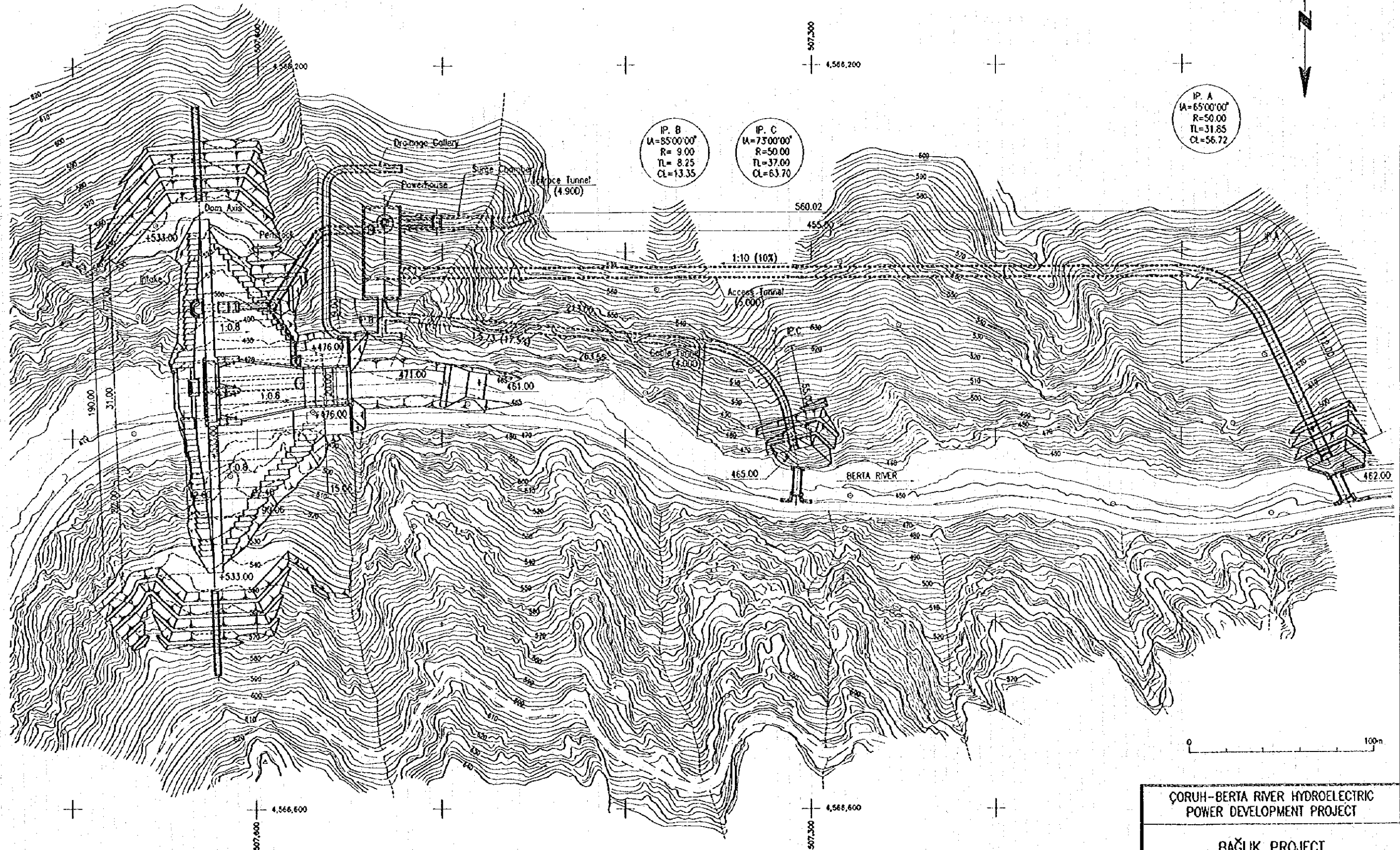


PLAN



IP. B
 IA=85°00'00"
 R= 9.00
 TL= 8.25
 CL=13.35

