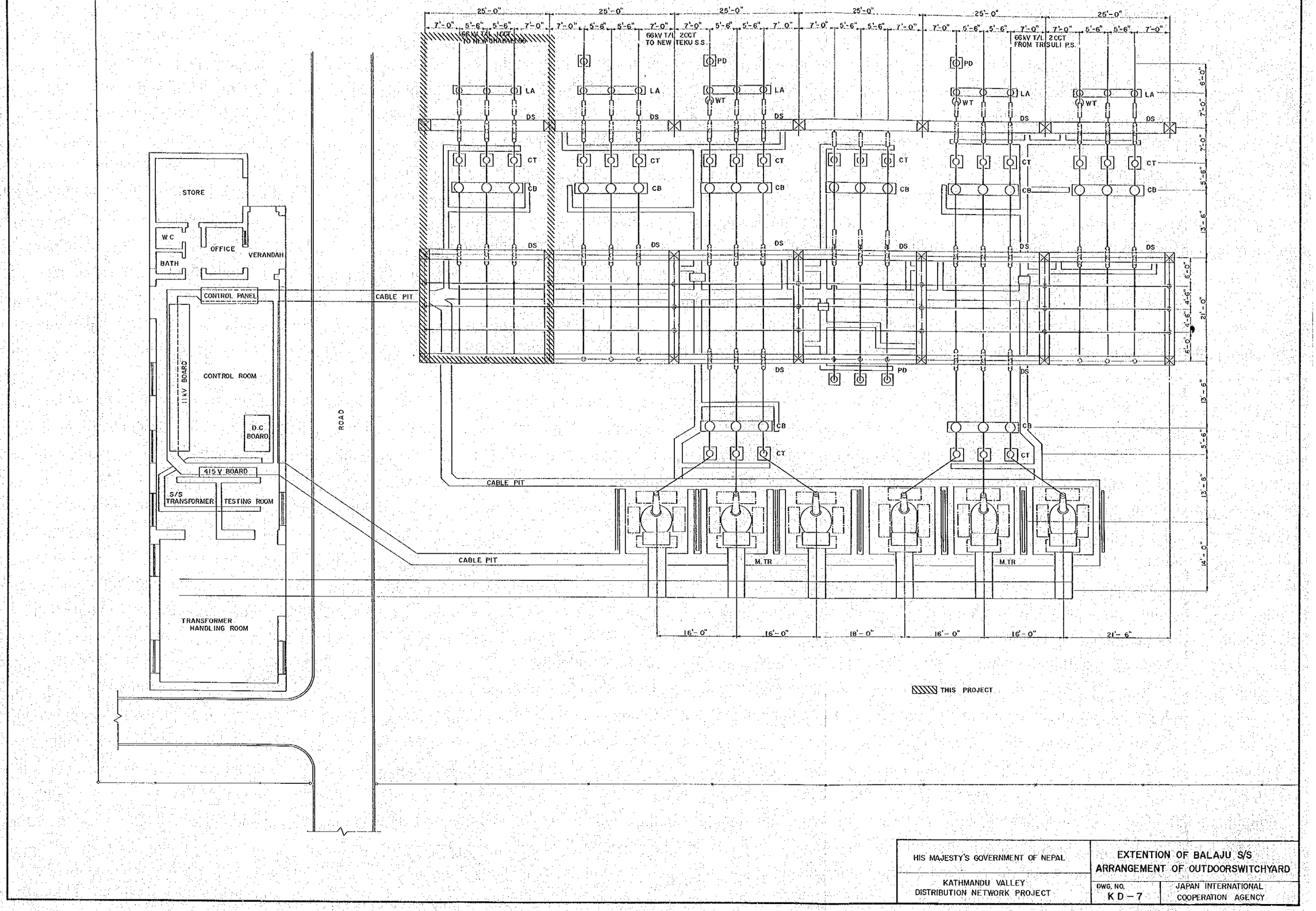
DEAD END POLE FOR
11kV DISTRIBUTION LINE

