11.2.4 Telecommunication Equipment

Power line carrier system (earth return) is provided for composing telecommunication circuits for power generation and dam operation.

11.3 Transmission Line

11.3.1 Transmission Line Route

Design of the transmission line is that the 154 kV two-circuit lines supported by two-circuit steel towers start from the Köprübaşı power station and extend to the Çıplak district, where is near to the planned site of the Çay power station, and these transmission lines are separated into two independent lines to reach Karabük and Ereğli substations respectively.

The transmission line route is planned to be constructed along the existing roads for reducing the construction costs and making maintenance of lines easy. However, for the section that the existing roads can not be directly utilized for construction, the shortest possible distance to the extent that it is allowed technically is selected in order to reduce the construction costs of the transmission line.

The first half of the total 15 km of the transmission lines from the Köprübaşı power station to the Çıplak district passes through rather steep mountainous areas (the maximum land height: 750 m), while the latter half passes through rather gentle hilly areas to finally reach the Karabük and Ereğli substations. Figure 10-1 shows the selected transmission line route. The distance of each section of the transmission line is as shown below:

Section	Number of circuits	Length (km)
Köprübaşı - Çıplak	2	15
Çıplak - Karabük	1	70
Çıplak - Ereğli	1	35

The ambient conditions for the transmission line are as follows:

Snow deposit: Max. 85 cm
Rainfall: Annual total 775 mm
Temperature: Annual average 13.5°C
Wind velocity: Average 35 m/sec

11.3.2 Conductor, Insulator and Ground-wire

In consideration of the electrical and mechanical characteristics needed for the conductor as well as the development plans for Çay and Karabük hydroelectric power stations, the aluminum conductor steel reinforced (ACSR) 1,272 MCM was selected.

Taking into account the results of electrical and mechanical studies and insulation coordination with the existing 154 kV transmission line, the number of insulators per one string and type are taken for 12 units of suspension insulators with 250 mm in diameter.

In order to reduce lightning strokes as less as possible and to enhance the stability of the system, an overhead ground-wire is fitted.

11.3.3 Supporting Structure

In view of the geographical features and meteorological conditions, steel towers which are provided with higher mechanical strength are adopted. As a design condition for these steel towers, the following loads due to wind pressure were considered.

Conductor: 68 kg/m^2
Steel tower: 90 kg/m^2

Figure 11-16 (two-circuit design) and 11-17 (one-circuit design) show typical tower types to be adopted into the design of this transmission line.

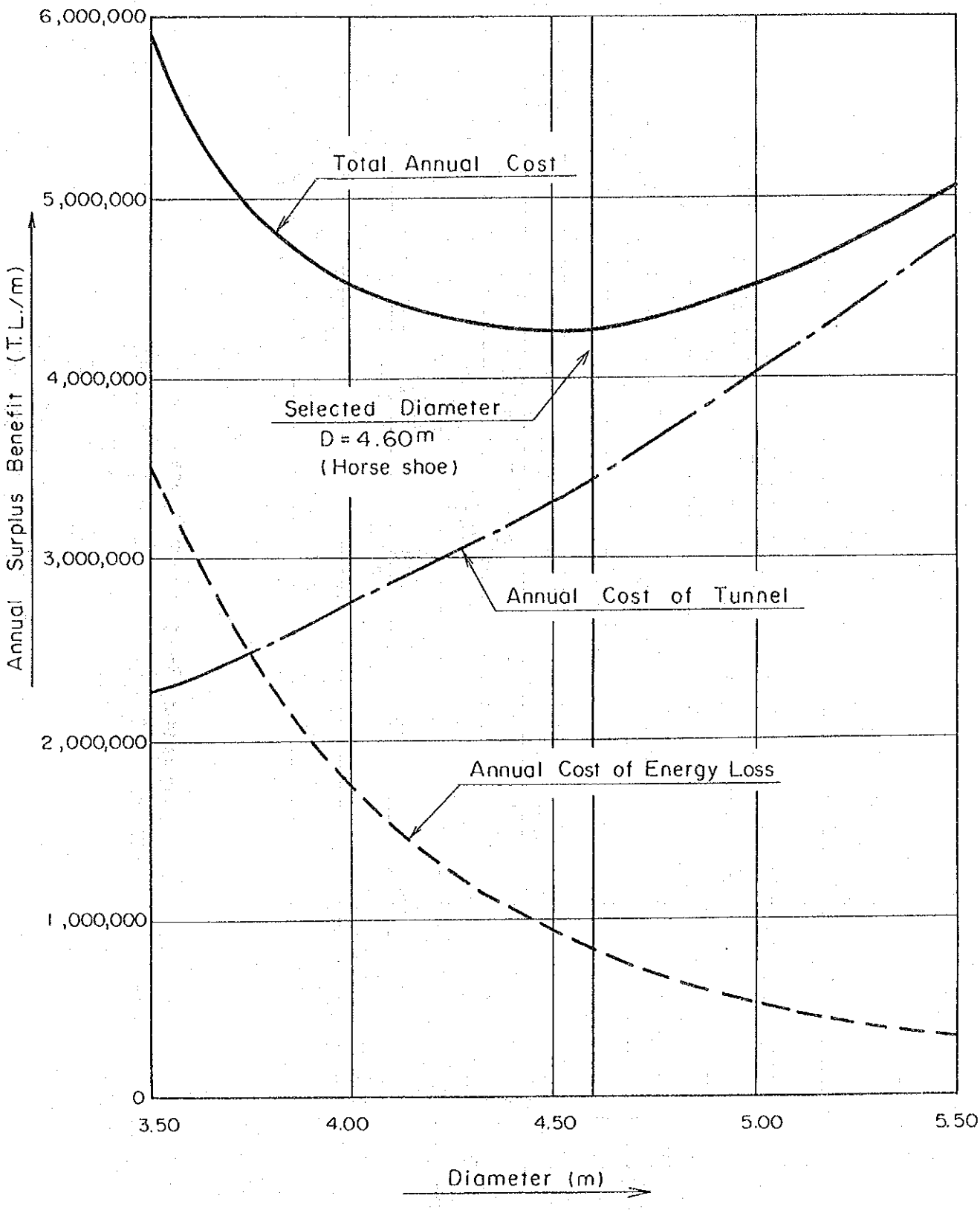


Figure 11-1 Optimization Study on Tailrace Tunnel

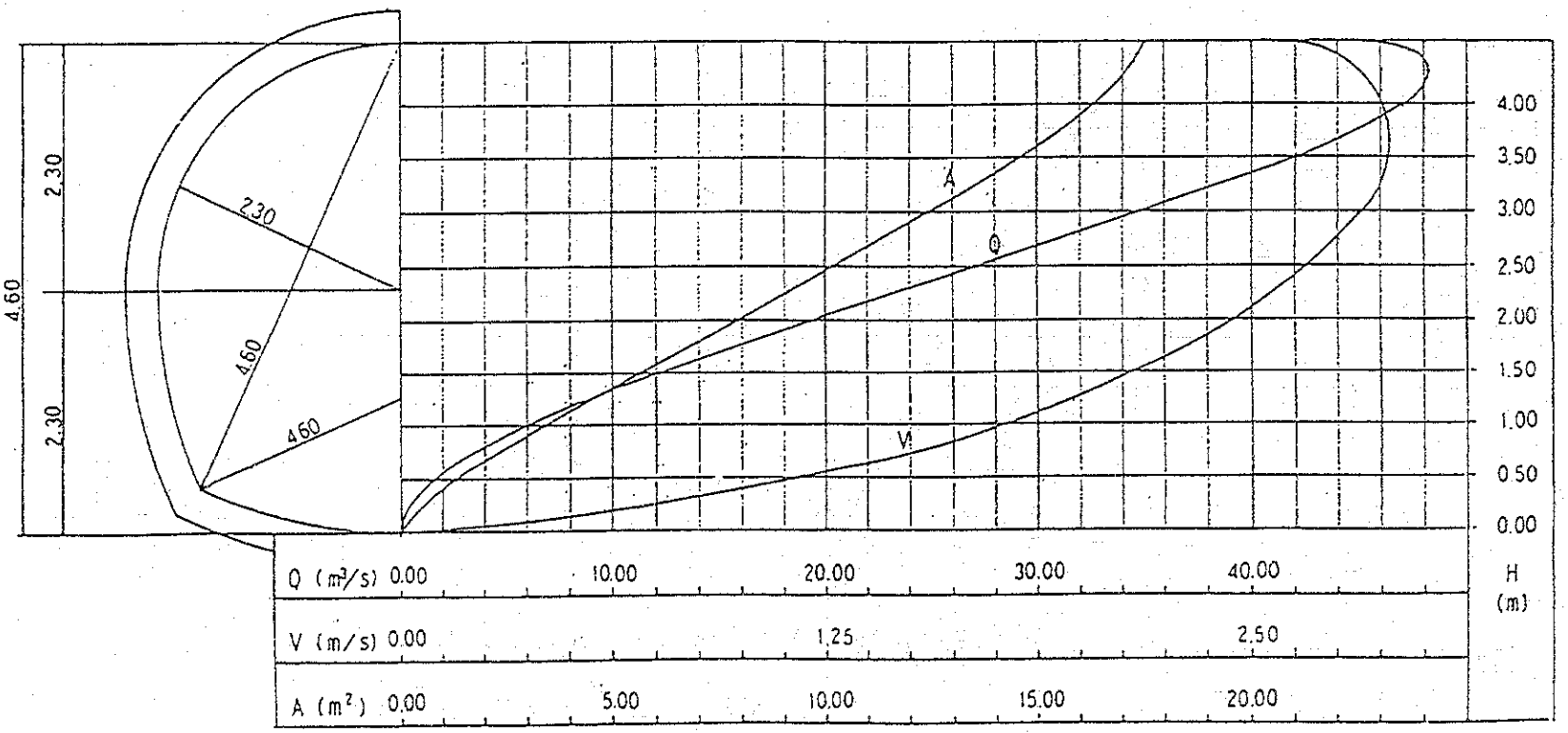
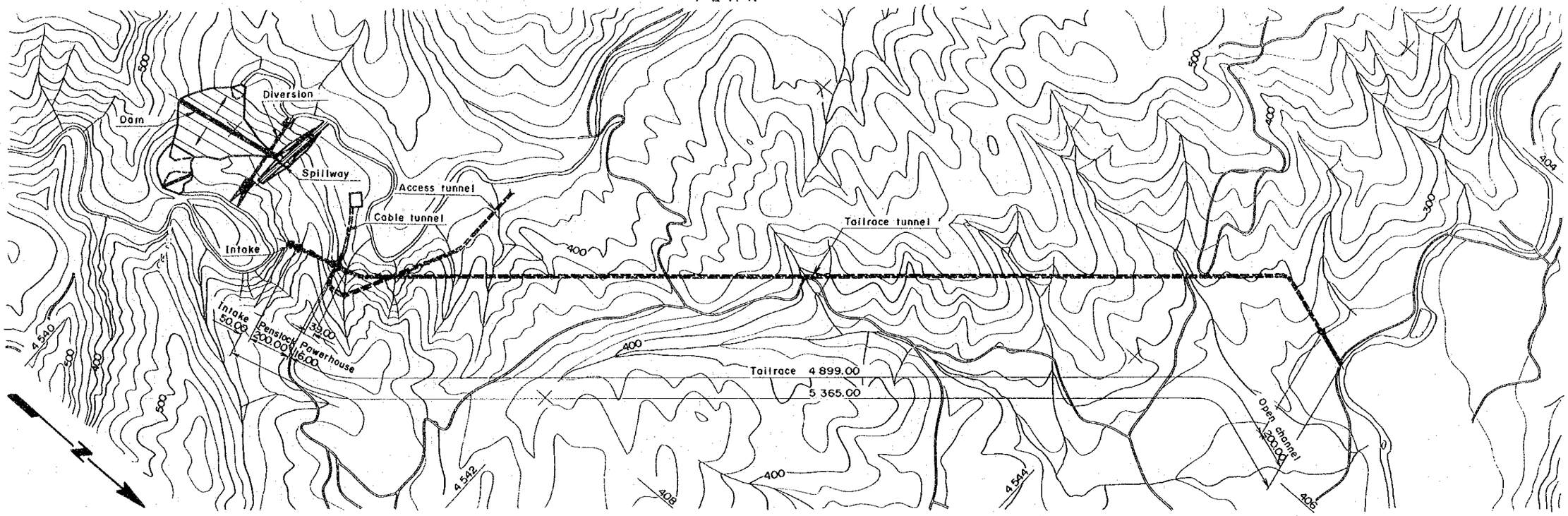
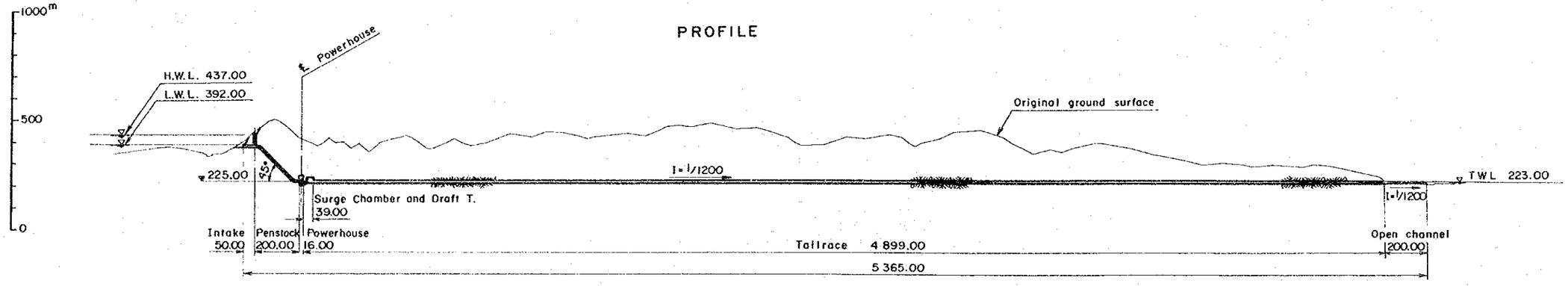