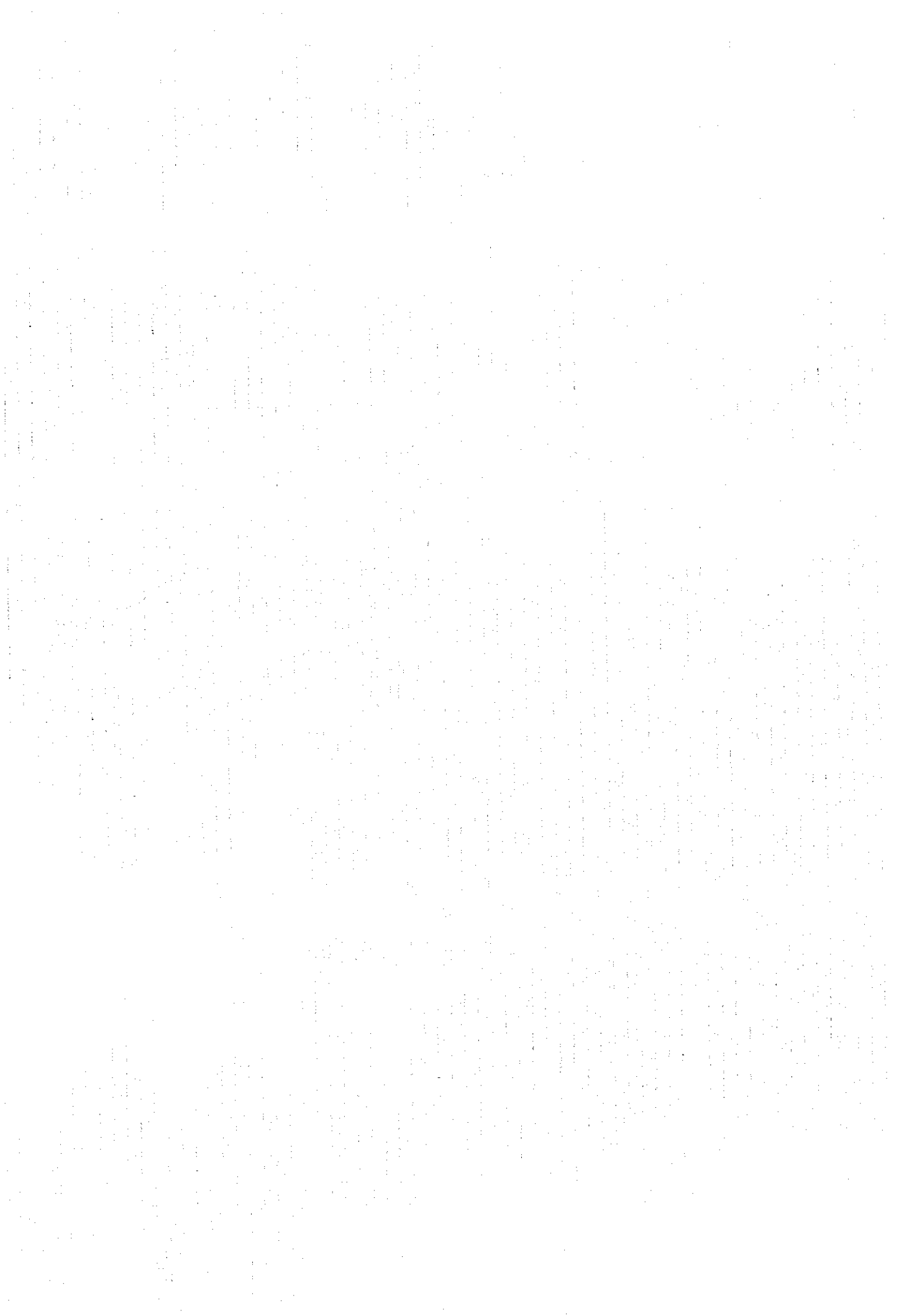
IP. C
 IA=73°00'00"
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 TL=37.00
 CL=63.70