SCALE 0 2 4 6 8 10 20m

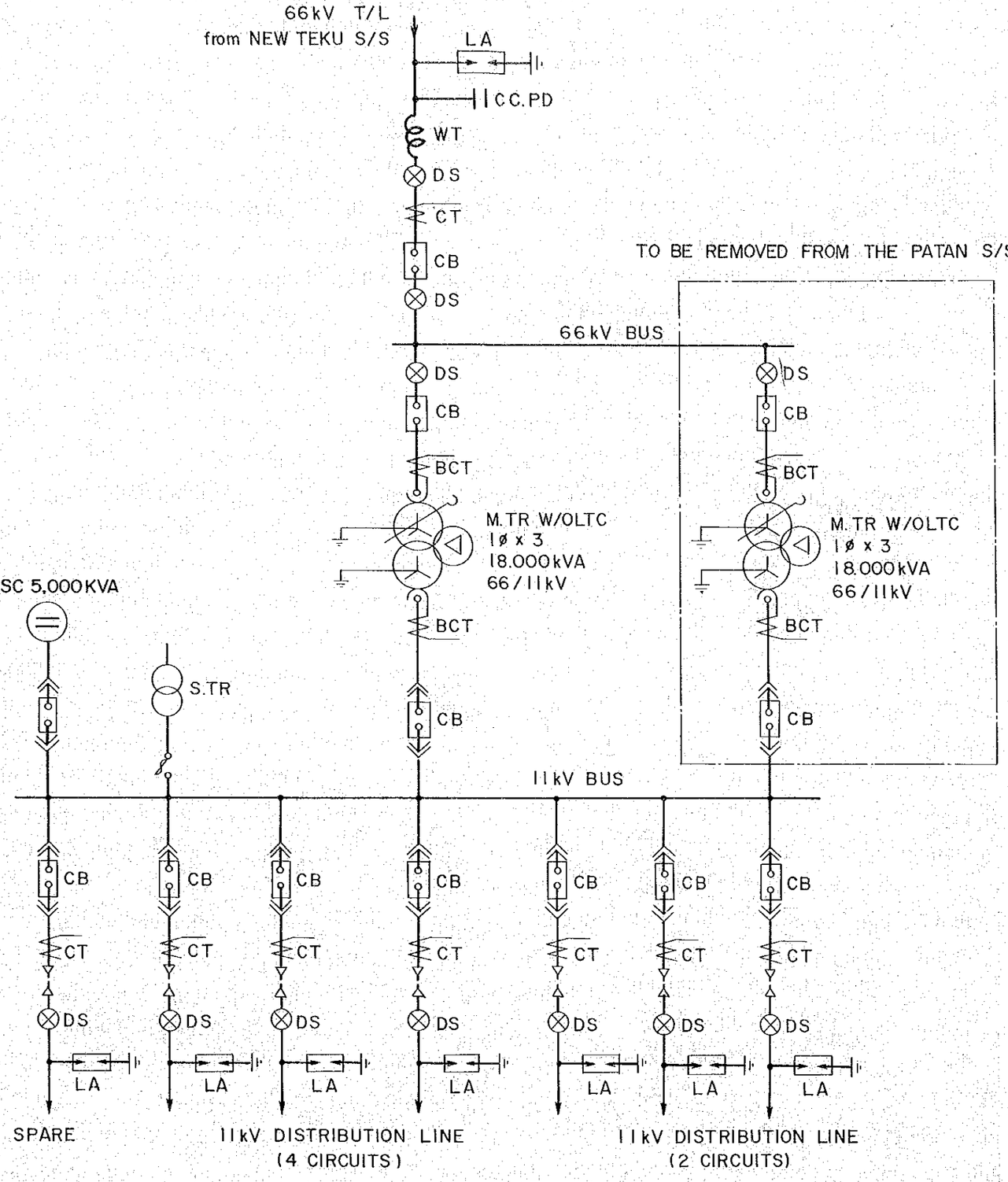
HIS MAJESTY'S GOVERNMENT OF NEPAL	NEW TEKU S/S OUTDOOR SWITCHYARD ARRANGEMENT OF EQUIPMENT
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG.NO. KD-5 / JAPAN INTERNATIONAL COOPERATION AGENCY