Figure 11-2 Rating Curve of Tailrace Tunnel

PLAN

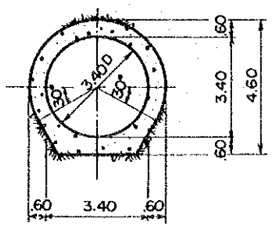


PROFILE



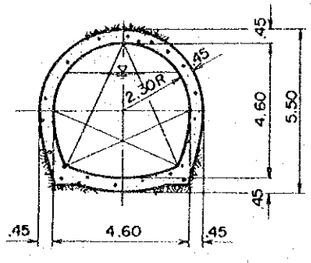
TYPICAL SECTION

PENSTOCK

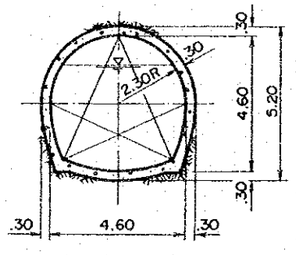


TAILRACE

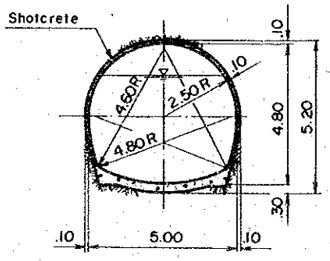
TYPE I



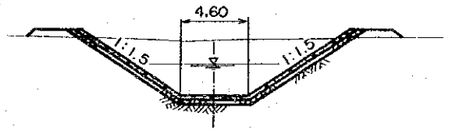
TYPE II



TYPE III



OPEN CHANNEL



0 100 m
PLAN, PROFILE

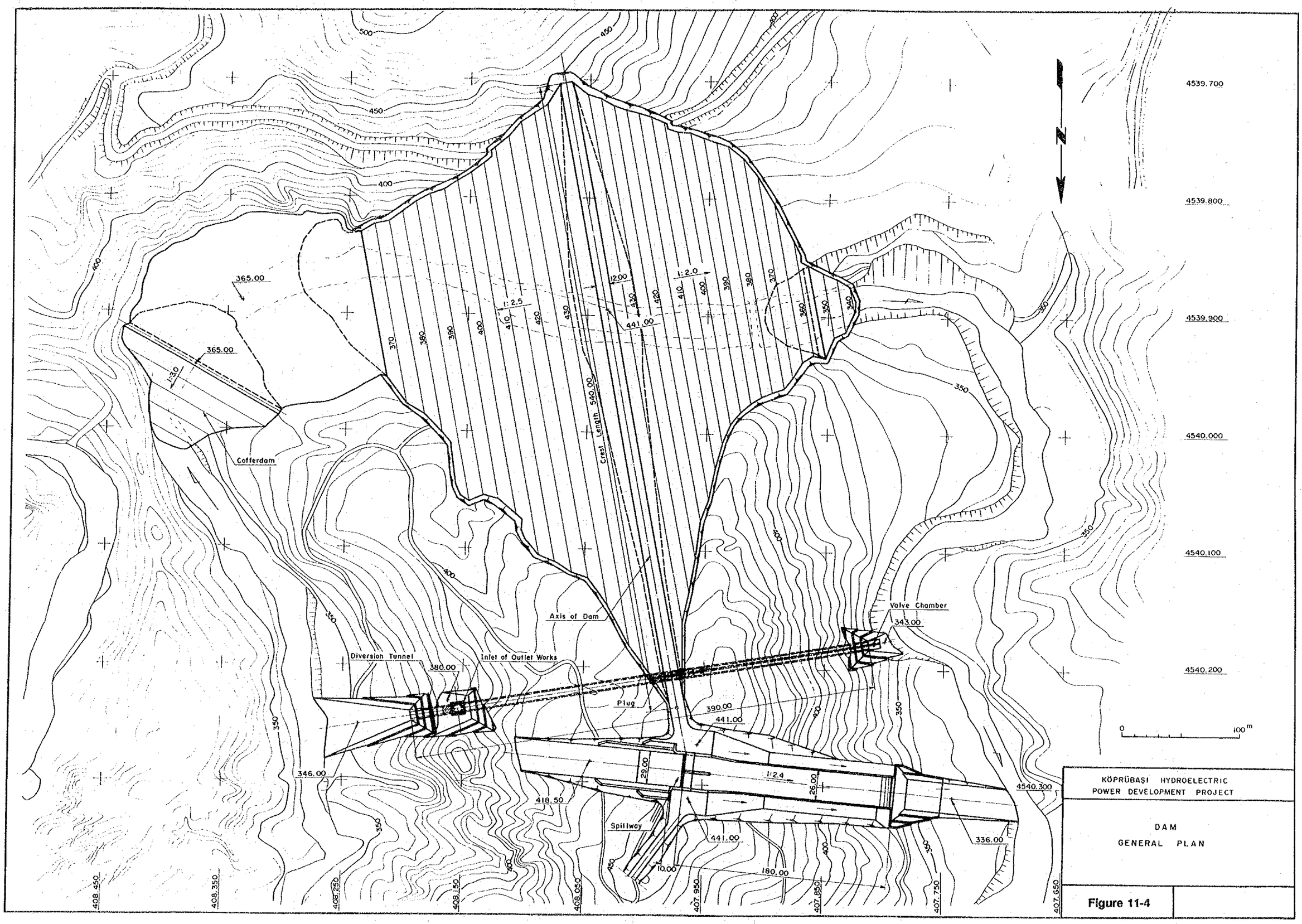
0 10 m
TYPICAL SECTION

KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

WATERWAY

PLAN AND PROFILE

Figure 11-3

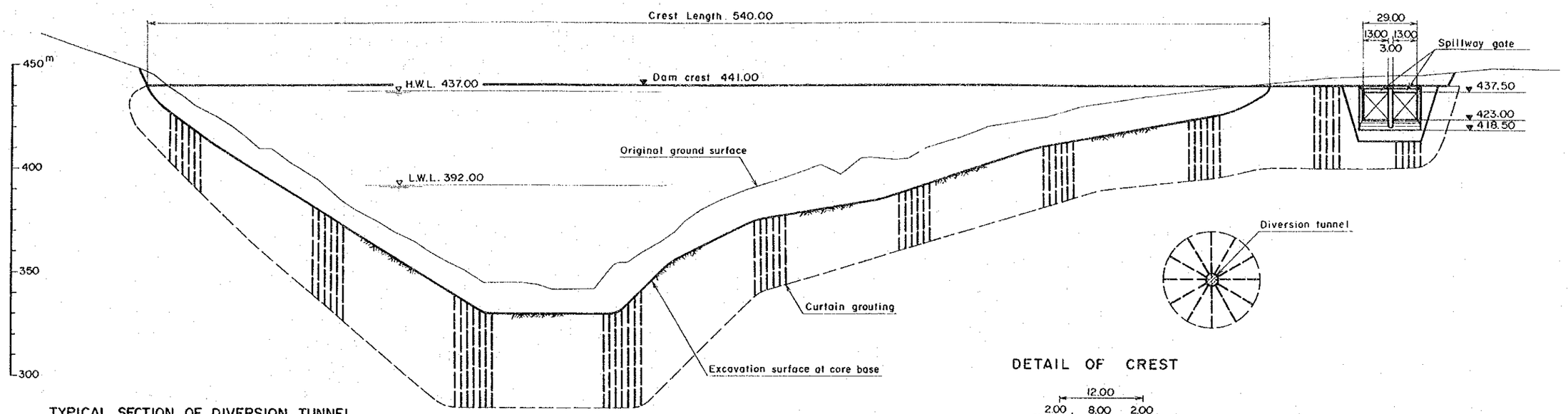


KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

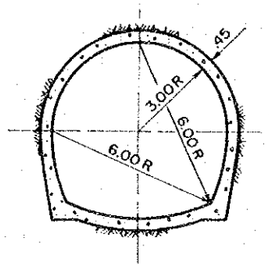
DAM
GENERAL PLAN

Figure 11-4

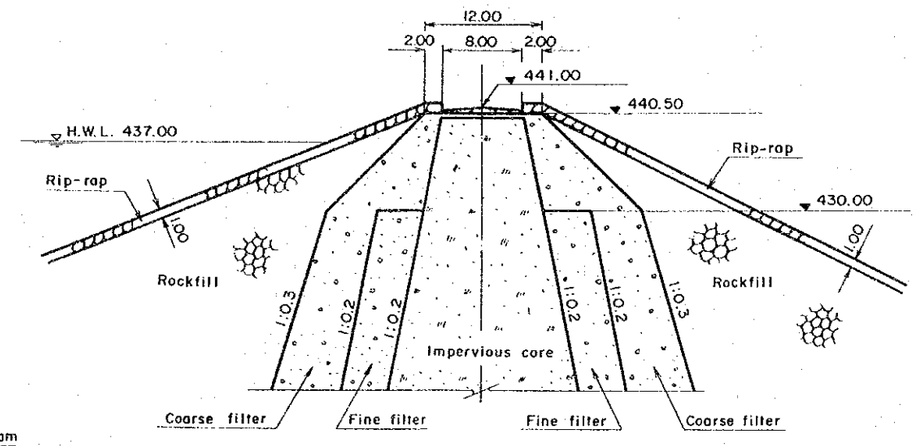
PROFILE OF DAM



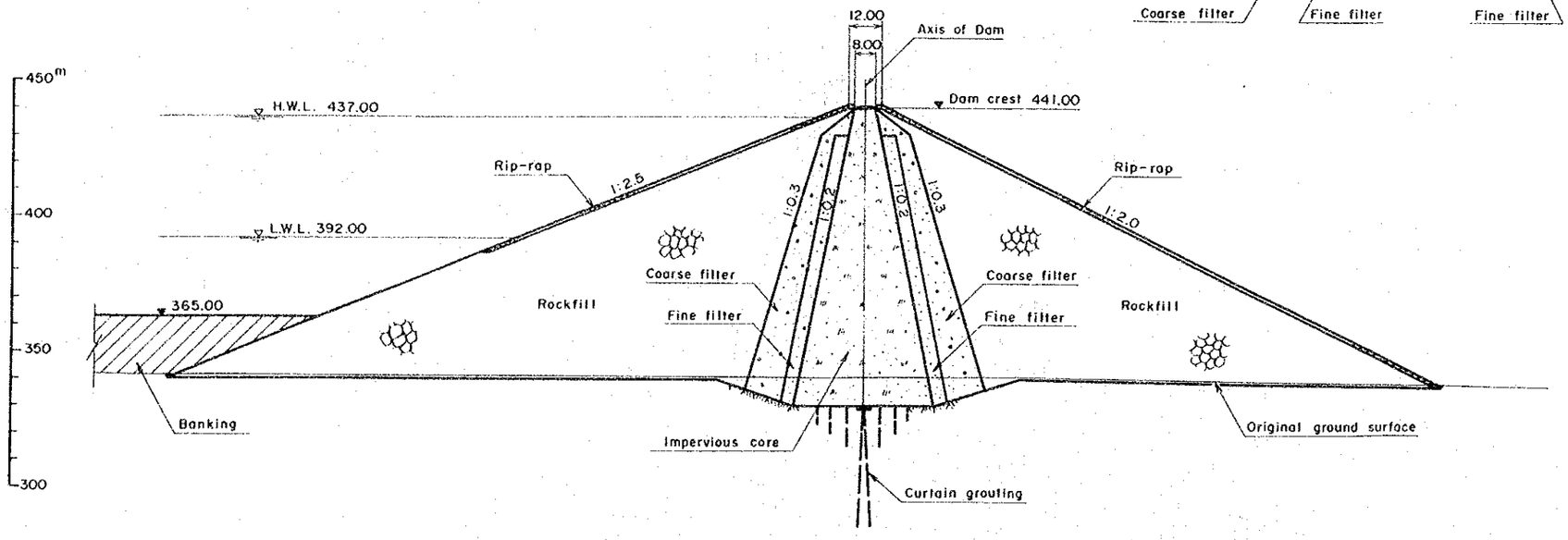
TYPICAL SECTION OF DIVERSION TUNNEL



DETAIL OF CREST



TYPICAL SECTION OF DAM



0 100m
PROFILE, TYPICAL SECTION

0 30m
DETAIL OF CREST

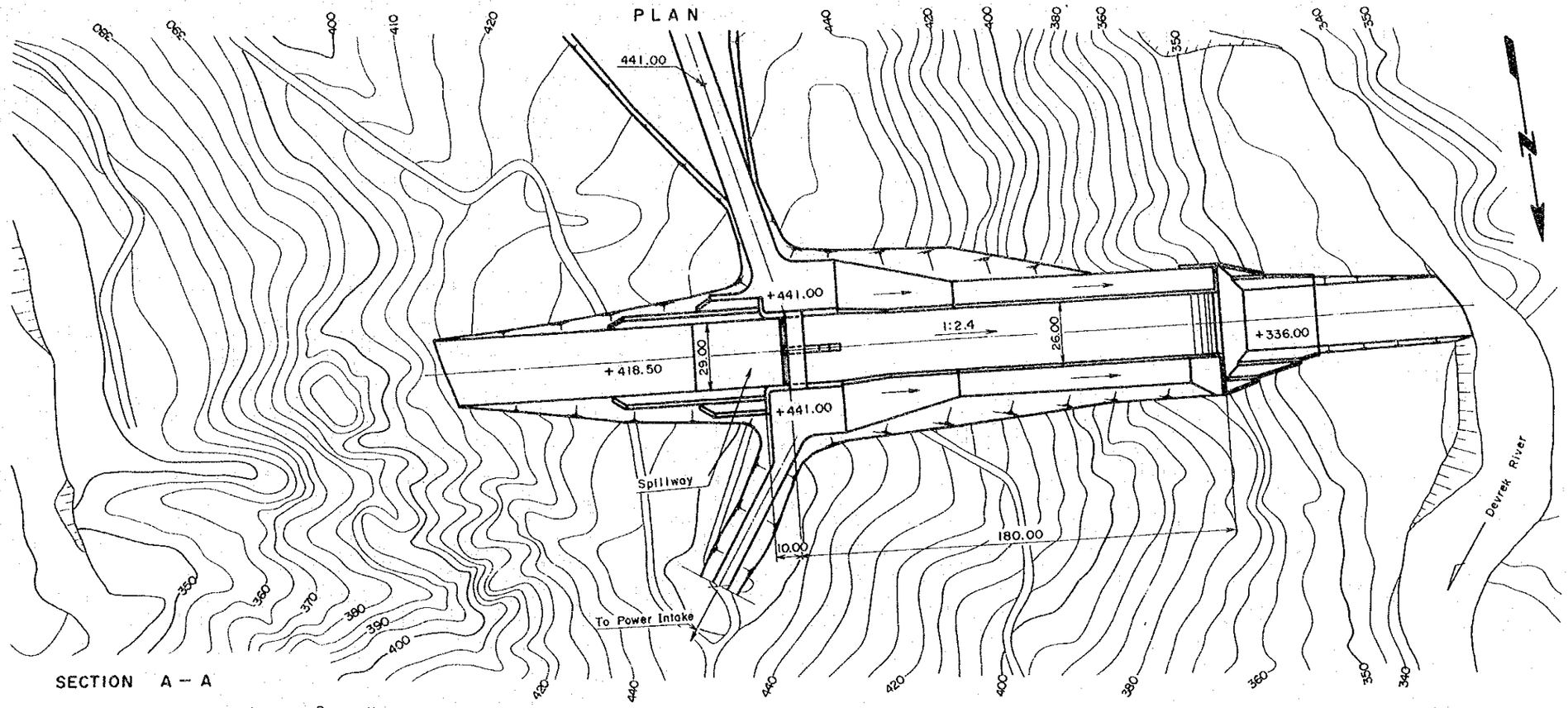
KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

DAM

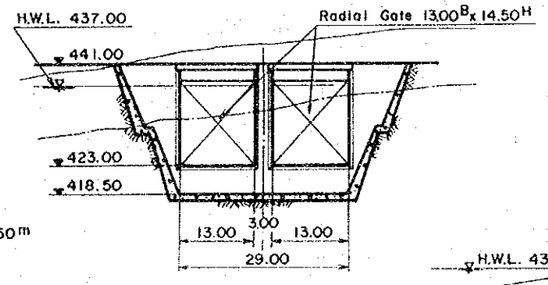
PROFILE AND SECTIONS

Figure 11-5

PLAN

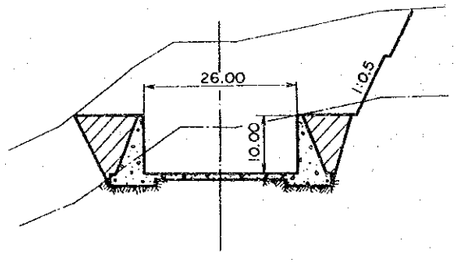


SECTION A – A



PROFILE

SECTION B – B



0 100m (PLAN, PROFILE)

0 50m (SECTION A–A, B–B)

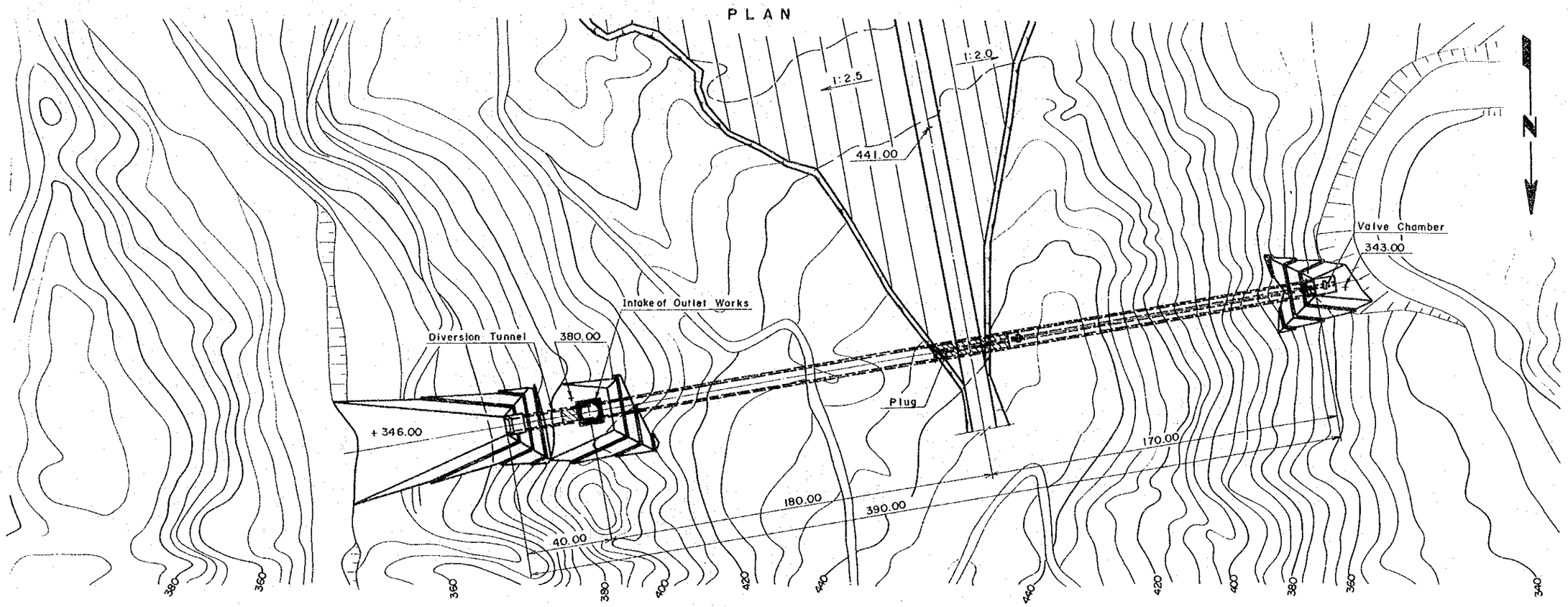
KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

SPILLWAY

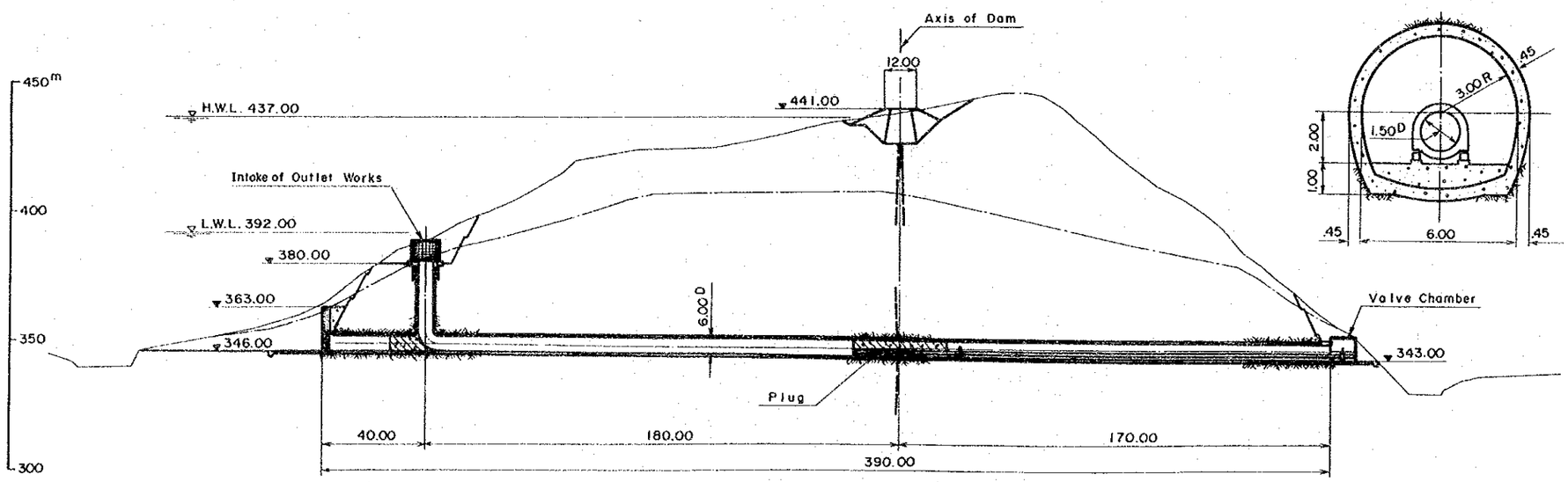
PLAN AND PROFILE

Figure 11-6

PLAN



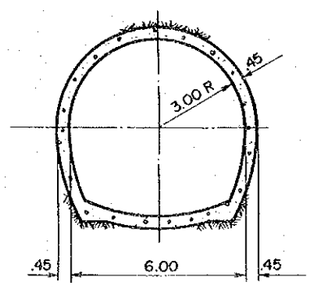
PROFILE



TYPICAL SECTION

OUTLET WORKS

DIVERSION TUNNEL



0 10m
(TYPICAL SECTION)