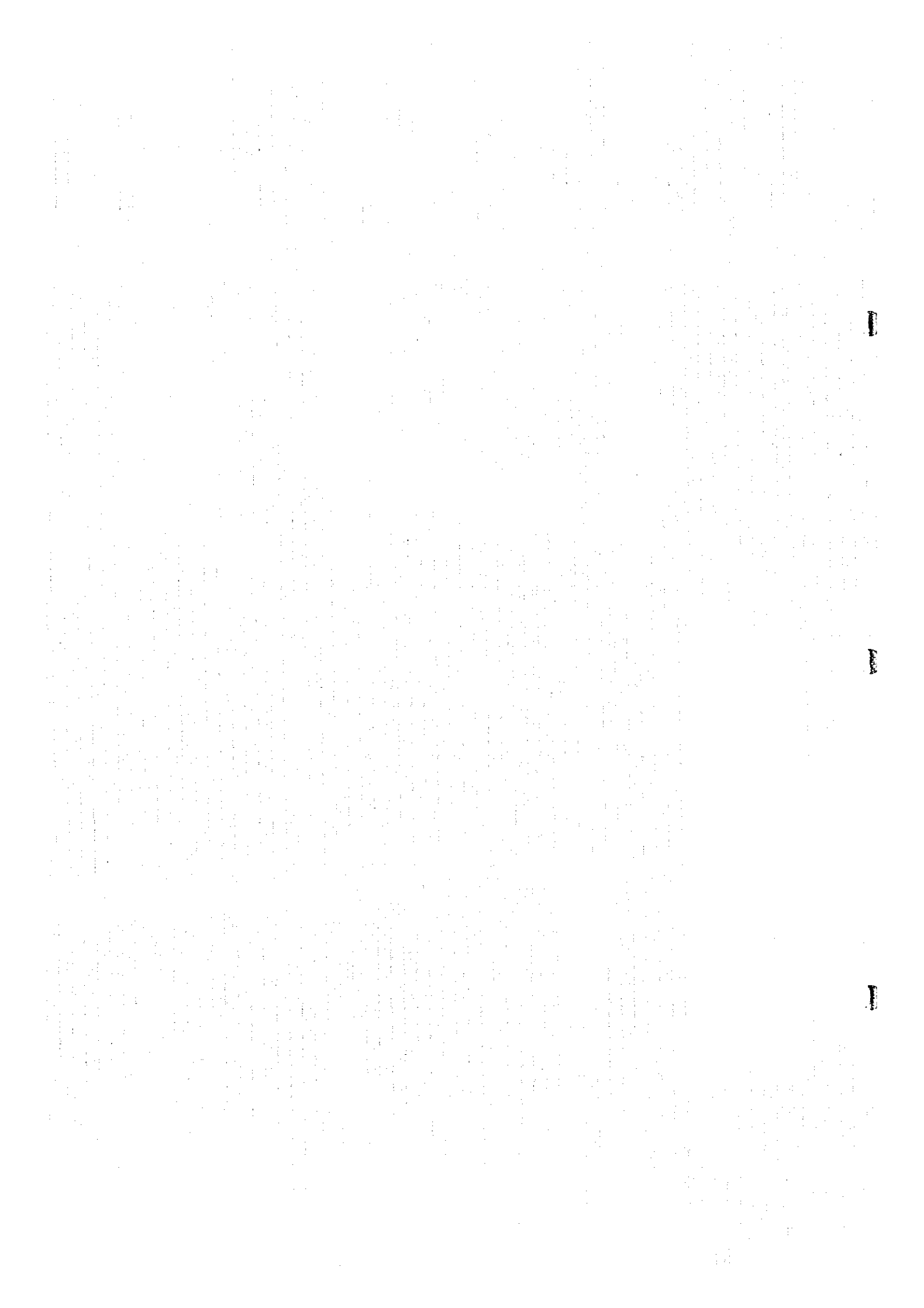
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 CL=56.72