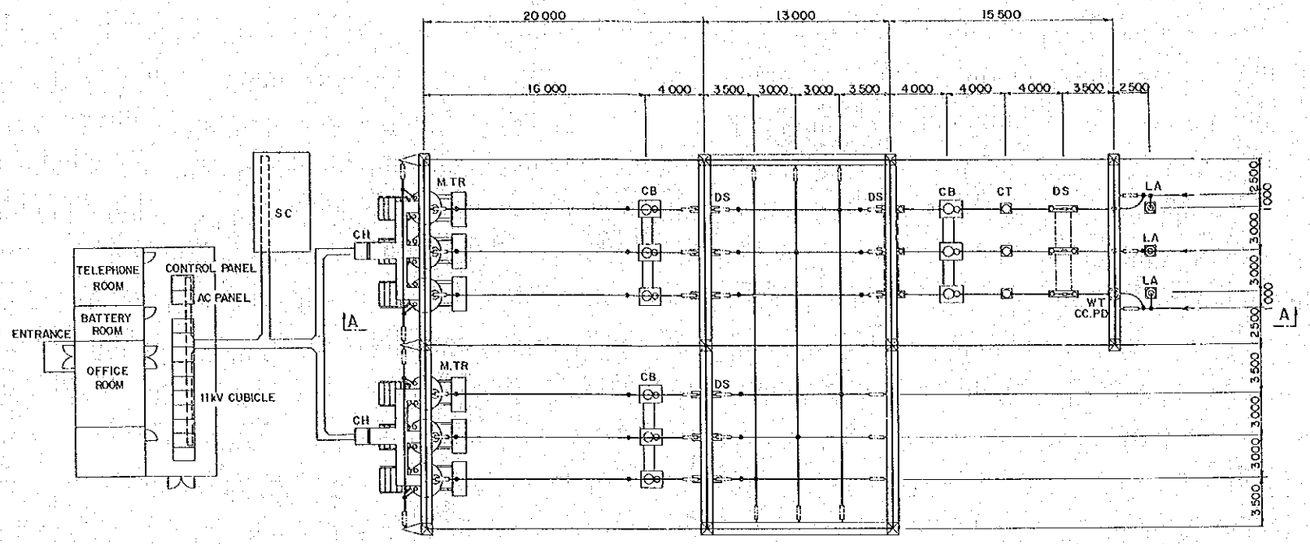
HIS MAJESTY'S GOVERNMENT OF NEPAL	SINGLE LINE DIAGRAM EXTENSION OF BALAJU S/S
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. KD-6 / JAPAN INTERNATIONAL COOPERATION AGENCY



HIS MAJESTY'S GOVERNMENT OF NEPAL	EXTENTION OF BALAJU S/S ARRANGEMENT OF OUTDOORSWITCHYARD
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. K D – 7 / JAPAN INTERNATIONAL COOPERATION AGENCY

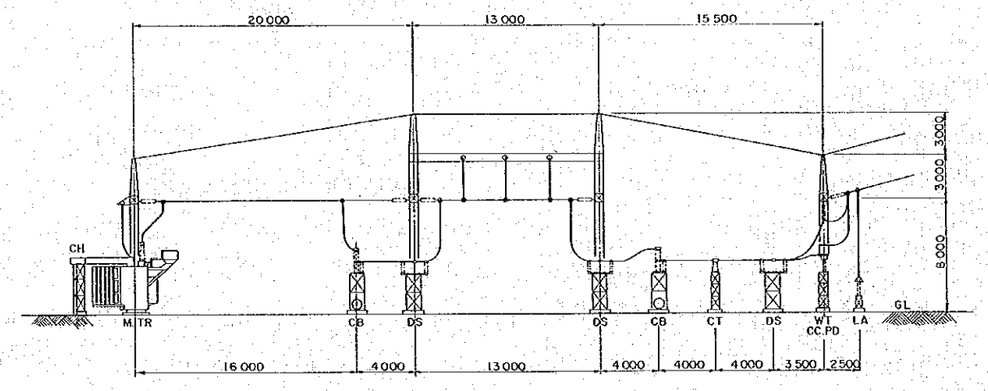


HIS MAJESTY'S GOVERNMENT OF NEPAL	SINGLE LINE DIAGRAM NEW K2 S/S
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. KD-8 / JAPAN INTERNATIONAL COOPERATION AGENCY