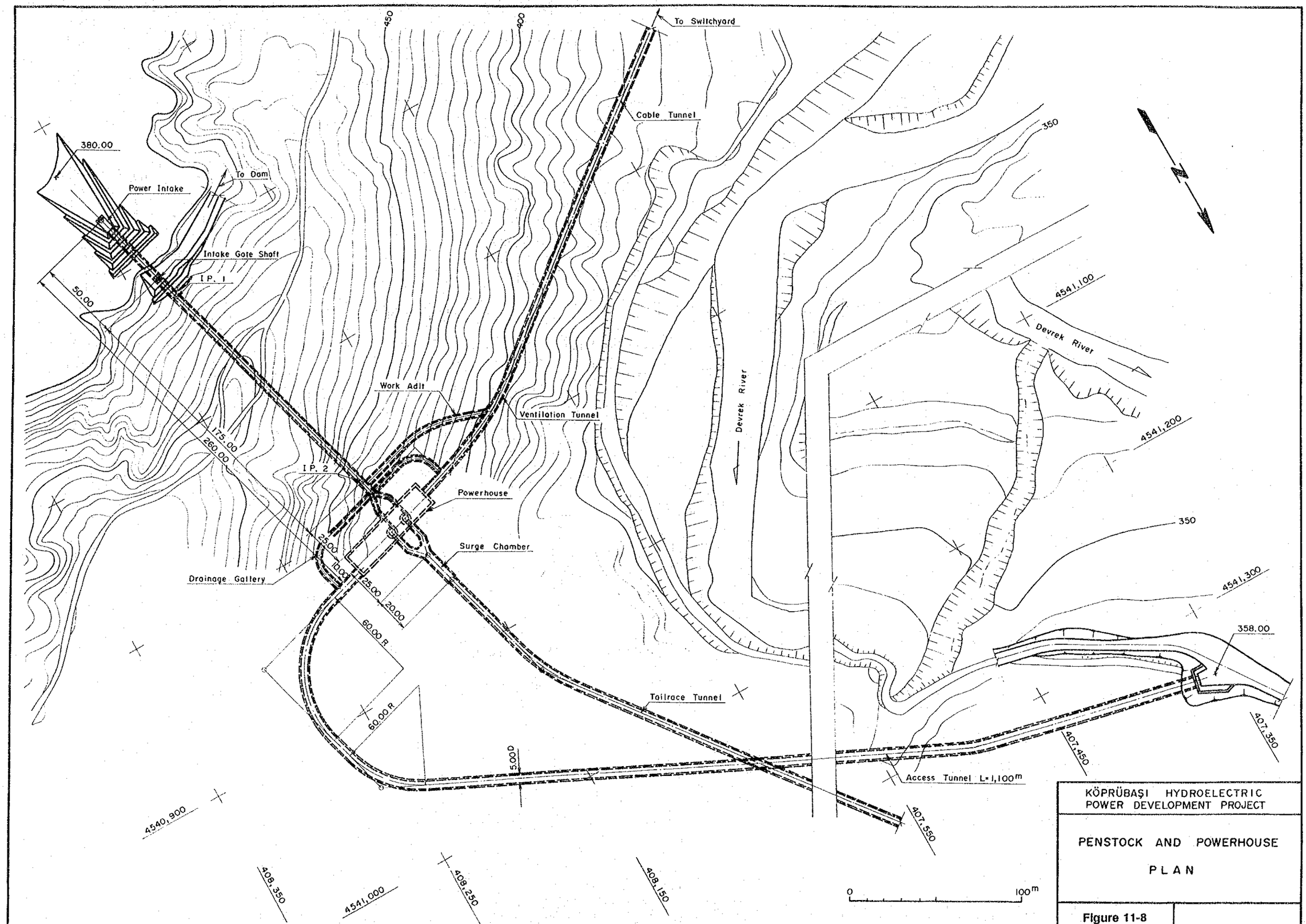
0 100m
(PLAN, PROFILE)

KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

OUTLET WORKS

PLAN AND PROFILE

Figure 11-7



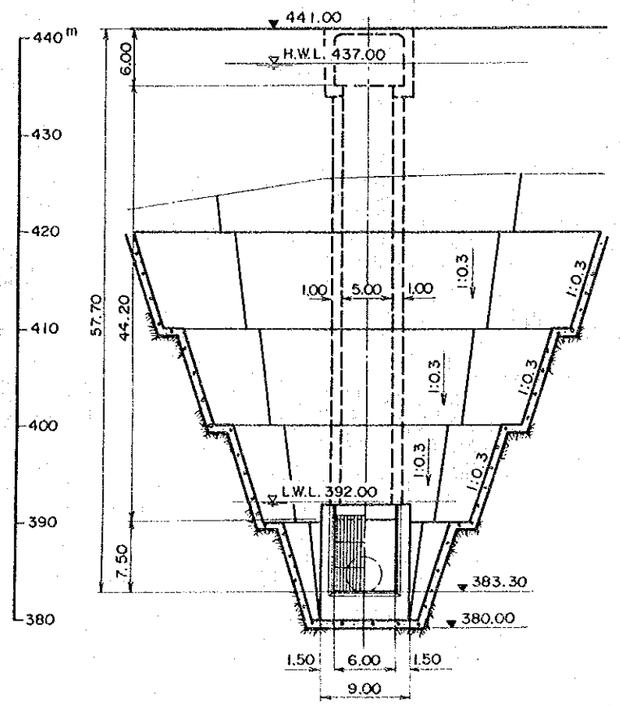
KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

PENSTOCK AND POWERHOUSE

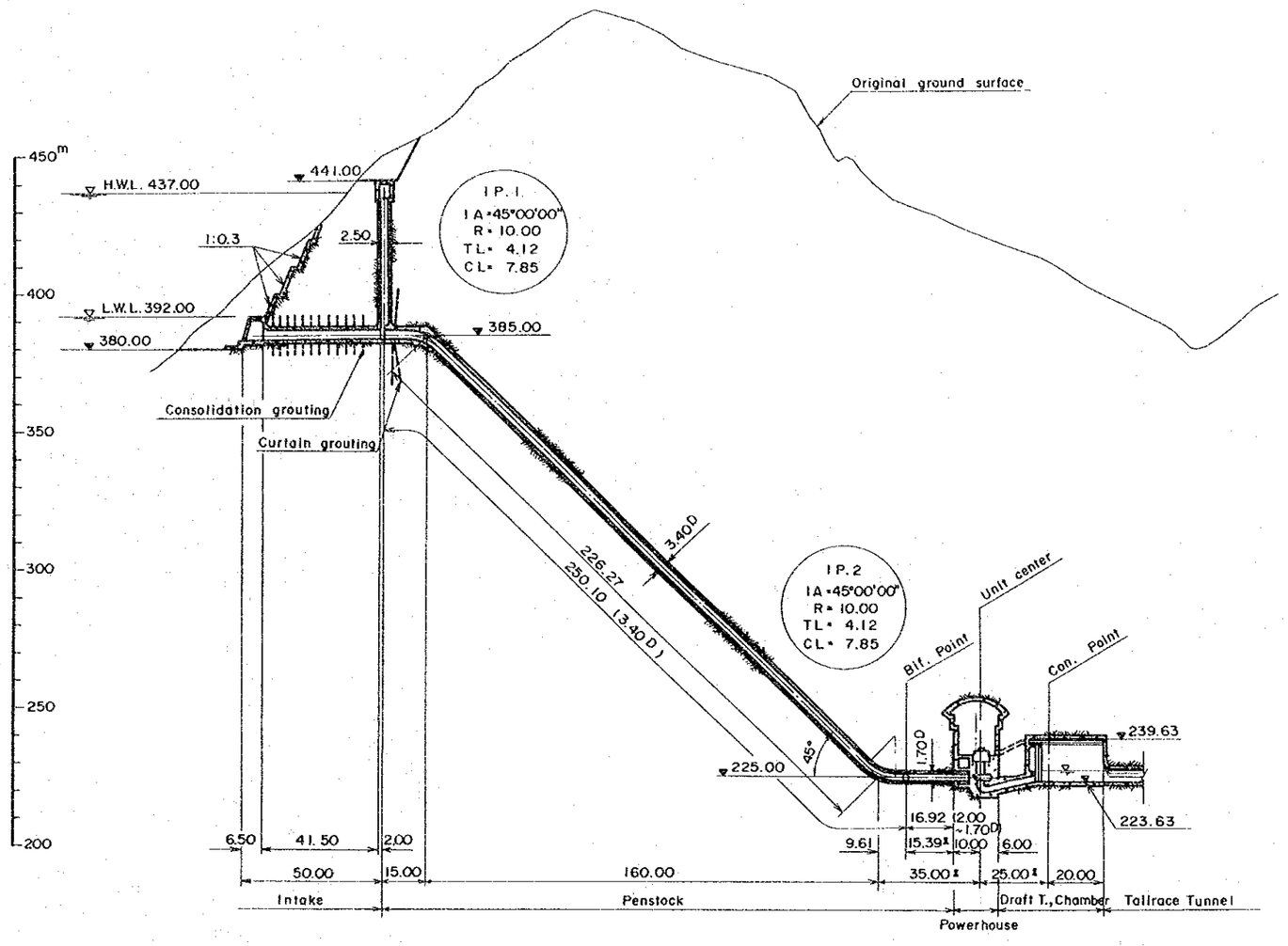
PLAN

Figure 11-8

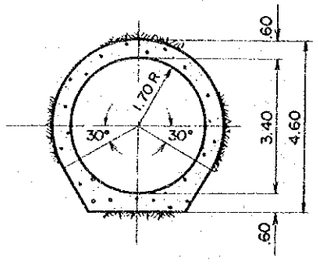
FRONT VIEW OF INTAKE



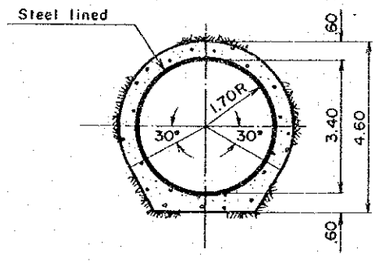
PROFILE



TYPICAL SECTION (INTAKE)



TYPICAL SECTION (PENSTOCK)



Note;

* All figures with * mark are to be straight distances between points.

0 100m (PROFILE)

0 30m (FRONT VIEW)

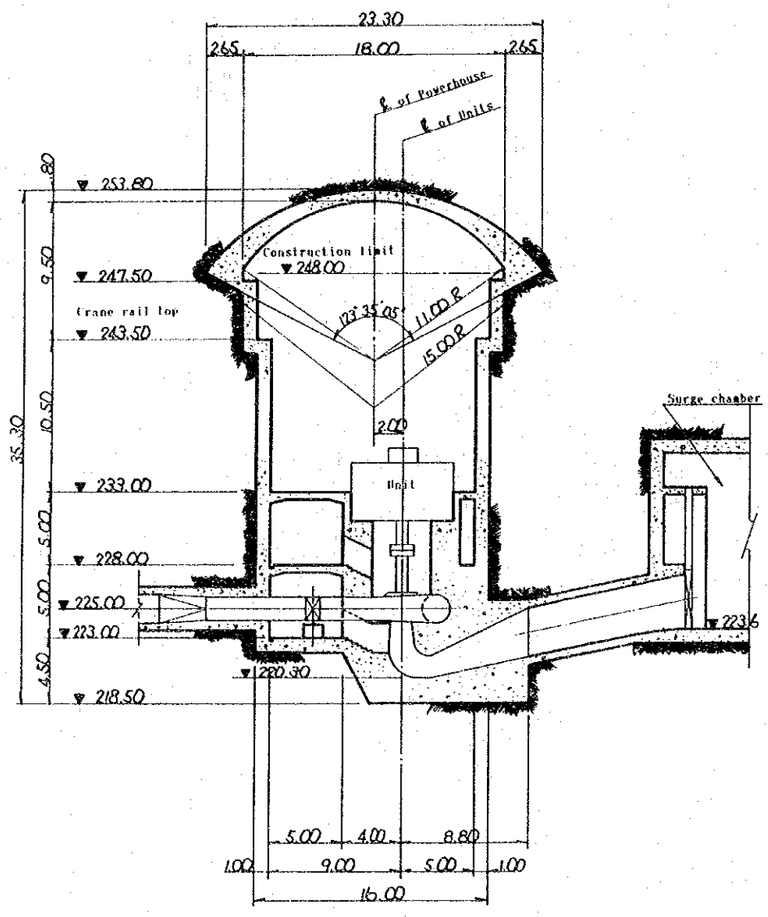
0 10m (TYPICAL SECTION)

KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

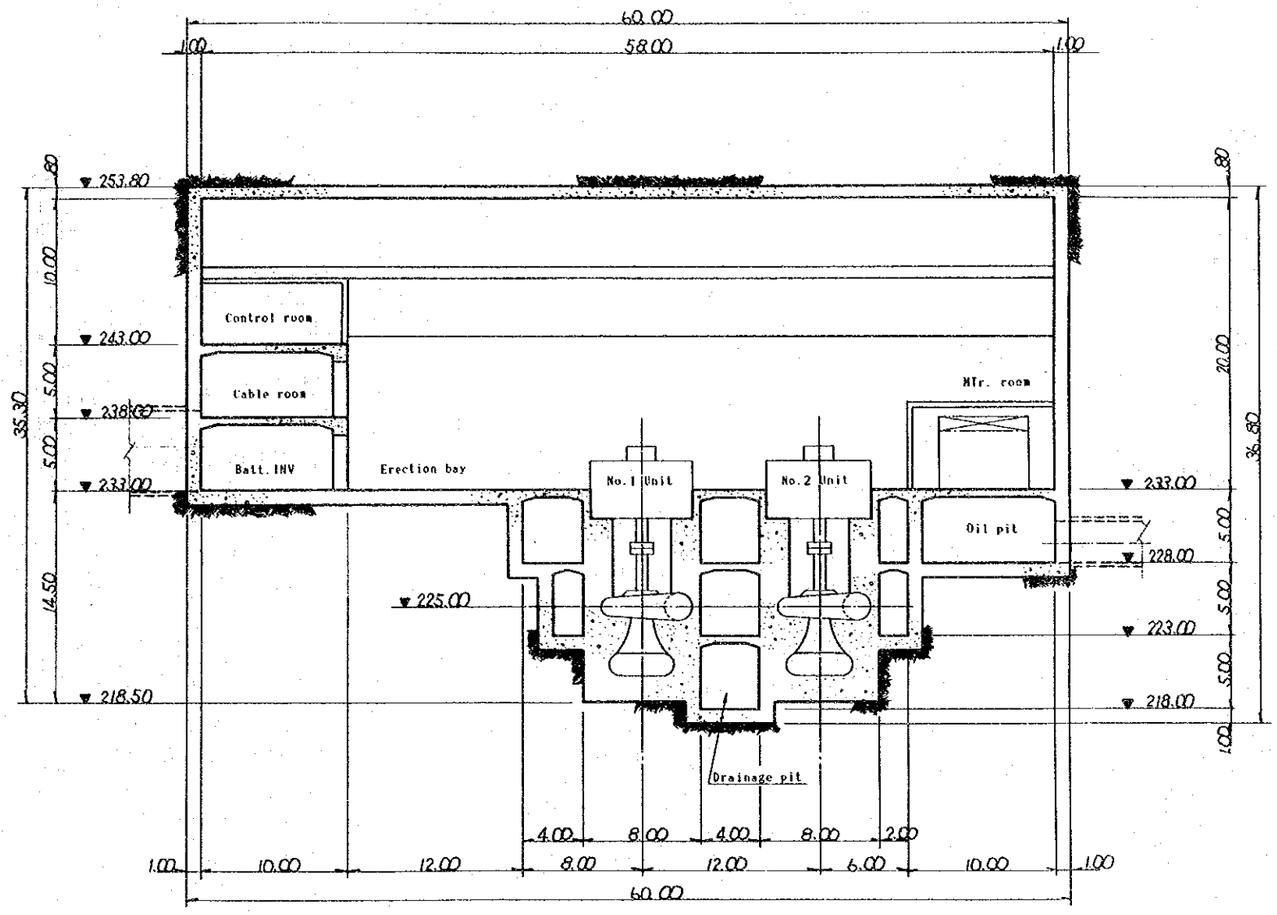
PENSTOCK AND POWERHOUSE PROFILE

Figure 11-9

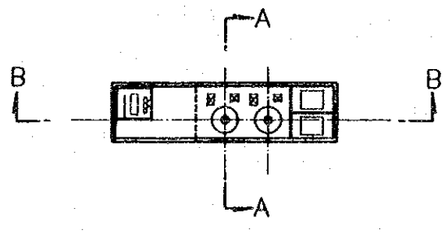
TRANSVERSE SECTION (A—A)



LONGITUDINAL SECTION (B—B)