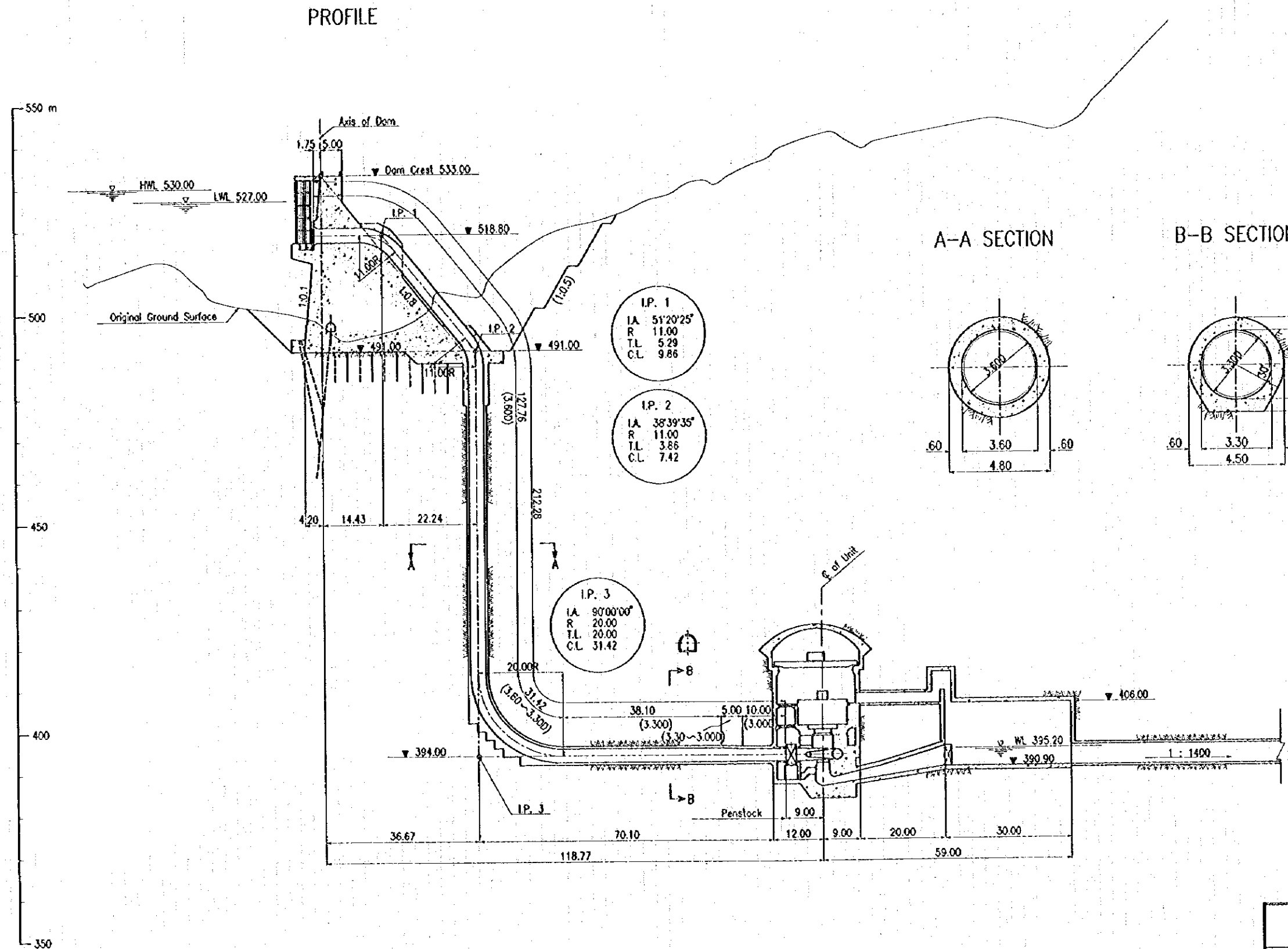
ÇORUH-BERTA RIVER HYDROELECTRIC
 POWER DEVELOPMENT PROJECT

BAĞLIK PROJECT
 PENSTOCK AND POWERHOUSE
 GENERAL PLAN

Figure 11-18