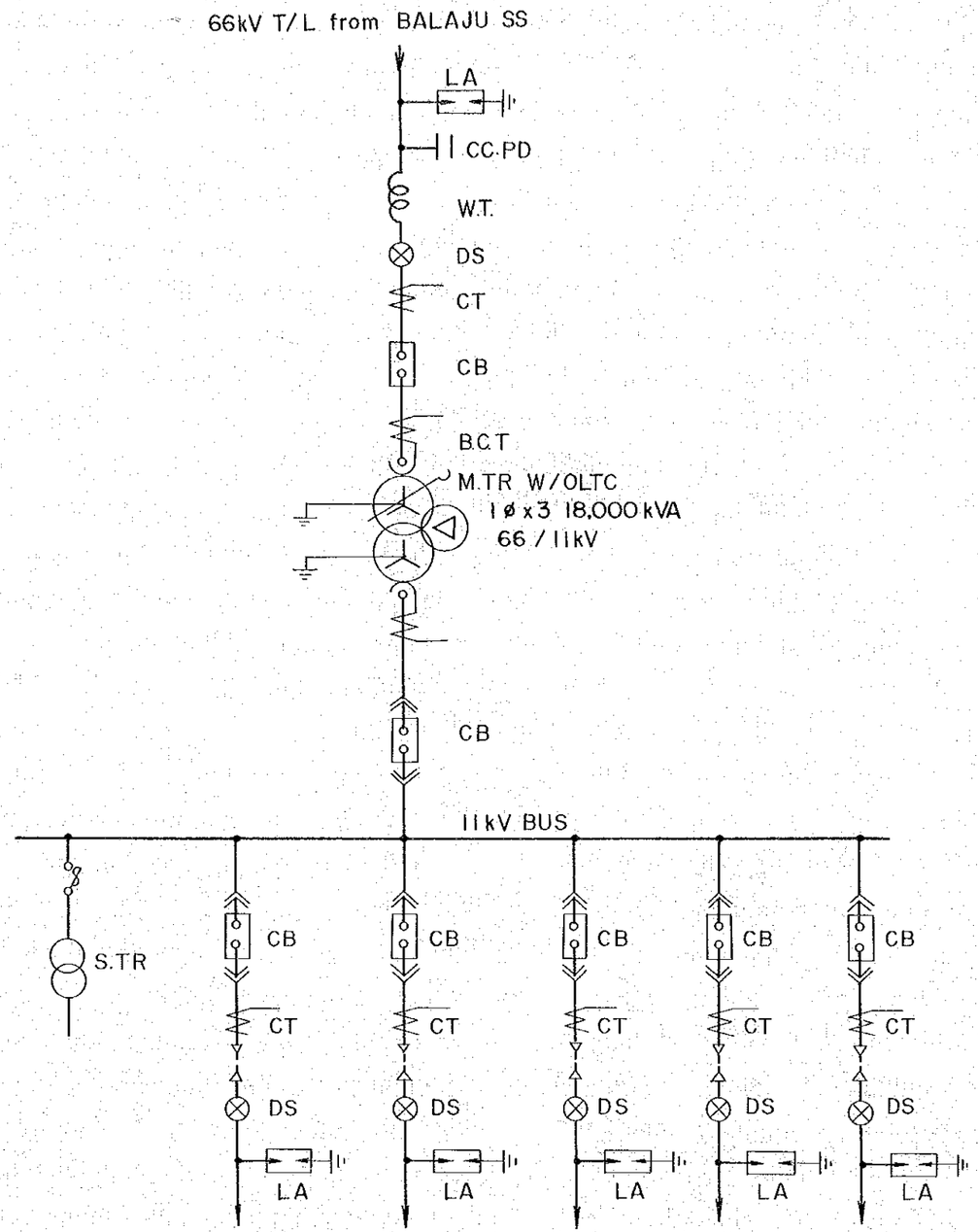
PLAN S=1:200

LEGEND	
L A	LIGHTNING ARRESTER
WT	WAVE TRAP
CC	COUPLING CAPASITOR
PD	POTENTIAL DEVICE
DS	DISCONNECTING SWITCH
CT	CURRENT TRANSFORMER
CB	CIRCUT BREAKER
M.TR	MAIN TRANSFORMER
CH	CABLE HEAD