KEY PLAN



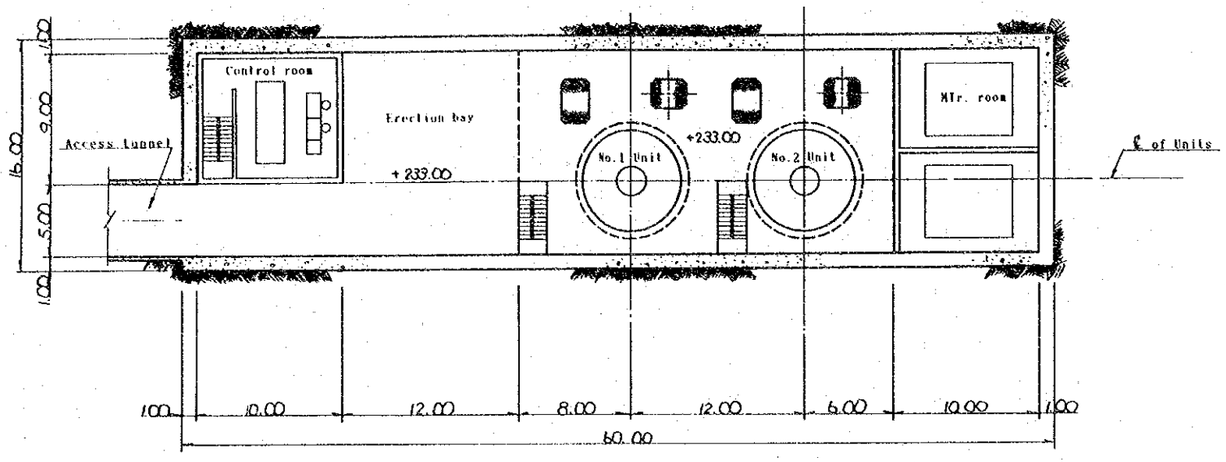
0 20m

KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

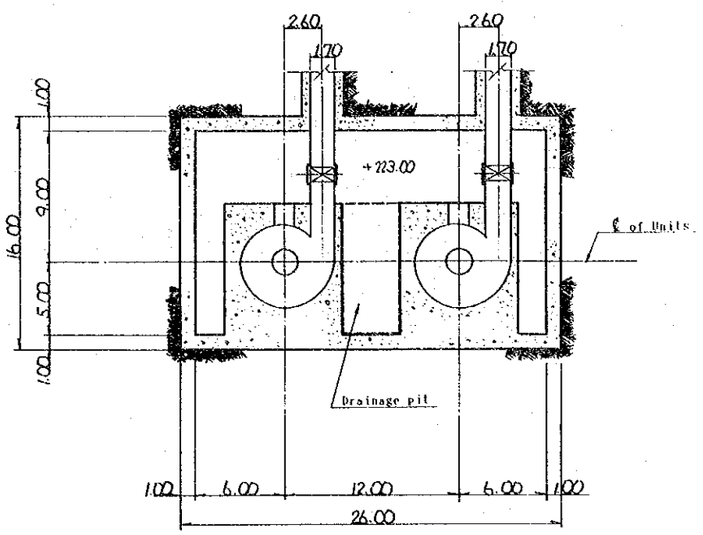
POWERHOUSE TRANSVERSE AND LONGITUDINAL SECTIONS

Figure 11-10

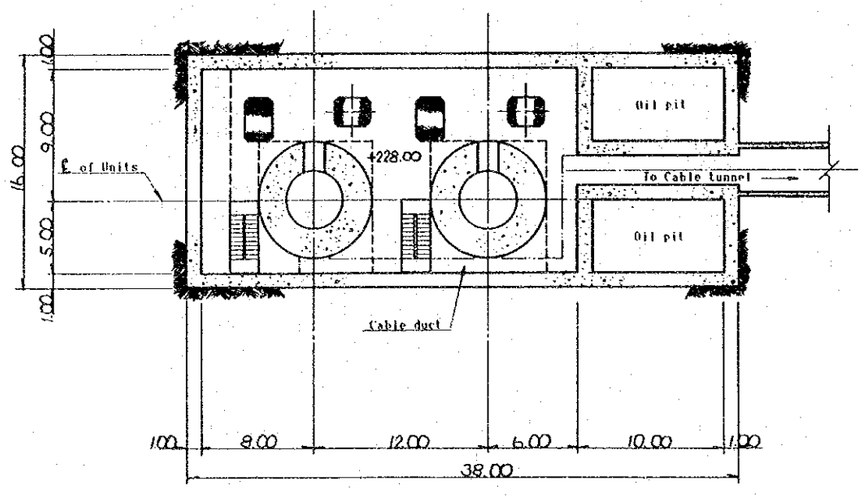
PLAN AT 233.00m



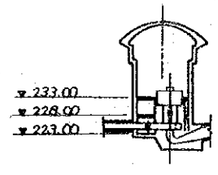
PLAN AT 223.00m



PLAN AT 228.00m



KEY SECTION



0m

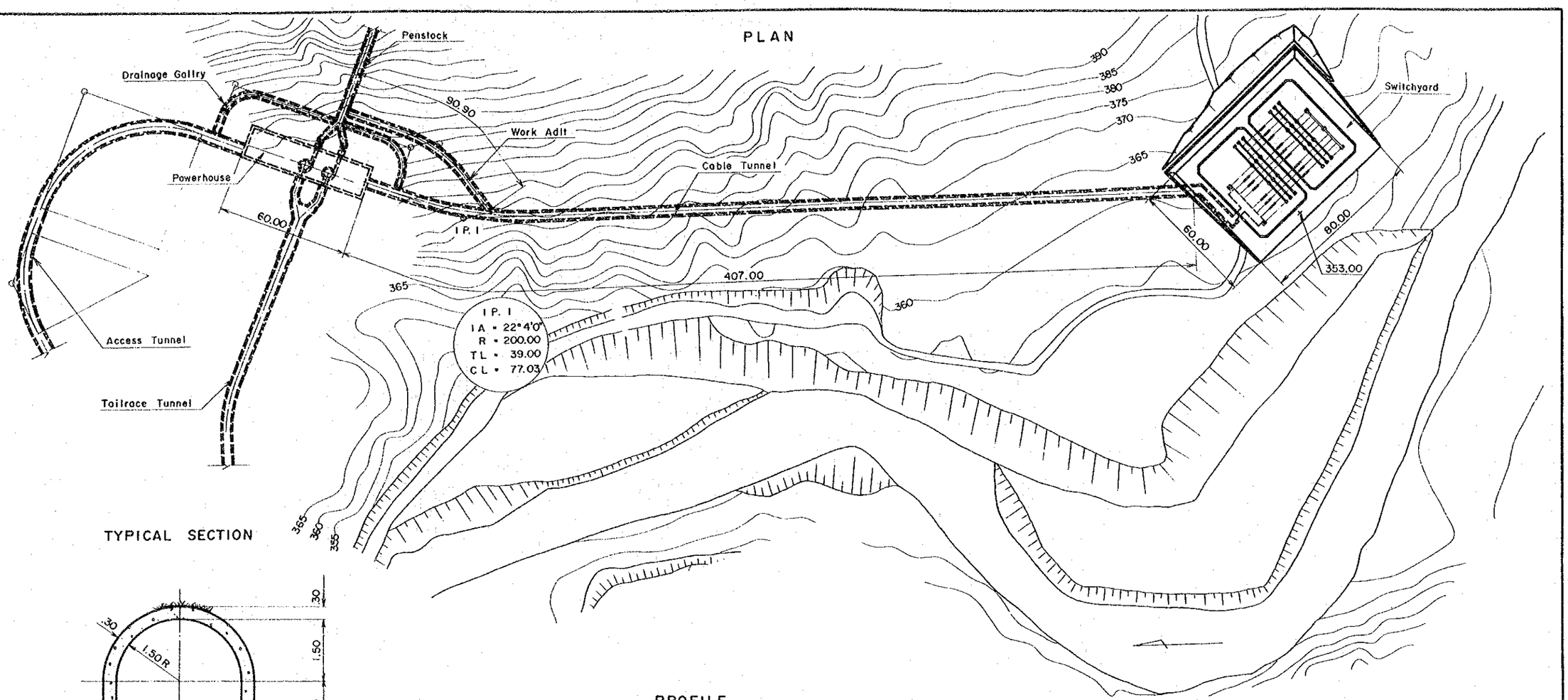
KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

POWERHOUSE

PLANS

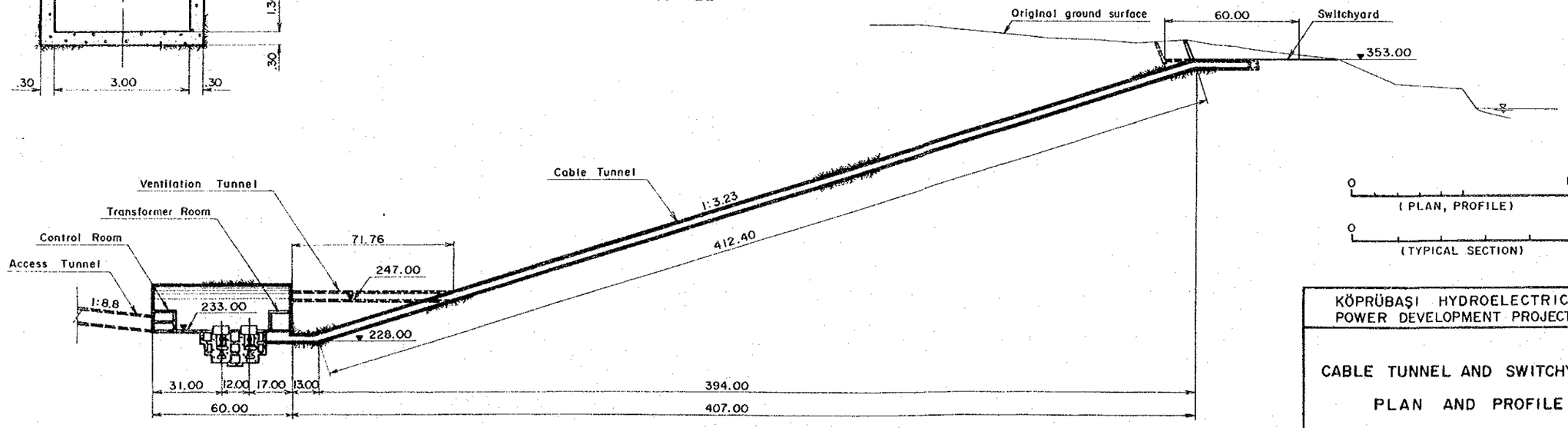
Figure 11-11

PLAN



TYPICAL SECTION

PROFILE



0 100 m
(PLAN, PROFILE)

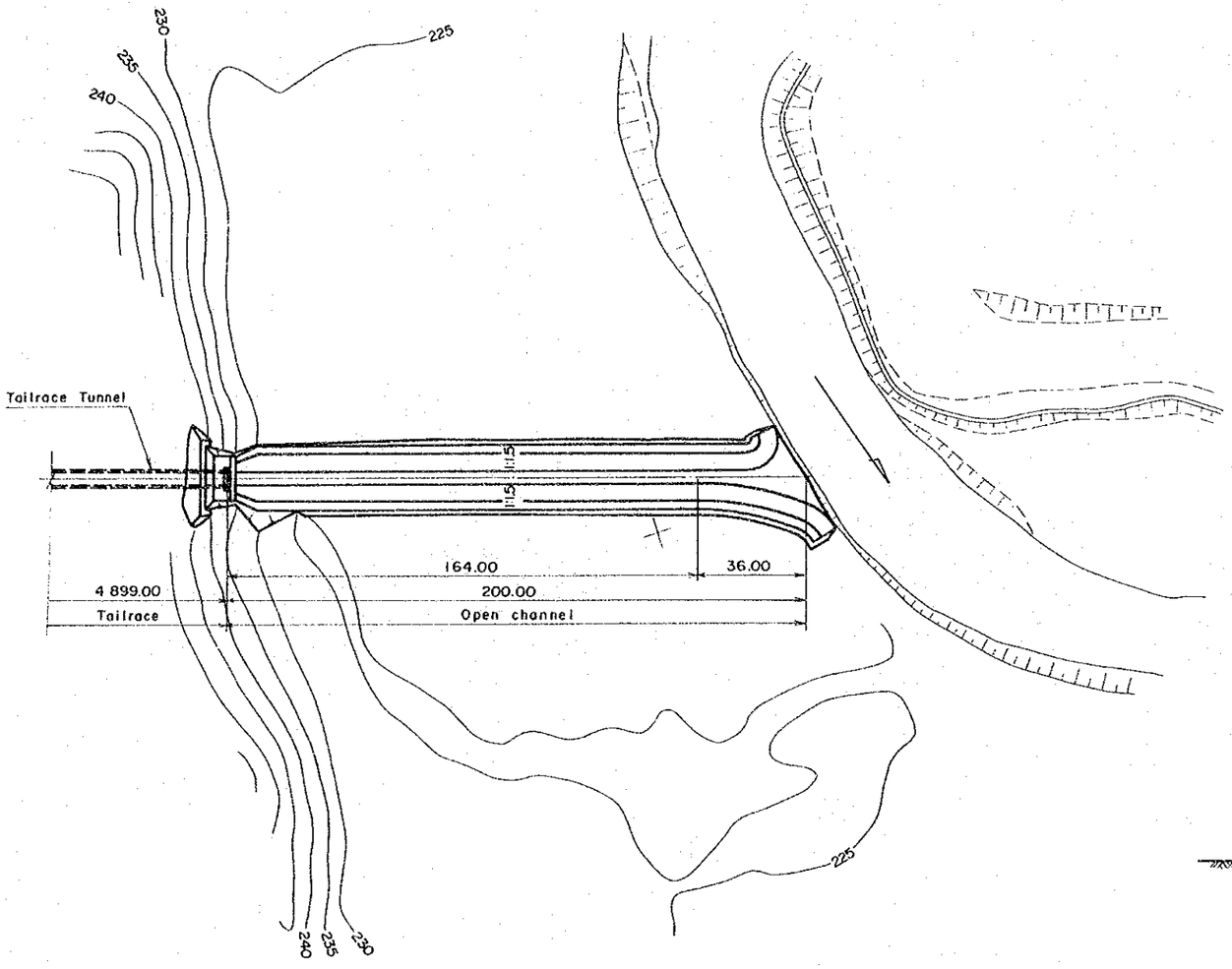
0 5 m
(TYPICAL SECTION)

KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

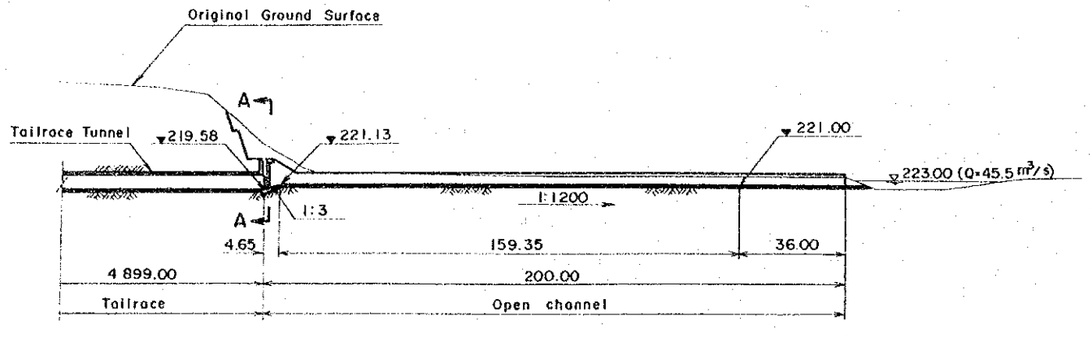
CABLE TUNNEL AND SWITCHYARD PLAN AND PROFILE

Figure 11-12

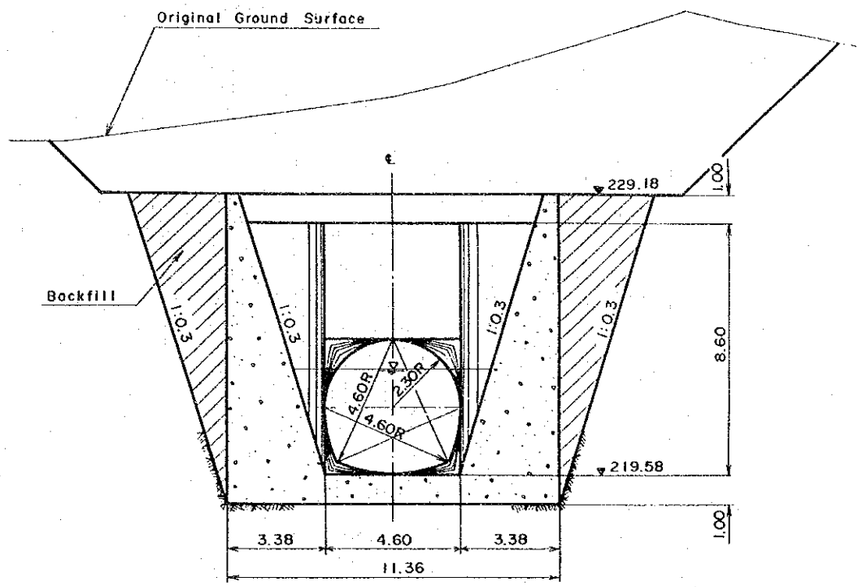
PLAN



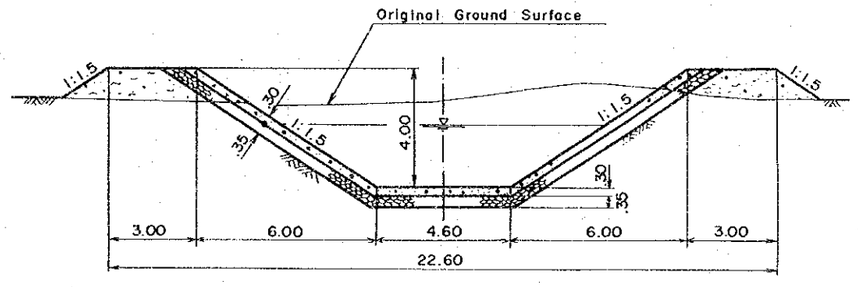
PROFILE



TYPICAL SECTION
A – A



OPEN CHANNEL



0 100m (PLAN, PROFILE)

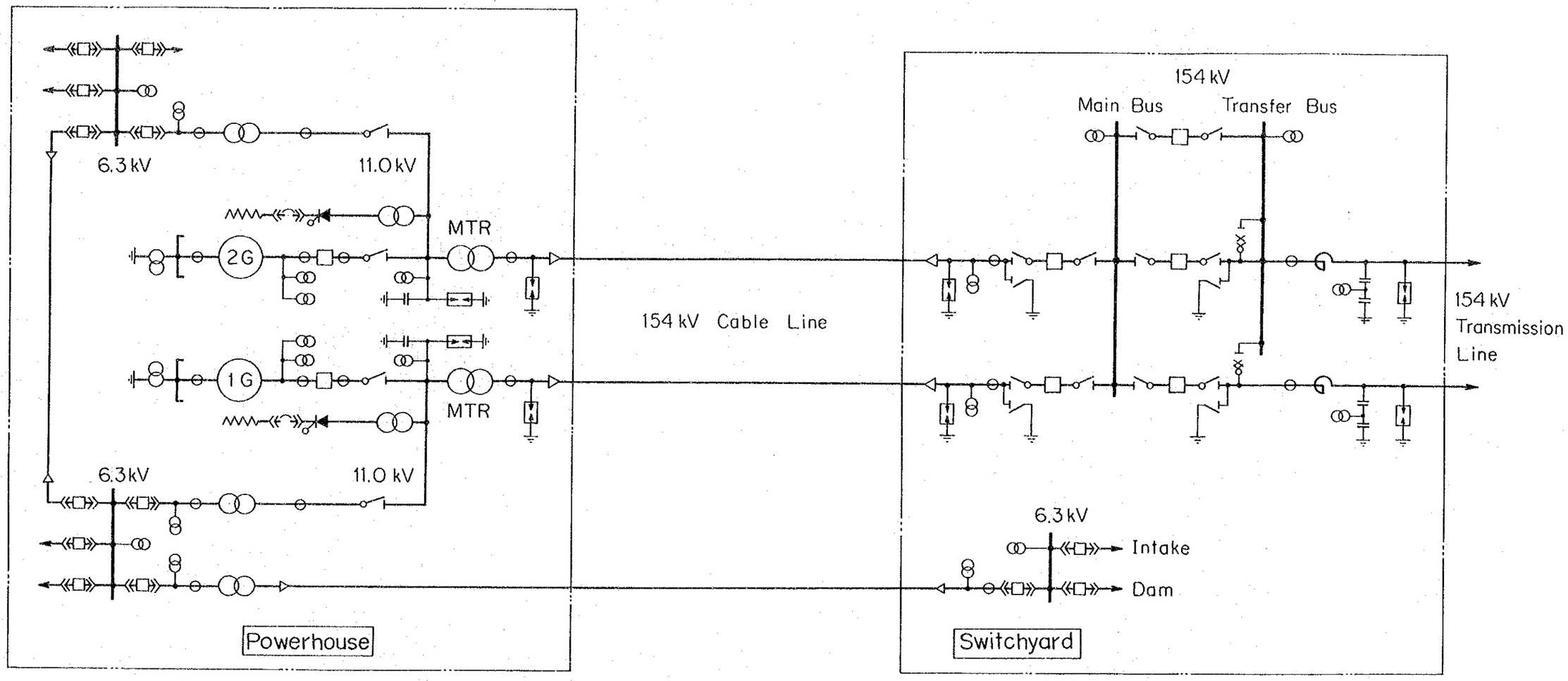
0 10m (TYPICAL SECTION)

KÖPRÜBAŞI HYDROELECTRIC POWER PROJECT

TAILRACE CANAL

PLAN AND SECTION

Figure 11-13

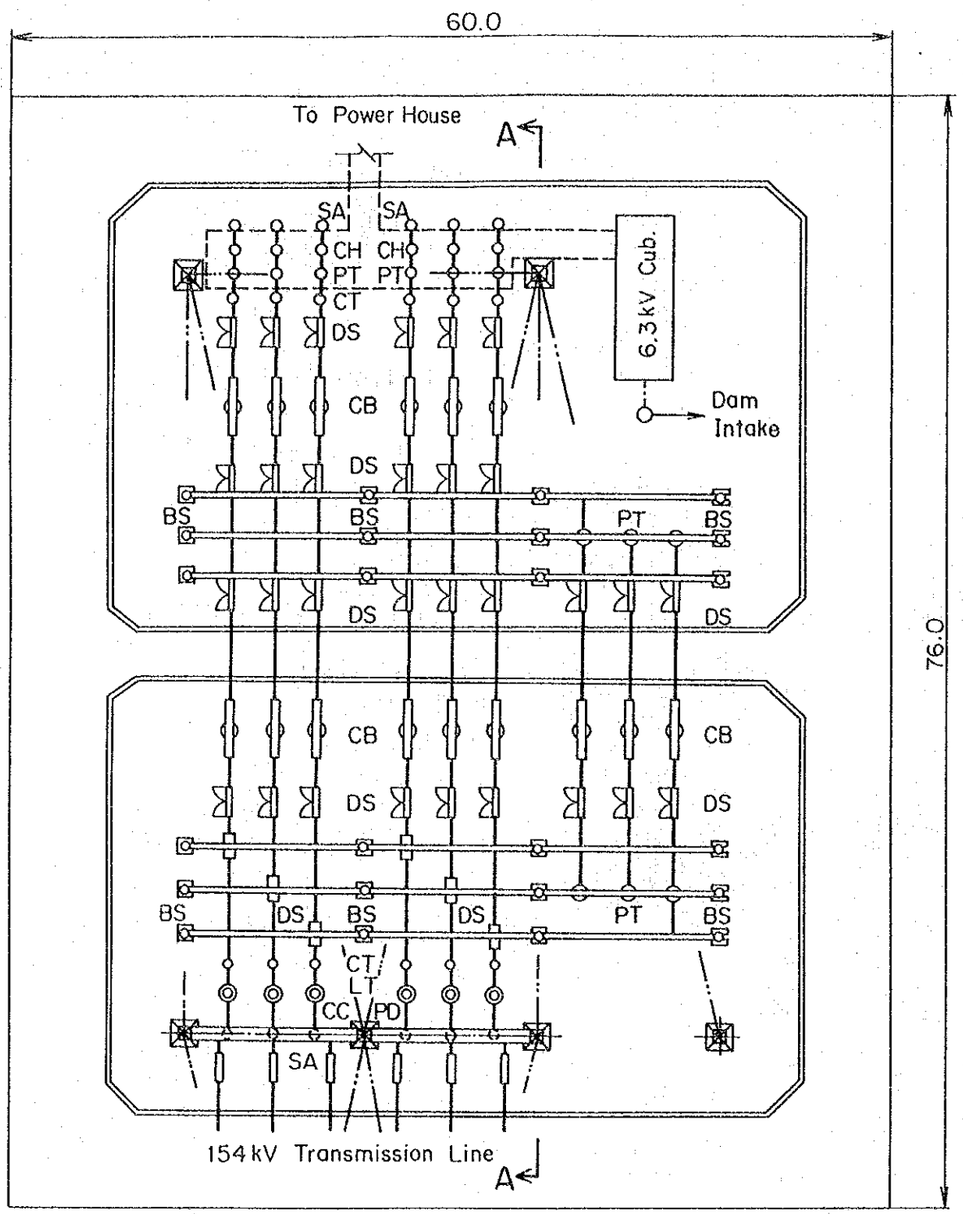


Francis Turbine	Generator	Main Transformer	154kV Cable Line	Switchyard
36.2 MW	38.9 MVA	13 MVA x 3	2 cct	Single Bus + Transfer Bus
21.5 m/sec	429 rpm	11.0 : 154/√3 kV	XLPE Cable	Self-Supporting Type Alminum Pipe Bus
190.0 m	50 Hz	50 Hz	200 mm²	154 kV

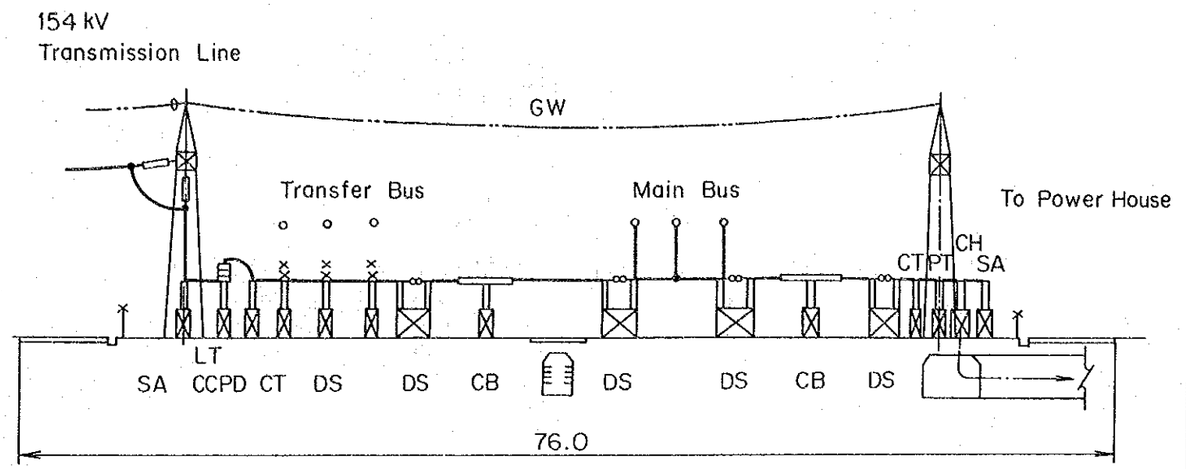
KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

SINGLE LINE DIAGRAM

Figure 11-14



SECTION A - A



LEGEND

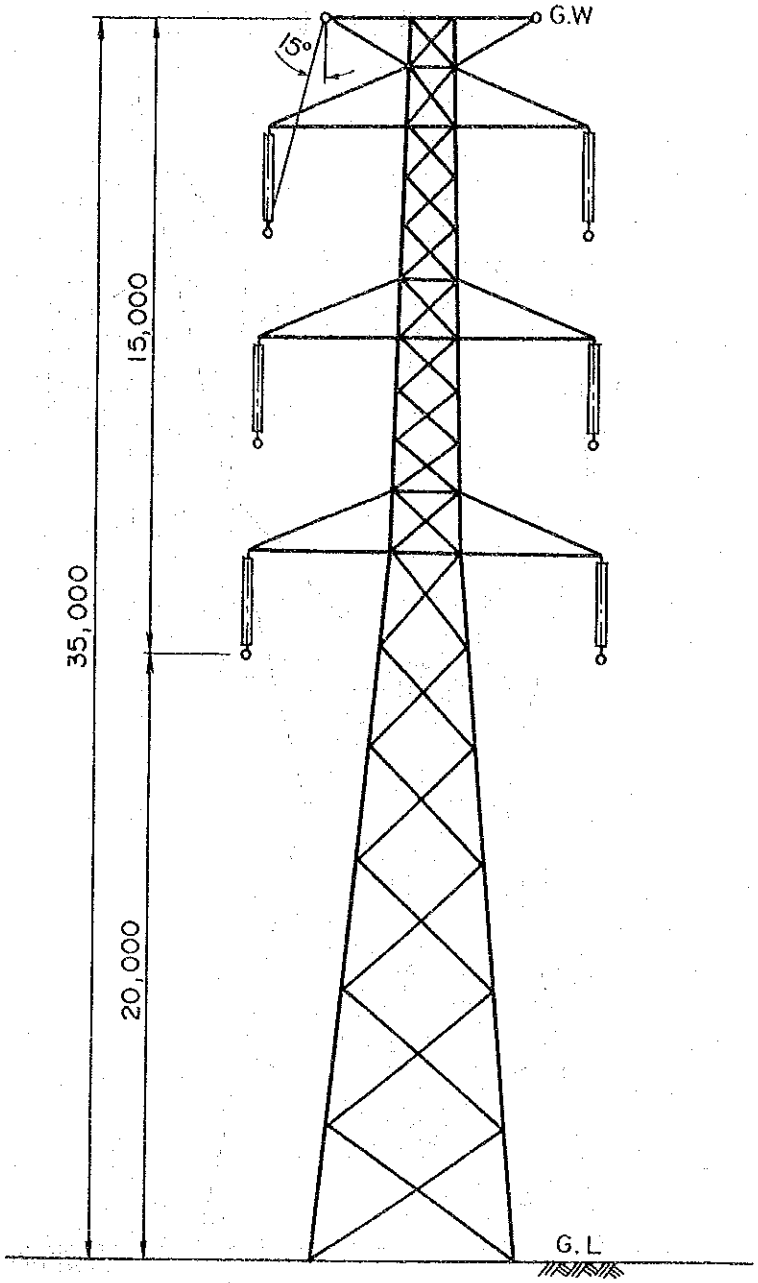
BS	Bus Support	LT	Line Trap
CCPD	Coupling Capacitor Potential Device	CB	Circuit Breaker
CT	Current Transformer	PT	Potential Transformer
DS	Disconnecting Switch	CH	Cable Head
GW	Overhead Ground Wire		
SA	Surge Arrester		

KÖPRÜBAŞI HYDROELECTRIC POWER DEVELOPMENT PROJECT

PLAN OF SWITCHYARD

Figure 11-15

154 kV 2cct Standard Suspension Tower



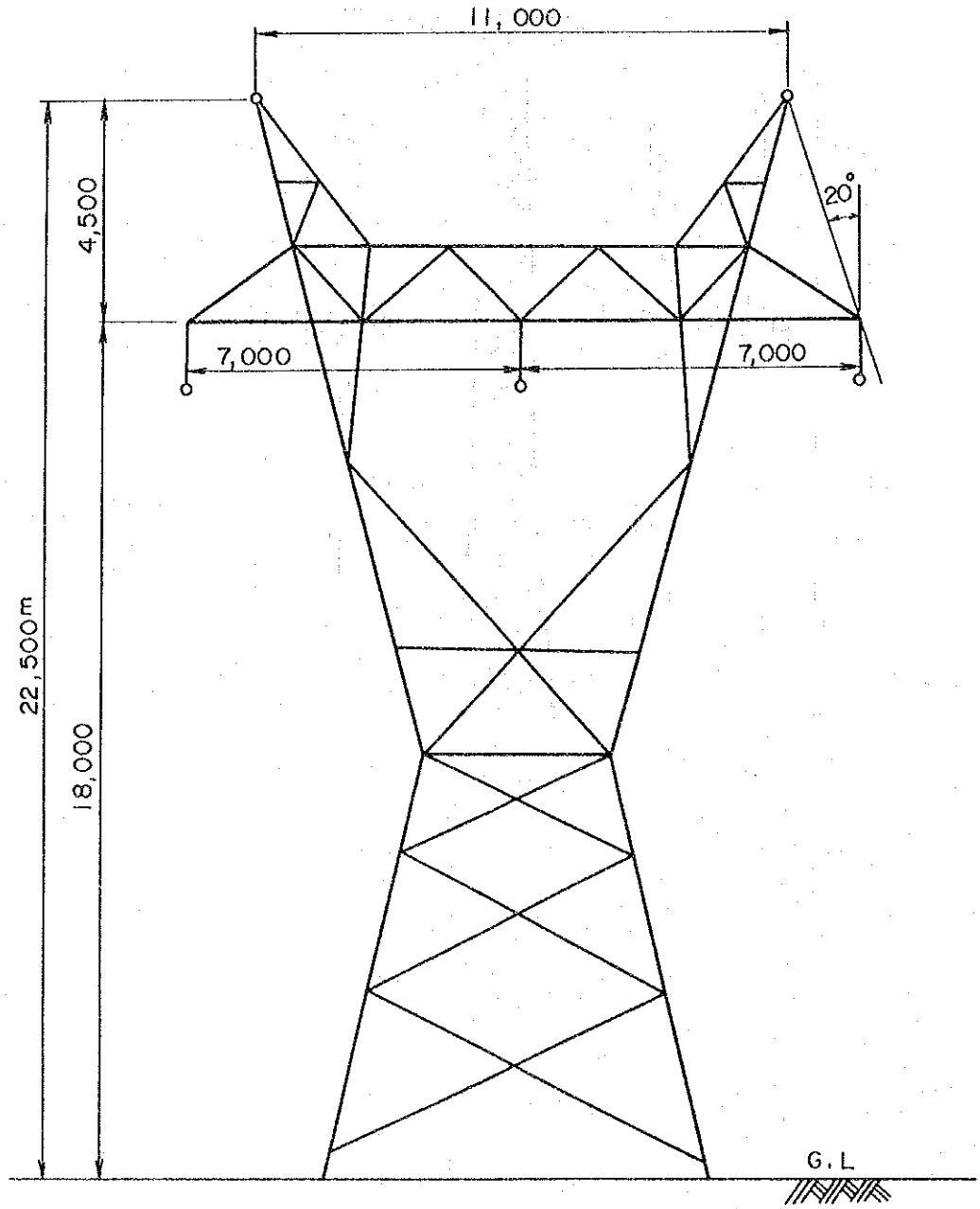
Span = 350m

KÖPRÜBASI HYDROELECTRIC POWER DEVELOPMENT PROJECT

Standard Suspension Tower

Figure 11-16

154kV 1 cct Standard Suspension Tower



Span = 350m

KOPRUBASI HYDROELECTRIC POWER DEVELOPMENT PROJECT

Standard Suspension Tower

Figure 11-17

Chapter 12 CONSTRUCTION PROGRAM AND CONSTRUCTION COST

Chapter 12

CONSTRUCTION PROGRAM AND CONSTRUCTION COST

Contents

List of Figures

List of Tables

Chapter 12 CONSTRUCTION PROGRAM AND CONSTRUCTION COST

12.1 Construction Program and Construction Schedule

12.1.1 Basic Conditions to Affect the Construction Program

It is expected that structures planned for the Project will consist of a rockfill dam of height approximately 110 m and a tailrace tunnel of length approximately 5 km as main, along with an intake, penstock and power plant. The outline of matters that affect construction planning and the construction schedule of this Project are as follows:

(1) Meteorology

The meteorological conditions of this project area are as described in Chapter 6. The construction schedule was set up assuming that excavation and embankment of the rockfill dam and placement of spillway concrete would be possible 9 months out of a year, and that other underground works would be possible to perform throughout the year.

(2) Transportation

Mengen is the nearest city for the Project Site. The trunk road No. 100 and a main road of approximately 310 km in total connect Mengen with Istanbul. The highway No. 750 and a main road of 170 km in total connect Mengen with Ankara. Those roads have enough capacity to transport electro-mechanical equipment, construction equipment, and materials, because those are the most important roads in Turkey on which much similar heavy equipment has already been transported.

There is a route between Mengen and the powerhouse of the Project, the main road of approximately 3 km and the earth

road of approximately 22 km in length, 5 or 6 m in width, with 7 or 8 bridges. It has a possibility to transport electro-mechanical equipment, construction equipment, and materials by partial improvements of the road.

There is another route between Mengen and the Project Site, a secondary road with asphalt pavement of 13 km from Mengen to Gökçesu and an earth road of 18 km from Gökçesu to the dam site which pass through the reservoir of the Project.

An earth road of 8 km connects the dam with the powerhouse.

The Istanbul port has a capability to unload electro-mechanical equipment for the Project because much similar equipment has been unloaded.

(3) Construction Materials

a) Cement

A cement factory is located at Caydurt, approximately 30 km south from the Project Site and 20 km east from Bolu. Another cement factory has been installed at 11 km east from Bolu. Both cement factories will be a major source of cement utilized for the Project.

b) Steel

A steel mill is located at Karabük, approximately 65 km northeast from the Project Site. The steel mill has a capability to be a major source of steel bars utilized for the Project.

Another steel mill is located at Ereğlı, approximately 50 km northwest from the Project site, and produces steel plates which will be required for the penstock and gates of the Project.

c) Concrete Aggregates

DSI performed the study and test on concrete aggregates utilized for the Project at C and G-Area on Devrek river sand-gravel deposit.

Aggregates are to be manufactured from sand-gravel deposit at the river bed near the outlet of the Project G Area.

(4) Electric Power Facilities for Construction

Electric power will be required for construction at the dam, headrace, powerhouse, and outlet. Two power distribution schemes for construction are conceivable as follows:

Case A: Addition of one circuit to the existing 15 kV Mengen-Çubuk-Köprübaşı distribution line, with new 15 kV distribution lines to be constructed from Köprübaşı to the dam site and powerhouse.

Case B: A 34.5 kV distribution line is to be newly constructed from Kayabükü to the dam site via the powerhouse.

(5) Hydraulic Equipment

Hydraulic equipment except steel penstock pipes and steel conduits are to be fabricated in the vicinity of Ereğli, and hauled overload to Köprübaşı by trailer.

For steel penstock pipes and steel conduits a temporary plant is to be constructed in the field, where manufacturing is to be done, with installation carried out at the specified places.

(6) Electrical Equipment

The principal items of electrical equipment are to be manufactured overseas and landed at Istanbul Port, from where they would be transported by trailer for installation at the powerhouse.

12.1.2 Construction Program and Construction Schedule

Assuming that the year of commissioning of this Project is to be 2001, it would be necessary for preparations and start of construction to be roughly in accordance with the schedule below.

Oct. 1992 - Sep. 1994	Feasibility study (2 years)
Oct. 1994 - Mar. 1995	Provision and award of final design (0.5 year)
Apr. 1995 - Dec. 1996	Final design (1 year)
Mar. 1996 - Dec. 1996	Finance formalities (1 year)
Jul. 1997 - Dec. 1997	Bidding and award of contract for construction (1 year)
Aug. 1998 -	Start of construction
Dec. 2001	End of construction

The quantities of the principal civil works in this Project are as shown in Table 12-1. The major items of machinery and equipment expected to be required at the peak of the construction work are given in Table 12-2.

As a result of study considering the scale of the construction work, the layout of structures, etc., it is thought a period of approximately 5 years will be needed, including preparatory works. The layout of temporary facilities for construction and construction schedule are shown in Figure 12-1 and Figure 12-3, respectively.

The critical path in the construction schedule of the Project is construction by the powerhouse work. Therefore, the first work to be done in this Project is the access roads for the powerhouse, in succession to which excavation of cable tunnel is to be started. The construction programs and construction schedule for the various works will be described below, the procedures of the works being indicated in the construction schedule.

First Year

Completion of improvement of the road between Dirǧine and dam for powerhouse and dam construction, prior to starting construction is indispensable for carrying out construction work smoothly. Simultaneously with start of construction, procurement of materials, construction of access roads to access tunnel, cable tunnel and access adits of tailrace tunnel, excavation of diversion tunnel, offices and housing facilities of the owner and contractor, materials storage yard, etc., site development for temporary facilities such as repair shop, concrete plant, aggregate plant, and assembly of apparatus are to be commenced.