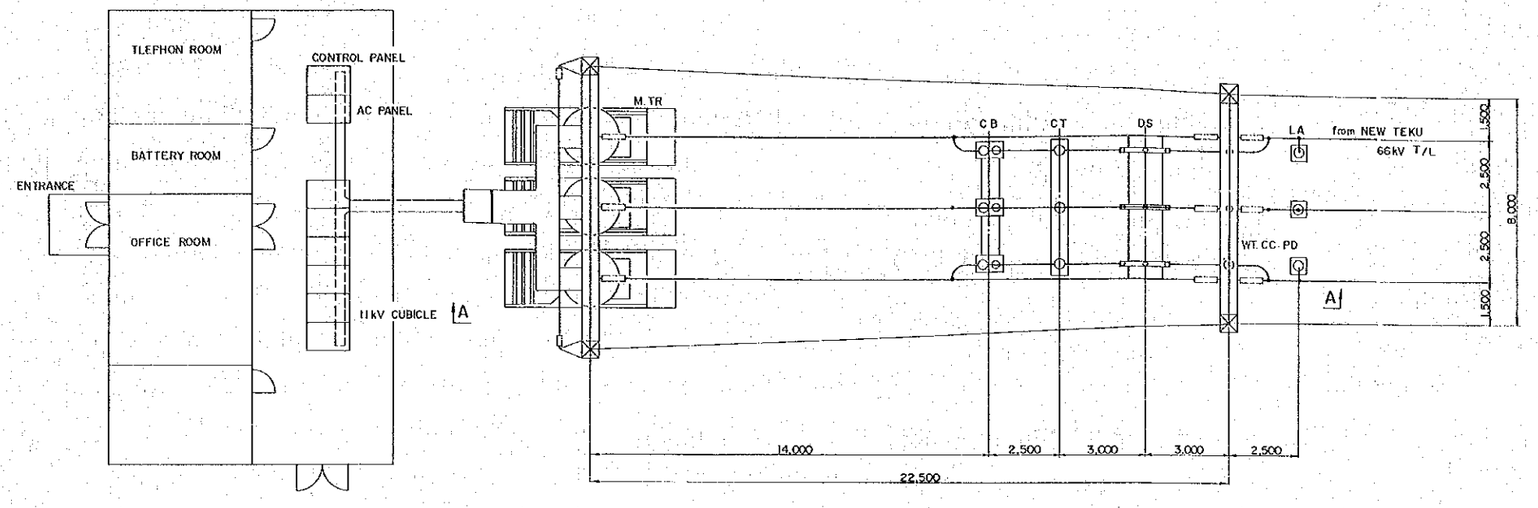


SECTION A — A S=1:200

HIS MAJESTY'S GOVERNMENT NEPAL	NEW K2 S/S ARRANGEMENT OUTDOOR SWITCHYARD
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. KD-9 / JAPAN INTERNATIONAL COOPERATION AGENCY