Diversion of the river to the diversion tunnel is to be done immediately after completion of excavation and lining concrete. After completion of river diversion, constructions of the upstream and downstream cofferdams are to be done.

The excavation of dam foundation is commenced from upper part of both left and right bank.

Excavation for the headrace tunnel is to be commenced after completion of open air excavation of intake.

After completion of installation of belt conveyer in cable tunnel, powerhouse excavation and hauling of the muck is to be started in succession.

Second Year

For dam construction, embankment work would be done after completion of excavation of the alluvium, and carrying out foundation treatment. Prior to the commencement of dam embankment, construction of hauling roads from quarry and borrow area and preparatory works should be ready for the work.

Spillway excavation would be started. Of the excavated muck, utilizable material would be transported for embankment of the dam. Intake gate shaft excavation is to be started.

Excavation of penstock would commence when the excavation of powerhouse reach to elevation of generator room. As for transportation of excavation muck from penstock, it will be done parallel to powerhouse excavation by the belt conveyer installed in cable tunnel.

Concrete placement in powerhouse would be done in step with progress of excavation. Draft tube liner installation would be done while placing foundation concrete.

Meanwhile, excavation at access tunnel would be completed and lining concrete be commenced.

At the tailrace tunnel excavation would continue.

Third Year

In dam construction, grouting work and embankment works such as of the impervious core, filter and rock zones would continue to be carried out. At the spillway, concrete of the wall, chute and weir portions would be placed.

For the penstock, installation of the penstock would be done. After completion of the penstock work lining concrete placement at headrace tunnel would be done in succession.

At the intake, concrete of inlet and gate shaft is to be done.

At the powerhouse, work on the side-wall and slab concrete would be almost finished, in succession to which installation of the crane girder, the overhead travelling crane would be installed. At the powerhouse, in succession to installation of the crane, equipment installation such as of turbines and generators would be commenced.

After completion of excavation of the tailrace tunnel, placement of lining concrete is to be started.

Foundation works for the outdoor switchyard and transmission line construction are to be commenced.

Fourth Year

Dam construction embankment work to be completed by the end of the year. Installation of spillway and intake gates would be done.

After completion of lining concrete placement of the tailrace tunnel plugging of adits is to be done in succession to grouting work.

In diversion tunnel after installation of the outlet valve, plugging work is to be done in parallel with impoundment of water in the reservoir.

At the powerhouse and outdoor switchyard, installation and assembly of turbines, generators, electrical equipment and control equipment would be underway aiming for the start of operation in succession to dry test and wet test at the end of the year.

Construction of a transmission line is to be completed by the time wet tests of the power station are started.

Table 12-1 Principal Civil Works

Item	Description	Civil Works	
Diversion Tunnel	D = 6.0 m L = 390 m	Tunnel ex.	16,400 m^3
		Lining conc.	4,100 m^3
Cofferdam		Embankment	87,000 m^3
Dam	H = 110 m L = 540 m	Ex. in open	553,000 m^3
		Em. of Core	757,000 m^3
		Em. of Filter	735,000 m^3
		Em. of Rock	3,067,000 m^3
		Banking	334,000 m^3
		Riprap	132,000 m^3
Spillway	W = 26.0 m L = 180 m W = 13 m, H = 14.5 m	Ex. in open	356,000 m^3
		Concrete	44,800 m^3
		Gate	2
Power Intake	D = 3.4 m, L = 41.5 m W = 2.5 m x 5.0 m, H = 57.7 m	Ex. in open	26,200 m^3
		Tunnel ex.	750 m^3
		Shaft ex.	1,700 m^3
		Concrete	2,190 m^3
		Gate	1
Penstock	(D=3.4m, L=248m x 1) (D = 2.2 m ~ 1.70 m L = 17 m x 2)	Tunnel ex.	4,850 m^3
		Plug conc.	2,410 m^3
		Steel Penstock	715 t
Powerhouse	W = 16 m, H = 35.5 m L = 60 m	Ex. in underground	31,000 m^3
		Concrete	9,100 m^3
Access Tunnel	W = 5 m, H = 5 m L = 1,100 m	Tunnel ex.	32,300 m^3
		Lining conc.	4,250 m^3
Tailrace Tunnel	D = 4.6 m, L = 4,850 m	Tunnel ex.	120,000 m^3
		Lining conc.	25,000 m^3
Switchyard	W = 60 m x 80 m	Ex. in open	53,000 m^3
		Concrete	2,400 m^3

Table 12-2 Machinery for the Project

Item		Machinery			Nos.
Dam	Core and Filter	Wheel loader	4.5	m^3 class	2
		Dump truck	32	t class	8
		Bulldozer	32	t class	5
		Vibratory roller	15	t class	2
	Rock	Wheel loader	8.5	m^3 class	2
		Dump truck	45	t class	8
		Bulldozer	43	t class	5
		Vibratory roller	15	t class	2
		Shovel	1.2	m^3 class	2
Tunnel	Tunnel Ex.	Jumbo	3	boom	4
		Rocker shovel	0.6	m^3	4
	Concrete	Concrete pump	60	m^3/hr	4
		Concrete plant	0.75	m^3/min	2
		Aggregate plant	150	t/hr	1

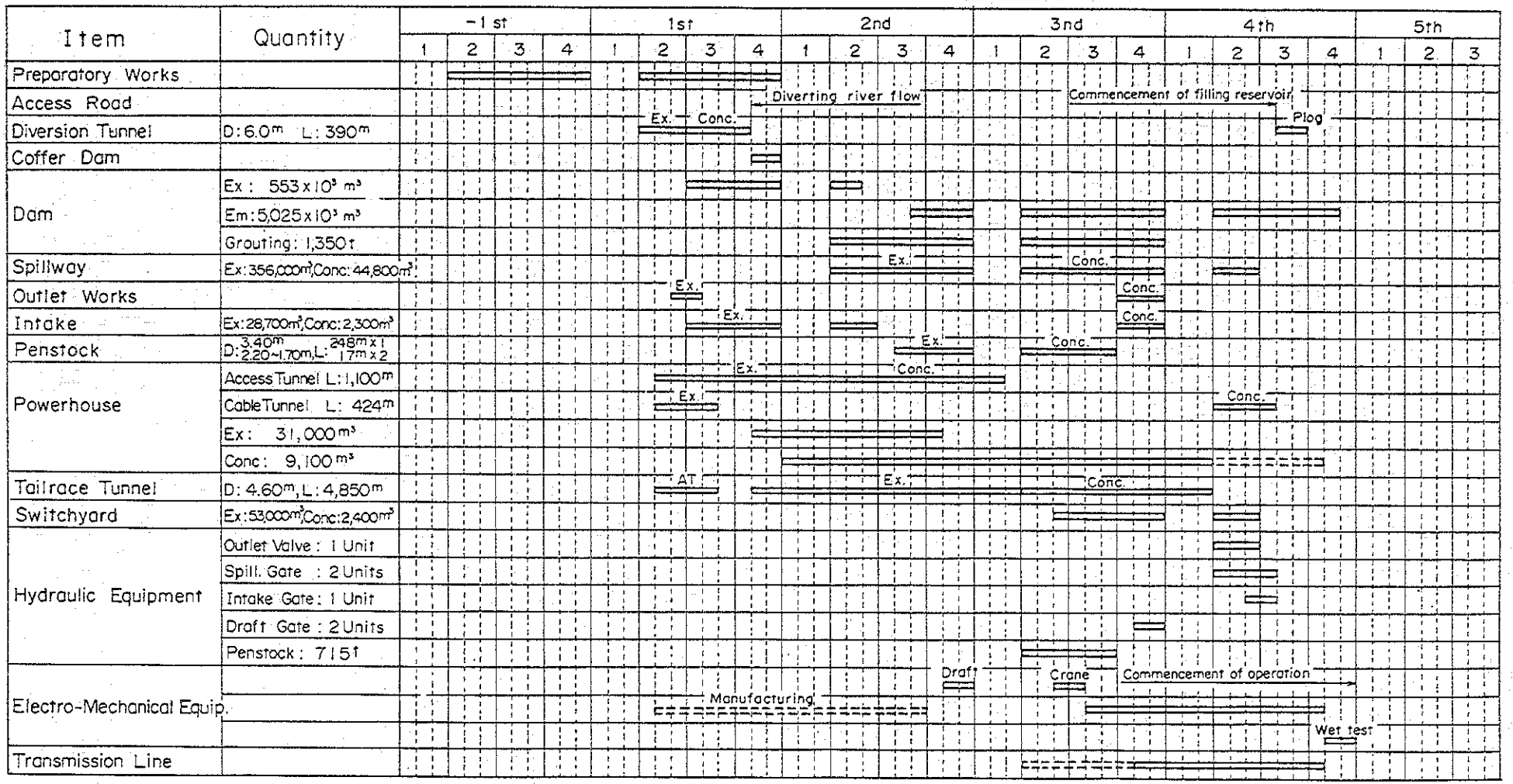
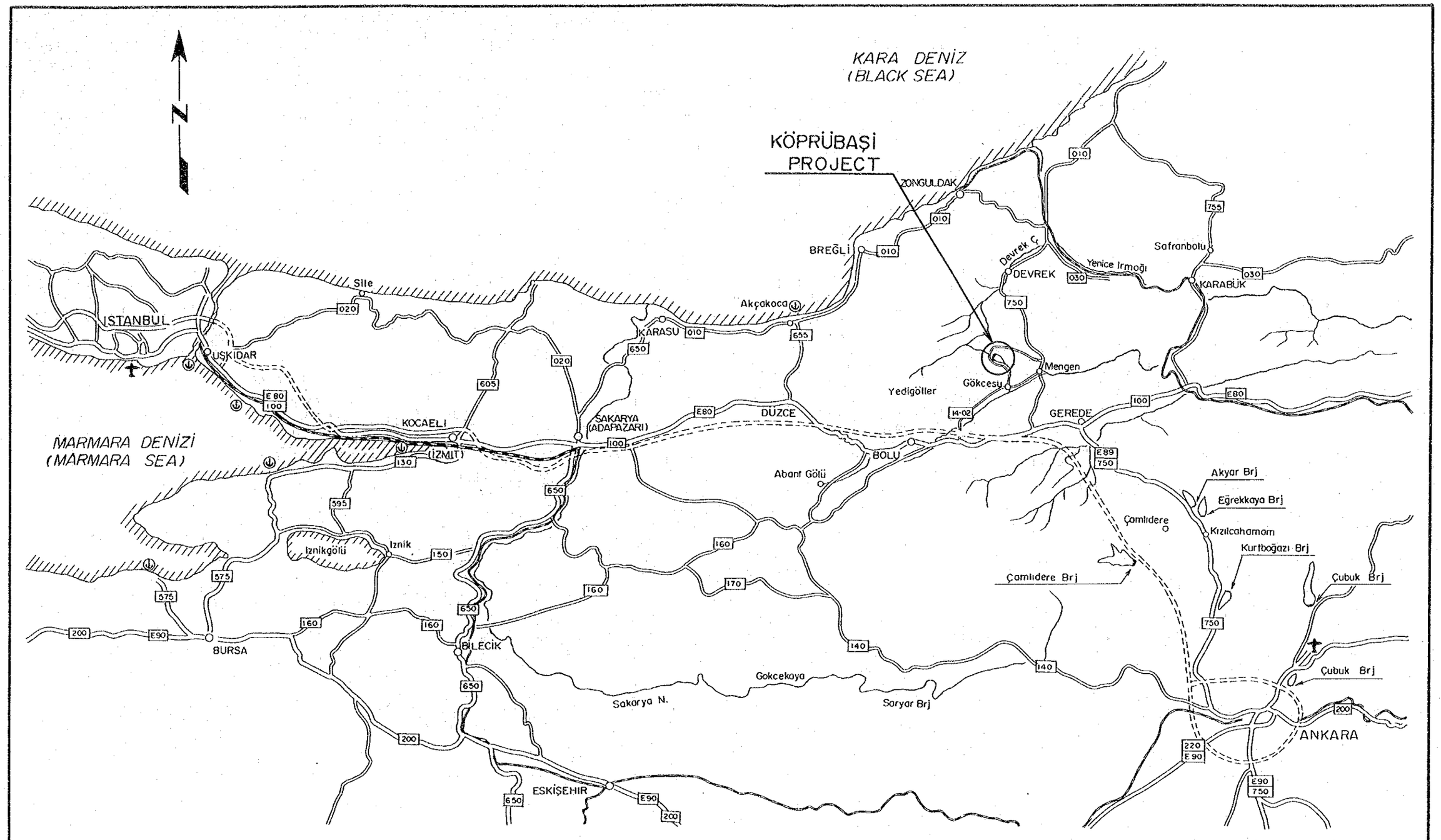


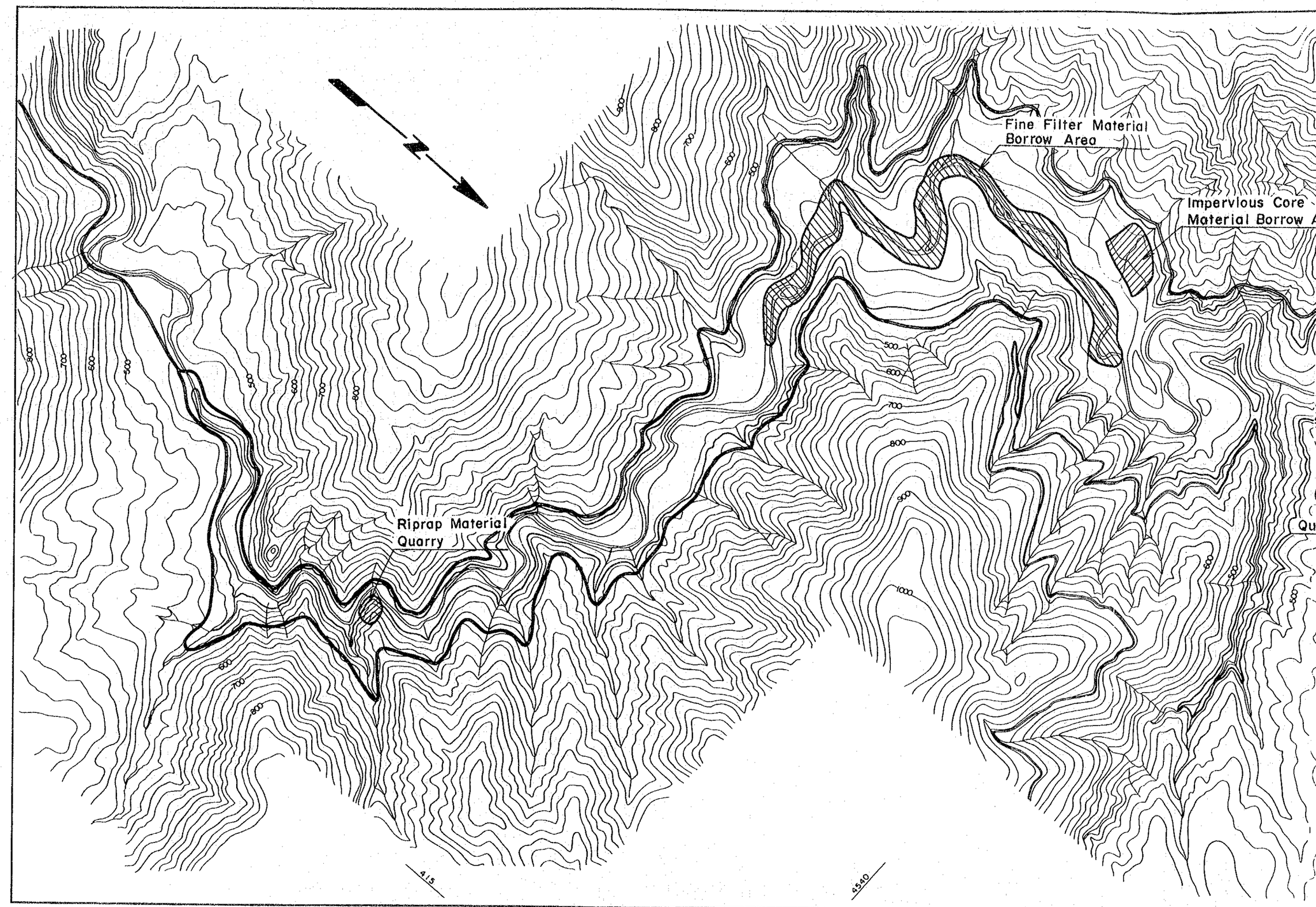
Figure 12-1 Construction Schedule

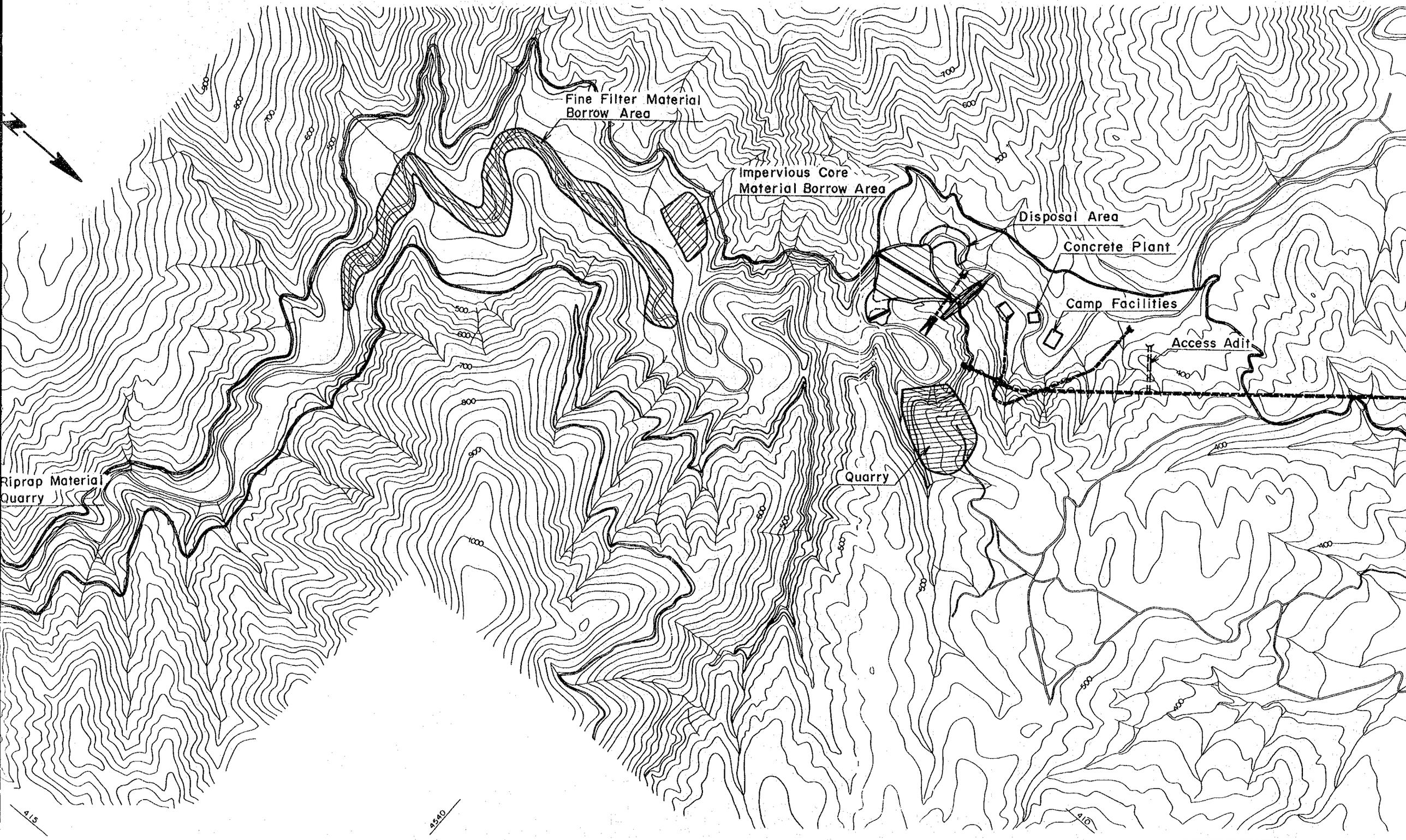


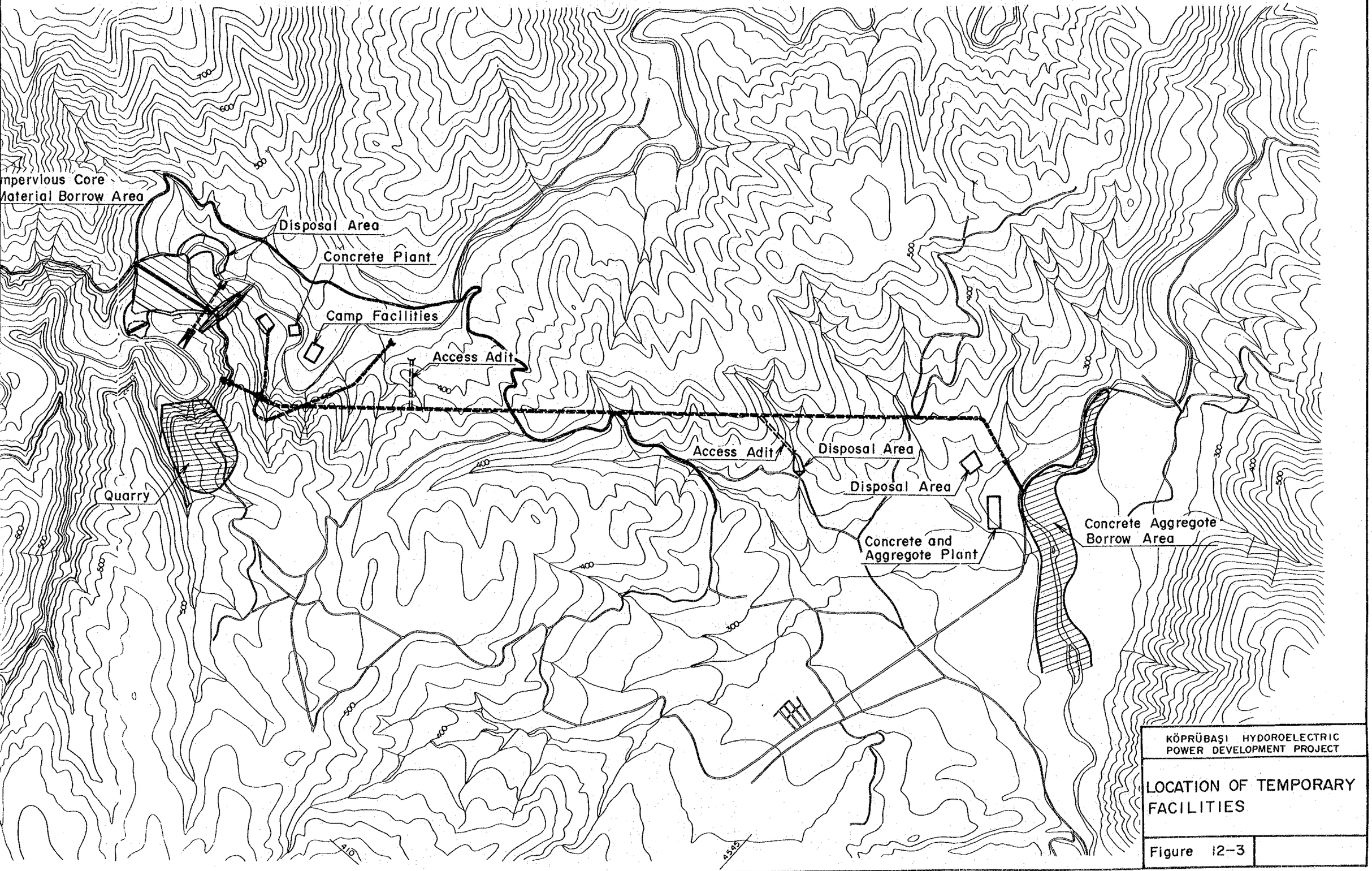
KÖPRUBASI HYDROELECTRIC POWER DEVELOPMENT PROJECT

TRANSPORTATION ROUTE

Figure 12 - 2


Fine Filter Material
Borrow Area
Impervious Core
Material Borrow A
Riprap Material
Quarry
Qu
415
4540


Fine Filter Material
Borrow Area
Impervious Core
Material Borrow Area
Disposal Area
Concrete Plant
Camp Facilities
Access Adit
Riprap Material
Quarry
Quarry
415
4540
410



KÖPRÜBAŞI HYDOROELECTRIC
POWER DEVELOPMENT PROJECT

LOCATION OF TEMPORARY FACILITIES

Figure 12-3

12.2 Estimate of Construction Cost

The construction cost of the Project would be estimated assuming that construction methods, materials and products, according to the technological level that can be expected at the present time, would be used, and taking into consideration the run-off discharge, geologies, and regional conditions of the project sites, and in addition, the project scales. The time of estimate is to be taken as the beginning of 1993, with the exchange rate between local and foreign currencies being US$1 = TL8,700.

12.2.1 Fundamental Matters

(1) Construction Cost Estimate Items

1)	Civil Works	
	Care of River	Diversion tunnel, and cofferdam
	Dam	
	Spillway	
	Outlet Works	
	Power Intake	Power intake, Gate shaft, Headrace tunnel
	Penstock	
	Tailrace	Tailrace tunnel
	Powerhouse & Switchyard	Civil and architectural Works
	Access Road	
2)	Hydraulic Equipment	Gate, penstock, etc.

3)	Electro-mechanical Equipment	Turbine, generator, switchyard equipment, etc.
4)	Camp Facilities	Camp for power station operation
5)	Administrative Cost	Engineering service concerning work, coordinating and management of work, etc.
6)	Compensation Cost	Compensation for land buildings, etc. in reservoir
7)	Transmission Line	
8)	Interest during Construction	Interest during period of construction

(2) Criteria of Cost Estimate

1) Civil Works

For unit prices of civil works and hydraulic equipment, the 1993 YILINA AIT, İNŞAAT BİRİM FİYATLARINA ESAS IŞÇİLİK-ARAÇ VE GEREÇ RAYİÇ LİSTELERİ, BİRİM FİYAT CETVELİ 1993 (DSI) are used or referred to, and the prices are determined upon comparison studies with construction cost unit prices at sites in Turkey of power stations existing, under construction, or for which feasibility studies had been made.

The unit prices are composed of labor, materials, machinery depreciation, and various insurance costs.

a) Labor and Materials Costs

Labor costs and material costs used are the primary costs in 1993 YILINA AÎT, İNŞAAT BÎRÎM FÎYATLARINA ESAS İŞÇİLİK-ARAÇ VE GEREÇ RAYİÇ LISTELERI.

The principal costs are given in Table 12-3 and Table 12-4.

Table 12-3 Labor Cost

Item	Labor Cost TL/day
Foreman	124,200
Skilled Labor	86,600
Driller	105,300
Operator	98,600
Carpenter	86,600
Welder	86,600
Electrician	86,600
Labor	47,600
Mechanic	86,600

Table 12-4 Construction Material Cost

Item	Price	Cost TL
Cement (bag)	Ton	480,000
Cement (bulk)	Ton	445,000
Dynamite	kg	24,200
ANFO	kg	3,600
Gasoline	kg	6,179
Diesel oil	kg	4,791
Reinforcement	Ton	2,771,000
Shape steel	Ton	3,369,000
Timber	m^3	2,500,000

The transportation costs of cement, reinforcing bar and shaped steel are calculated referring to the method of calculating transportation costs given in the DSI BIRIM FIYAT CETVELI 1993.

b) Construction Machinery

Principal construction machinery such as dump trucks, bulldozers, loading equipment, concrete pumps, aggregate plants, bathing plants, cranes, boring and grouting machines is assumed to be all imported, and the machinery costs are calculated from CIF Prices of Istanbul Port.

c) Relocation Roads and Access Roads

Construction costs of relocation roads and access roads would be calculated based on the unit construction costs of the Highway Department.

2) Hydraulic Equipment

Steel penstock, spillway gates, outlet works, intake gate, outlet gate of tailrace etc. will be manufactured in Turkey.

3) Electro-mechanical Equipment

Electro-mechanical equipment such as turbines, generators, transformer and control equipment would be imported from abroad, while steel structures of switchyard and overhead travelling crane would be procured in Turkey. The costs are to include the transportation costs to the power station sites, installation costs, insurance costs, etc.

4) Camp Facilities

These would include the costs of quarters and other requirements of power station operating personnel.

5) Administrative Cost

The administrative cost for the Project is considered to be 15% of the cost of construction works.

6) Compensation Cost

Compensation costs such as land acquisition costs would be calculated based on data furnished by DSI. The costs of relocated roads would be included separately under costs of civil works.

7) Transmission line Cost

The transmission line costs would be calculated referring to the periodic unit cost of TEK.

8) Interest during Construction

Interest during construction is to be 9.5% for both local and foreign currency funds based on discussions with DSI.

9) Import Duty and Various Taxes

Import duties are not to be included for imported construction machinery and electro-mechanical equipment such as turbine and generator.

Value added taxes of 10% would be considered in the construction cost for both local and foreign currency portions to be used in financial evaluation of the project.

10) Contingency Cost

Based on discussions with DSI, contingency costs are to be 15% for civil works, and 5 ~ 15% for hydraulic equipment and electro-mechanical equipment.

12.2.2 Construction Cost

(1) Construction Cost of Civil Works

The principal materials used for civil works - cement, steel such as reinforcing bars and structural steel, fuel, oils and fats, explosives - are to be domestically procured, and come under local currency requirements.

Machinery for civil works, such as heavy dump trucks, bulldozers, loading equipment, concrete plants, aggregate plants, cranes, etc. are all to be imported and construction costs calculated in terms of foreign currency.

Drilling machines, grout pumps, compressors, etc. are also to be procured through importation, and come under foreign currency requirements.

(2) Hydraulic Equipment

Hydraulic equipment, except for special types, would all come under local currency.

(3) Electro-mechanical Equipment and Transmission Lines

Principal electro-mechanical equipment would come under foreign currency requirements, while overhead traveling crane and steel structures of switchyard would be local currency. The inland transportation costs and installation costs of these would be local currency.

(4) Engineering Service Cost

This cost would be 70% local currency and 30% foreign currency.

(5) Compensation Cost

All compensation costs would be in local currency.

(6) Interest during Construction

Interest amounts according to local currency and foreign currency would be respectively allocated.

(7) Estimated Construction Cost

The domestic and foreign currency portions of construction costs and the fund requirement of each year of the Project are respectively given in Tables 12-5.

Table 12-5 Found Requirement of Each Year of Köprübaşı Project

unit: 10^6 TL

Item	Total			1st Year		2nd Year		3rd Year		4th Year	
	Local Currency	Foreign Currency	Total	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency
Civil Work											
Relocation Road	41,000	0	41,000	8,200	0	4,100	0	12,300	0	16,400	0
Camp Facilities	10,000	0	10,000	10,000	0	0	0	0	0	0	0
Care of River	15,004	7,429	22,433	15,004	6,268	0	0	0	0	0	1,161
Dam	144,843	103,160	248,003	5,674	7,184	31,345	20,586	59,593	40,205	48,231	35,185
Spillway	33,517	11,337	44,854	0	0	5,128	6,412	21,292	3,696	7,097	1,229
Outlet Works	2,185	518	2,703	1,273	336	0	0	912	182	0	0
Intake	2,921	938	3,859	611	506	262	50	2,048	382	0	0
Penstock	3,379	1,651	5,030	0	0	1,784	1,450	1,595	201	0	0
Powerhouse	34,861	13,955	48,816	8,024	6,913	16,537	5,170	7,471	1,533	2,829	339
Tailrace	59,664	40,901	100,565	8,402	7,312	22,080	23,280	23,266	9,187	5,916	1,122
Switchyard	2,317	1,112	3,429	0	0	0	0	664	911	1,653	201
Sub. Total	298,691	181,001	479,692	38,988	28,519	77,136	56,948	116,841	56,297	65,726	39,237
Hydraulic Equipment	39,710	0	39,710	0	0	0	0	20,976	0	18,734	0
Electro-Mechanical Equipment	31,059	151,641	182,700	3,106	15,164	0	0	0	0	27,953	136,477
Transmission Line	43,132	0	43,132					21,566	0	21,566	0
Total Cost	463,592	332,642	796,234	60,294	43,683	81,236	56,948	171,683	56,297	150,379	175,714
Contingency	60,134	34,732	94,866	8,733	5,036	12,185	8,542	22,547	8,445	16,668	12,709
Engineering and Administration Cost	72,480	47,145	119,625	10,191	6,512	14,013	9,824	26,849	9,711	21,427	21,098
Land Aquisition	81,900	0	81,900	16,380	0	0	0	0	0	65,520	0
Interest during Construction	100,871	56,813	157,684	4,541	2,623	14,185	8,824	29,789	15,938	52,355	29,427
Grand Total	778,977	471,332	1,250,309	100,139	57,854	121,620	84,138	250,868	90,391	306,350	238,949

Table 12-6 Construction Cost of Civil Works (Summary)

CONSTRUCTION COST OF CIVIL WORKS

KOPRUBASI PROJECT

NUMBER	DESCRIPTION	LC	FC	TOTAL
1	DIVERSION TUNNEL	11,992,000,000	5,147,000,000	17,139,000,000
2	COFFER DAM	3,012,000,000	2,282,000,000	5,294,000,000
3	DAM	144,843,000,000	103,160,000,000	248,003,000,000
4	SPILLWAY	33,517,000,000	11,337,000,000	44,854,000,000
5	OUTLET WORKS	2,185,000,000	518,000,000	2,703,000,000
6	INTAKE	2,921,000,000	938,000,000	3,859,000,000
7	PENSTOCK	3,379,000,000	1,651,000,000	5,030,000,000
8	POWERHOUSE	34,861,000,000	13,955,000,000	48,816,000,000
9	TAILRACE TUNNEL	59,664,000,000	40,901,000,000	100,565,000,000
10	SWITCHYARD	2,317,000,000	1,112,000,000	3,429,000,000
11	HYDRAULIC EQUIPMENT	39,710,000,000	0	39,710,000,000
	TOTAL	338,401,000,000	181,001,000,000	519,402,000,000

Table 12-7 Construction Cost of Civil Works (1)

KOPRUBASI
1. DIVERSION TUNNEL

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	23,300	11,500	10,600	22,100	267,950,000	246,980,000	514,930,000
Rock excavation	m3	58,300	30,400	22,900	53,300	1,772,320,000	1,335,070,000	3,107,390,000
Tunnel excavation	m3	16,400	137,800	154,200	292,000	2,259,920,000	2,528,880,000	4,788,800,000
Portal concrete	m3	1,700	217,400	61,200	278,600	369,580,000	104,040,000	473,620,000
Tunnel lining concrete	m3	4,100	338,500	103,700	442,200	1,387,850,000	425,170,000	1,813,020,000
Shotcrete open	m2	4,600	62,700	10,300	73,000	288,420,000	47,380,000	335,800,000
Shotcrete tunnel	m2	3,600	70,600	15,400	86,000	254,160,000	55,440,000	309,600,000
Rock bolt	pc	620	378,100	98,900	477,000	234,422,000	61,318,000	295,740,000
Mortar injection	m3	400	664,200	0	664,200	265,680,000	0	265,680,000
Drilling consolidation	m	1,700	275,900	0	275,900	469,030,000	0	469,030,000
Grouting consolidation	t	170	1,585,700	579,200	2,164,900	269,569,000	98,464,000	368,033,000
Reinforcement	t	180	5,040,000	0	5,040,000	907,200,000	0	907,200,000
Cement	t	2,200	713,300	0	713,300	1,569,260,000	0	1,569,260,000
Closure gate	t	30	38,700,000	0	38,700,000	1,161,000,000	0	1,161,000,000
Others	L.S.	1				515,768,000	245,137,000	760,905,000
Total						11,992,000,000	5,147,000,000	17,139,000,000

Table 12-7 Construction Cost of Civil Works (2)

KOPRUBASI
2. COFFERDAM

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	21,000	7,900	14,600	22,500	165,900,000	306,600,000	472,500,000
Embankment impervious core	m3	22,000	16,200	24,200	40,400	356,400,000	532,400,000	888,800,000
Embankment rockfill	m3	65,000	27,900	15,200	43,100	1,813,500,000	988,000,000	2,801,500,000
Drilling curtain	m	530	419,600	0	419,600	222,388,000	0	222,388,000
Grouting curtain	t	50	2,179,900	796,200	2,976,100	108,995,000	39,810,000	148,805,000
Cement	t	50	713,300	0	713,300	35,665,000	0	35,665,000
Others	L.S.	1				135,142,000	93,340,000	228,482,000
Care of river	L.S.	1				174,600,000	322,600,000	497,200,000
Total						3,012,000,000	2,282,000,000	5,294,000,000

Table 12-7 Construction Cost of Civil Works (3)