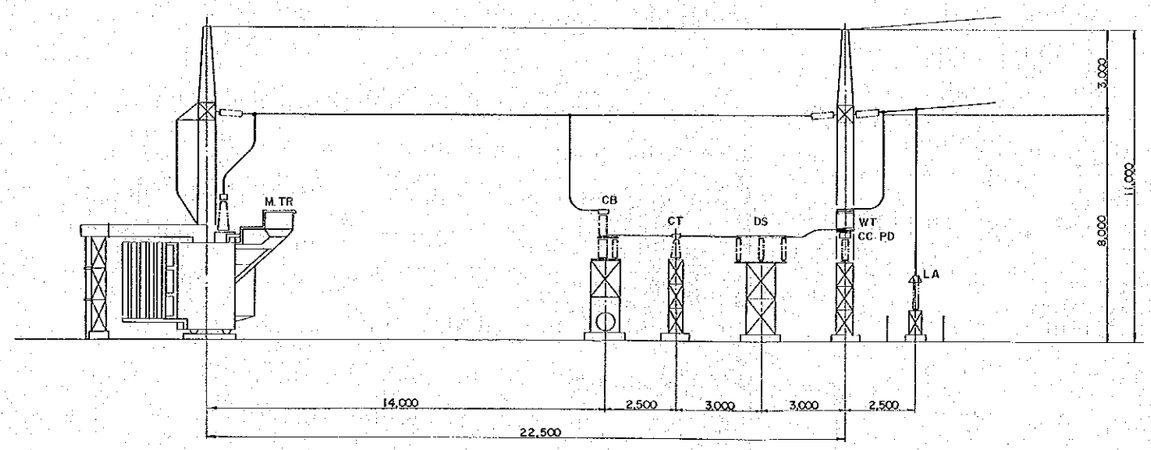


HIS MAJESTY'S GOVERNMENT OF NEPAL	SINGLE LINE DIAGRAM NEW CHABHEL S/S
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG. NO. KD-10 / JAPAN INTERNATIONAL COOPERATION AGENCY