KOPRBUS1
3. DAM

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	427,000	7,900	14,600	22,500	3,373,300,000	6,234,200,000	9,607,500,000
Rock excavation	m3	126,000	30,400	22,900	53,300	3,830,400,000	2,885,400,000	6,715,800,000
Embankment impervious core	m3	757,000	16,200	24,200	40,400	12,263,400,000	18,319,400,000	30,582,800,000
Embankment fine filter	m3	328,000	17,500	29,300	46,800	5,740,000,000	9,610,400,000	15,350,400,000
Embankment coarse filter	m3	407,000	15,200	25,200	40,400	6,186,400,000	10,256,400,000	16,442,800,000
Embankment rockfill	m3	3,067,000	27,900	15,200	43,100	85,569,300,000	46,618,400,000	132,187,700,000
Embankment rip rap	m3	132,000	75,600	17,100	92,700	9,979,200,000	2,257,200,000	12,236,400,000
Embankment backfill	m3	334,000	2,500	2,600	5,100	835,000,000	868,400,000	1,703,400,000
Cap concrete	m3	1,900	87,200	93,400	180,600	165,680,000	177,460,000	343,140,000
Drilling curtain	m	10,900	419,600	0	419,600	4,573,640,000	0	4,573,640,000
Drilling consolidation	m	4,900	275,900	0	275,900	1,351,910,000	0	1,351,910,000
Grouting curtain	t	1,100	2,179,900	796,200	2,976,100	2,397,890,000	875,820,000	3,273,710,000
Grouting consolidation	t	250	1,585,700	579,200	2,164,900	396,425,000	144,800,000	541,225,000
Cement	t	1,800	713,300	0	713,300	1,283,940,000	0	1,283,940,000
Others	L.S.	1				6,897,324,000	4,912,394,000	11,809,718,000
Total						144,843,000,000	103,160,000,000	248,003,000,000

Table 12-7 Construction Cost of Civil Works (4)

KOPRUBASI
4. SPILLWAY

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	249,000	7,900	14,600	22,500	1,967,100,000	3,635,400,000	5,602,500,000
Rock excavation	m3	107,000	27,300	23,100	50,400	2,921,100,000	2,471,700,000	5,392,800,000
Pier,Weir concrete	m3	3,100	125,900	101,200	227,100	390,290,000	313,720,000	704,010,000
Invert concrete	m3	7,100	87,200	93,400	180,600	619,120,000	663,140,000	1,282,260,000
Wall concrete	m3	34,600	146,400	100,900	247,300	5,065,440,000	3,491,140,000	8,556,580,000
Drilling curtain	m	2,700	419,600	0	419,600	1,132,920,000	0	1,132,920,000
Grouting curtain	t	280	2,179,900	796,200	2,976,100	610,372,000	222,936,000	833,308,000
Reinforcement	t	2,100	5,040,000	0	5,040,000	10,584,000,000	0	10,584,000,000
Cement	t	11,500	713,300	0	713,300	8,202,950,000	0	8,202,950,000
Bridge	m	30	15,000,000	0	15,000,000	450,000,000	0	450,000,000
Others	L.S.	1				1,574,664,000	539,901,000	2,114,565,000
Total						33,517,000,000	11,337,000,000	44,854,000,000

Table 12-7 Construction Cost of Civil Works (5)

KOPRUBASI
5. OUTLET WORKS

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	9,900	11,500	10,600	22,100	113,850,000	104,940,000	218,790,000
Rock excavation	m3	2,500	27,300	23,100	50,400	68,250,000	57,750,000	126,000,000
Shaft excavation	m3	510	146,700	27,900	174,600	74,817,000	14,229,000	89,046,000
Concrete open	m3	1,000	146,400	100,900	247,300	146,400,000	100,900,000	247,300,000
Shaft lining concrete	m3	130	215,000	171,600	386,600	27,950,000	22,308,000	50,258,000
Plug concrete	m3	1,500	154,500	62,700	217,200	231,750,000	94,050,000	325,800,000
Shotcrete tunnel	m2	440	70,600	15,400	86,000	31,064,000	6,776,000	37,840,000
Rock bolt	pc	130	378,100	98,900	477,000	49,153,000	12,857,000	62,010,000
Drilling curtain	m	1,000	419,600	0	419,600	419,600,000	0	419,600,000
Grouting curtain	t	100	2,179,900	796,200	2,976,100	217,990,000	79,620,000	297,610,000
Reinforcement	t	30	5,040,000	0	5,040,000	151,200,000	0	151,200,000
Cement	t	770	713,300	0	713,300	549,241,000	0	549,241,000
Others	L.S.	1				104,063,000	24,671,000	128,734,000
Total						2,185,000,000	518,000,000	2,703,000,000

Table 12-7 Construction Cost of Civil Works (6)

KOPRUBASI

6. INTAKE (INCLUDING HEADRACE TUNNEL)

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	21,000	11,500	10,600	22,100	241,500,000	222,600,000	464,100,000
Rock excavation	m3	5,200	27,300	23,100	50,400	141,960,000	120,120,000	262,080,000
Tunnel excavation	m3	750	137,800	154,200	292,000	103,350,000	115,650,000	219,000,000
Shaft excavation	m3	1,700	146,700	27,900	174,600	249,390,000	47,430,000	296,820,000
Lining concrete	m3	350	338,500	103,700	442,200	118,475,000	36,295,000	154,770,000
Shaft lining concrete	m3	790	215,000	171,600	386,600	169,850,000	135,564,000	305,414,000
Concrete open	m3	1,050	146,400	100,900	247,300	153,720,000	105,945,000	259,665,000
Shotcrete tunnel(NATM)	m2	540	70,600	15,400	86,000	38,124,000	8,316,000	46,440,000
Rock bolt	pc	150	378,100	98,900	477,000	56,715,000	14,835,000	71,550,000
Reinforcement	t	60	5,040,000	0	5,040,000	302,400,000	0	302,400,000
Mortal injection	m3	30	664,200	0	664,200	19,926,000	0	19,926,000
Drilling consolidation	m	1,500	275,900	0	275,900	413,850,000	0	413,850,000
Grouting consolidation	t	150	1,585,700	579,200	2,164,900	237,855,000	86,880,000	324,735,000
Cement	t	750	713,300	0	713,300	534,975,000	0	534,975,000
Others	L.S.	1				139,104,000	44,681,000	183,785,000
Total						2,921,000,000	938,000,000	3,859,000,000

Table 12-7 Construction Cost of Civil Works (7)

KOPRUBASI

7. PENSTOCK

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Tunnel excavation	m3	4,900	221,400	251,300	472,700	1,084,860,000	1,231,370,000	2,316,230,000
Around penstock concrete	m3	2,400	213,100	63,400	276,500	511,440,000	152,160,000	663,600,000
Shotcrete tunnel	m2	3,500	70,600	15,400	86,000	247,100,000	53,900,000	301,000,000
Rock bolt	pc	970	378,100	98,900	477,000	366,757,000	95,933,000	462,690,000
Mortal injection	m3	50	664,200	0	664,200	33,210,000	0	33,210,000
Drilling curtain	m	500	419,600	0	419,600	209,800,000	0	209,800,000
Grouting curtain	t	50	2,179,900	796,200	2,976,100	108,995,000	39,810,000	148,805,000
Cement	t	920	713,300	0	713,300	656,236,000	0	656,236,000
Others	L.S.	1				160,919,000	78,658,000	239,577,000
Total						3,379,000,000	1,651,000,000	5,030,000,000

Table 12-7 Construction Cost of Civil Works (8-1)

KOPRUBASI

8. POWERHOUSE No. 1

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
(1)UNDERGROUND POWERHOUSE								
Rock excavation	m3	30,600	115,000	36,100	151,100	3,519,000,000	1,104,660,000	4,623,660,000
Arch concrete	m3	2,200	235,600	61,600	297,200	518,320,000	135,520,000	653,840,000
Wall concrete	m3	4,000	204,000	106,800	310,800	816,000,000	427,200,000	1,243,200,000
Slab concrete	m3	1,300	280,500	60,000	340,500	364,650,000	78,000,000	442,650,000
Around machine concrete	m3	1,600	188,100	62,000	250,100	300,960,000	99,200,000	400,160,000
Shotcrete	m2	6,100	70,600	15,400	86,000	430,660,000	93,940,000	524,600,000
Reinforcement	t	530	5,040,000	0	5,040,000	2,671,200,000	0	2,671,200,000
Rock bolt (5m)	pc	1,200	378,100	98,900	477,000	453,720,000	118,680,000	572,400,000
P.C Anchor	kg	14,000	182,800	21,300	204,100	2,559,200,000	298,200,000	2,857,400,000
Cement	t	3,000	713,300	0	713,300	2,139,900,000	0	2,139,900,000
Others	L.S.	1				688,680,000	117,770,000	806,450,000
Sub-total						14,462,000,000	2,473,000,000	16,935,000,000
(2)ACCESS TUNNEL								
Common excavation	m3	2,300	11,500	10,600	22,100	26,450,000	24,380,000	50,830,000
Rock excavation	m3	600	30,400	22,900	53,300	18,240,000	13,740,000	31,980,000
Tunnel excavation	m3	32,500	148,000	184,200	332,200	4,810,000,000	5,986,500,000	10,796,500,000
Shotcrete tunnel	m2	25,000	70,600	15,400	86,000	1,765,000,000	385,000,000	2,150,000,000
Lining concrete	m3	4,290	338,500	103,700	442,200	1,452,165,000	444,873,000	1,897,038,000
Portal concrete	m3	60	217,400	61,200	278,600	13,044,000	3,672,000	16,716,000
Reinforcement	t	110	5,040,000	0	5,040,000	554,400,000	0	554,400,000
Rock bolt	m	5,600	378,100	98,900	477,000	2,117,360,000	553,840,000	2,671,200,000
Mortar injection	m3	290	664,200	0	664,200	192,618,000	0	192,618,000
Cement	t	2,170	713,300	0	713,300	1,547,861,000	0	1,547,861,000
Others	L.S.	1				624,856,000	370,600,000	995,456,000
Sub-total						13,121,000,000	7,782,000,000	20,903,000,000

Table 12-7 Construction Cost of Civil Works (8-2)

KOPRUBASI
8. POWERHOUSE No. 2

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
(3)CABLE TUNNEL								
Tunnel excavation	m3	6,400	217,700	284,000	501,700	1,393,280,000	1,817,600,000	3,210,880,000
Lining concrete	m3	2,000	338,500	103,700	442,200	677,000,000	207,400,000	884,400,000
Shotcrete tunnel	m2	5,200	70,600	15,400	86,000	367,120,000	80,080,000	447,200,000
Reinforcement	t	50	5,040,000	0	5,040,000	252,000,000	0	252,000,000
Rock bolt	pc	1,950	378,100	98,900	477,000	737,295,000	192,855,000	930,150,000
Mortal injection	m3	230	664,200	0	664,200	152,766,000	0	152,766,000
Cement	t	800	713,300	0	713,300	570,640,000	0	570,640,000
Others	L.S.	1				207,505,000	114,896,000	322,401,000
Sub-total						4,357,000,000	2,412,000,000	6,769,000,000
(4)DRAINAGE TUNNEL								
Tunnel excavation	m3	970	217,700	284,000	501,700	211,169,000	275,480,000	486,649,000
Lining concrete	m3	370	338,500	103,700	442,200	125,245,000	38,369,000	163,614,000
Shotcrete tunnel	m2	1,010	70,600	15,400	86,000	71,306,000	15,554,000	86,860,000
Rock bolt	pc	430	378,100	98,900	477,000	162,583,000	42,527,000	205,110,000
Drainage boring	t	330	275,900	0	275,900	91,047,000	0	91,047,000
Cement	t	130	713,300	0	713,300	92,729,000	0	92,729,000
Others	L.S.	1				37,703,000	18,596,000	56,299,000
Sub-total						791,000,000	390,000,000	1,181,000,000

Table 12-7 Construction Cost of Civil Works (8-3)

KOPRUBASI
8. POWERHOUSE No. 3

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
(5)SURGE CHAMBER								
Tunnel excavation	m3	3,400	148,000	184,200	332,200	503,200,000	626,280,000	1,129,480,000
Lining concrete	m3	1,500	338,500	103,700	442,200	507,750,000	155,550,000	663,300,000
Shotcrete tunnel	m2	1,500	70,600	15,400	86,000	105,900,000	23,100,000	129,000,000
Reinforcement	t	75	5,040,000	0	5,040,000	378,000,000	0	378,000,000
Rock bolt	pc	510	378,100	98,900	477,000	192,831,000	50,439,000	243,270,000
Mortal injection	m3	30	664,200	0	664,200	19,926,000	0	19,926,000
Cement	t	450	713,300	0	713,300	320,985,000	0	320,985,000
Others	L.S.	1				101,429,000	42,768,000	144,197,000
Sub-total						2,130,000,000	898,000,000	3,028,000,000
Total						34,861,000,000	13,955,000,000	48,816,000,000

Table 12-7 Construction Cost of Civil Works (9)

KOPRUBASI

9. TAILRACE TUNNEL No. 1

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
(1) TAILRACE TUNNEL								
Common excavation	m3	7,000	11,500	10,600	22,100	80,500,000	74,200,000	154,700,000
Rock excavation	m3	3,000	30,400	22,900	53,300	91,200,000	68,700,000	159,900,000
Tunnel excavation	m3	120,000	129,100	241,800	370,900	15,492,000,000	29,016,000,000	44,508,000,000
Shotcrete tunnel	m2	87,300	70,600	15,400	86,000	6,163,380,000	1,344,420,000	7,507,800,000
Rock bolt	pc	25,000	378,100	98,900	477,000	9,452,500,000	2,472,500,000	11,925,000,000
Lining concrete	m3	22,600	338,500	103,700	442,200	7,650,100,000	2,343,620,000	9,993,720,000
Invert concrete	m3	2,400	87,200	93,400	180,600	209,280,000	224,160,000	433,440,000
Concrete open	m3	1,400	146,400	100,900	247,300	204,960,000	141,260,000	346,220,000
Reinforcement	t	810	5,040,000	0	5,040,000	4,082,400,000	0	4,082,400,000
Mortar injection	m3	1,800	664,200	0	664,200	1,195,560,000	0	1,195,560,000
Cement	t	10,300	713,300	0	713,300	7,346,990,000	0	7,346,990,000
Bridge	m	25	15,000,000	0	15,000,000	375,000,000	0	375,000,000
Others	L.S.	1				2,598,443,000	1,784,243,000	4,382,686,000
Sub-total						54,942,000,000	37,469,000,000	92,411,000,000
(2) WORK ADIT								
Tunnel excavation	m3	9,700	217,700	284,000	501,700	2,111,690,000	2,754,800,000	4,866,490,000
Lining concrete	m3	370	338,500	103,700	442,200	125,245,000	38,369,000	163,614,000
Shotcrete tunnel	m2	7,900	70,600	15,400	86,000	557,740,000	121,660,000	679,400,000
Rock bolt	pc	3,000	378,100	98,900	477,000	1,134,300,000	296,700,000	1,431,000,000
Plug concrete	m3	910	154,500	62,700	217,200	140,595,000	57,057,000	197,652,000
Cement	t	600	713,300	0	713,300	427,980,000	0	427,980,000
Others	L.S.	1				224,877,000	163,429,000	388,306,000
Sub-total						4,722,000,000	3,432,000,000	8,154,000,000
Total						59,664,000,000	40,901,000,000	100,565,000,000

Table 12-7 Construction Cost of Civil Works (10)

KOPRUBASI
10. SWITCHYARD

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	42,000	7,900	14,600	22,500	331,800,000	613,200,000	945,000,000
Rock excavation	m3	11,000	27,300	23,100	50,400	300,300,000	254,100,000	554,400,000
Foundation concrete	m3	1,100	591,000	55,100	646,100	650,100,000	60,610,000	710,710,000
Wall concrete	m3	1,300	146,400	100,900	247,300	190,320,000	131,170,000	321,490,000
Reinforcement	t	75	5,040,000	0	5,040,000	378,000,000	0	378,000,000
Cement	t	500	713,300	0	713,300	356,650,000	0	356,650,000
Others	L.S.	1				110,358,000	52,954,000	163,312,000
Total						2,317,000,000	1,112,000,000	3,429,000,000

Table 12-7 Construction Cost of Civil Works (11)

KOPRUBASI

11. HYDRAULIC EQUIPMENT

UNIT:TL

ITEM	UNIT	QUANTITY	UNIT PRICE			COST		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Spillway radial gate	t	280	33,100,000	0	33,100,000	9,268,000,000	0	9,268,000,000
Conduit pipe	t	75	33,100,000	0	33,100,000	2,482,500,000	0	2,482,500,000
Outlet gurad gate	t	15	88,400,000	0	88,400,000	1,326,000,000	0	1,326,000,000
Outlet jet flow gate	t	25	96,700,000	0	96,700,000	2,417,500,000	0	2,417,500,000
Intake gate & trashrack	t	65	37,100,000	0	37,100,000	2,411,500,000	0	2,411,500,000
Penstock pipe	t	715	27,600,000	0	27,600,000	19,734,000,000	0	19,734,000,000
Draft gate	t	30	41,400,000	0	41,400,000	1,242,000,000	0	1,242,000,000
Tailrace gate	t	20	41,400,000	0	41,400,000	828,000,000	0	828,000,000
Total						39,709,500,000	0	39,709,500,000

Chapter 13 EFFECT ON ENVIRONMENT AND COMPENSATION

Chapter 13

EFFECT ON ENVIRONMENT AND COMPENSATION

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Chapter 13 Effect on Environment and Compensation

The present survey is positioned to the Feasibility Study to grasp the content of influences the enforcement of project are giving to the project area and its peripheral environments and to study in advance the presence of problems to the natural and social environment and also the countermeasures to be taken. The knowledge being obtained here is to be taken over to the work of environmental effect evaluation which is being conducted before deciding the detailed design of facilities and the enforcement of project. In the environmental effect evaluation, the confirmation of environmental current situations and the evaluation of the said effect are to be conducted by the method being indicated by the Republic of Turkey's Environmental Act following the various factors of facilities and the detailed information of construction work position and construction work contents.

13.1 Study Method

In carrying out the Köprübaşı Hydroelectric Power Plant Development Project, the project's environmental impact was estimated and evaluated by grasping the present situation of natural environment and social environment.
Items in this study were selected by making preliminary studies of the project's outline and the project area according to evaluation items shown in the Regulation for Environmental Effect Evaluation prescribed by the Republic of Turkey's environmental law.

Documents were collected in making studies of documents and the project area including its vicinity to grasp the present situation of natural and social environment.

The study items are as follows:

(1) Physical and Biological Characteristics and Utilization of Natural Resources

Meteological and Climate Conditions, Geological Characteristics, Hydrogeological Characteristics, Soil Characteristics and Usage Conditions, Agricultural Fields, Hydrological Characteristics, Available and Planned Usage of Surface Water Resources Aquatic Organisms, Thermal and Geothermal Water Resources, Area under Protection, Forest Resources, Flora and Fauna, Dairy Breeding Resources, Mineral and Fossil Fuel Resources, Points and Area of High Landscape Value and Recreation, Present Pollution Loads of Area.

(2) Socio-Economic Environment Economic Characteristics, Population, Social Sub-structure Services, Land Utilization, Income, Unemployment

In compensation object surveying, target compensation objects were selected based on the results of studying the present situation of social environment. Then the amount of compensation was calculated.

13.2 Overall Environmental Assessment

(1) Out of the project site and its periphery areas, the natural vegetation at the dam site is extremely poor as compared with that in the peripheral forest areas. The reservoir area is mainly of the farming field including comparatively narrow irrigated agricultural land along the river. The upstream side of reservoir area is the valley covered by the forest, but because its tree species don't especially differ from those in the forest management area inclusive of its periphery areas and the volume of trees being immersed into water by the formation of reservoir,