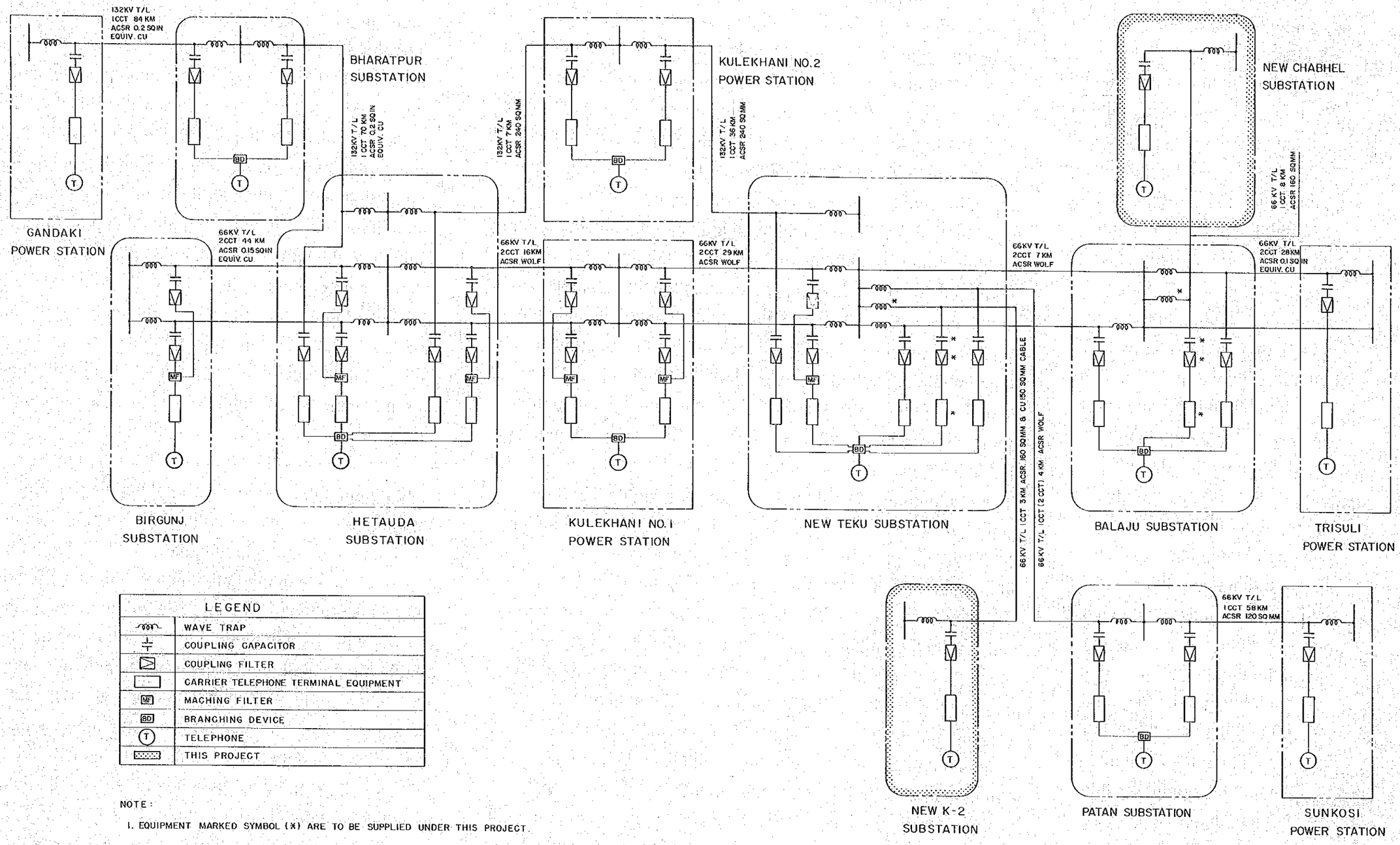
PLAN

	LEGEND
LA	LIGHTING ARRESTER
WT	WAVE TRAP
CC	COUPLING CAPASITOR
PD	POTENTIAL DEVICE
DS	DISCONNECTING SWITCH
CT	CURRENT TRANSFORMER
CB	CIRCUIT BREAKER
M.TR	MAIN TRANSFORMER
CH	CABLE HEAD



SECTION A – A

HIS MAJESTY'S GOVERNMENT OF NEPAL	NEW CHABHEL S/S ARRANGEMENT OUTDOOR SWITCHYARD
KATHMANDU VALLEY DISTRIBUTION NETWORK PROJECT	DWG.NO. KD – 11 / JAPAN INTERNATIONAL COOPERATION AGENCY


132KV T/L
1CCT 84 KM
ACSR 0.2 SQIN
EQUIV. CU
GANDAKI
POWER STATION
BHARATPUR
SUBSTATION
132KV T/L
1 CCT 70 KM
ACSR 0.2 SQIN
EQUIV. CU
132KV T/L
1 CCT 7KM
ACSR 240 SQMM
KULEKHANI NO.2
POWER STATION
132KV T/L
1 CCT 36 KM
ACSR 240 SQMM
NEW CHABHEL
SUBSTATION
66 KV T/L
1CCT 8 KM
ACSR 160 SQMM
66KV T/L
2CCT 44 KM
ACSR 0.15SQIN
EQUIV. CU
66KV T/L
2CCT 16KM
ACSR WOLF
66KV T/L
2CCT 29 KM
ACSR WOLF
66KV T/L
2CCT 7KM
ACSR WOLF
66KV T/L
2CCT 28KM
ACSR 0.1 SQIN
EQUIV. CU
66KV T/L 1CCT 3KM ACSR 150 SQMM & CU 150 SQMM CABLE
66KV T/L (2 CCT) 4 KM ACSR WOLF
BIRGUNJ
SUBSTATION
HETAUDA
SUBSTATION
KULEKHANI NO.1
POWER STATION
NEW TEKU SUBSTATION
BALAJU SUBSTATION
TRISULI
POWER STATION
NEW K-2
SUBSTATION
66KV T/L
1CCT 58KM
ACSR 120 SQMM
PATAN SUBSTATION
SUNKOSI
POWER STATION
LEGEND
WAVE TRAP
COUPLING CAPACITOR
COUPLING FILTER
CARRIER TELEPHONE TERMINAL EQUIPMENT
MACHING FILTER
BRANCHING DEVICE
TELEPHONE
THIS PROJECT
NOTE :
1. EQUIPMENT MARKED SYMBOL (X) ARE TO BE SUPPLIED UNDER THIS PROJECT.
HIS MAJESTY'S GOVERNMENT OF NEPAL
KATHMANDU VALLEY
DISTRIBUTION NETWORK PROJECT
POWER LINE CARRIER TELEPHONE SYSTEM
DWG No.
KD - 12
JAPAN INTERNATIONAL
COOPERATION AGENCY