PROFILE

A-A SECTION

B-B SECTION

I.P. 1
 IA 51°20'25"
 R 11.00
 T.L 5.29
 C.L 9.86

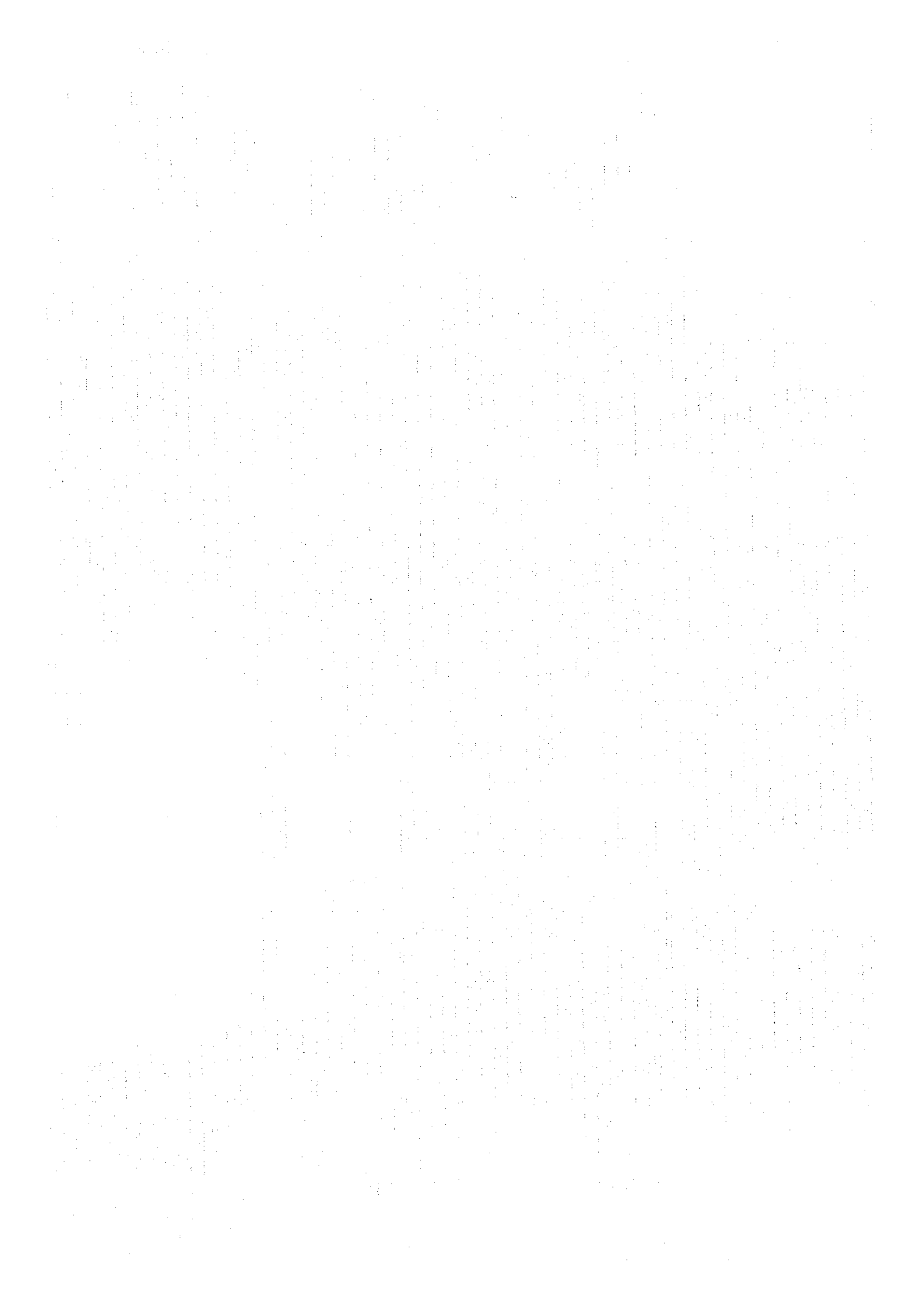
I.P. 2
 IA 38°39'35"
 R 11.00
 T.L 3.86
 C.L 7.42

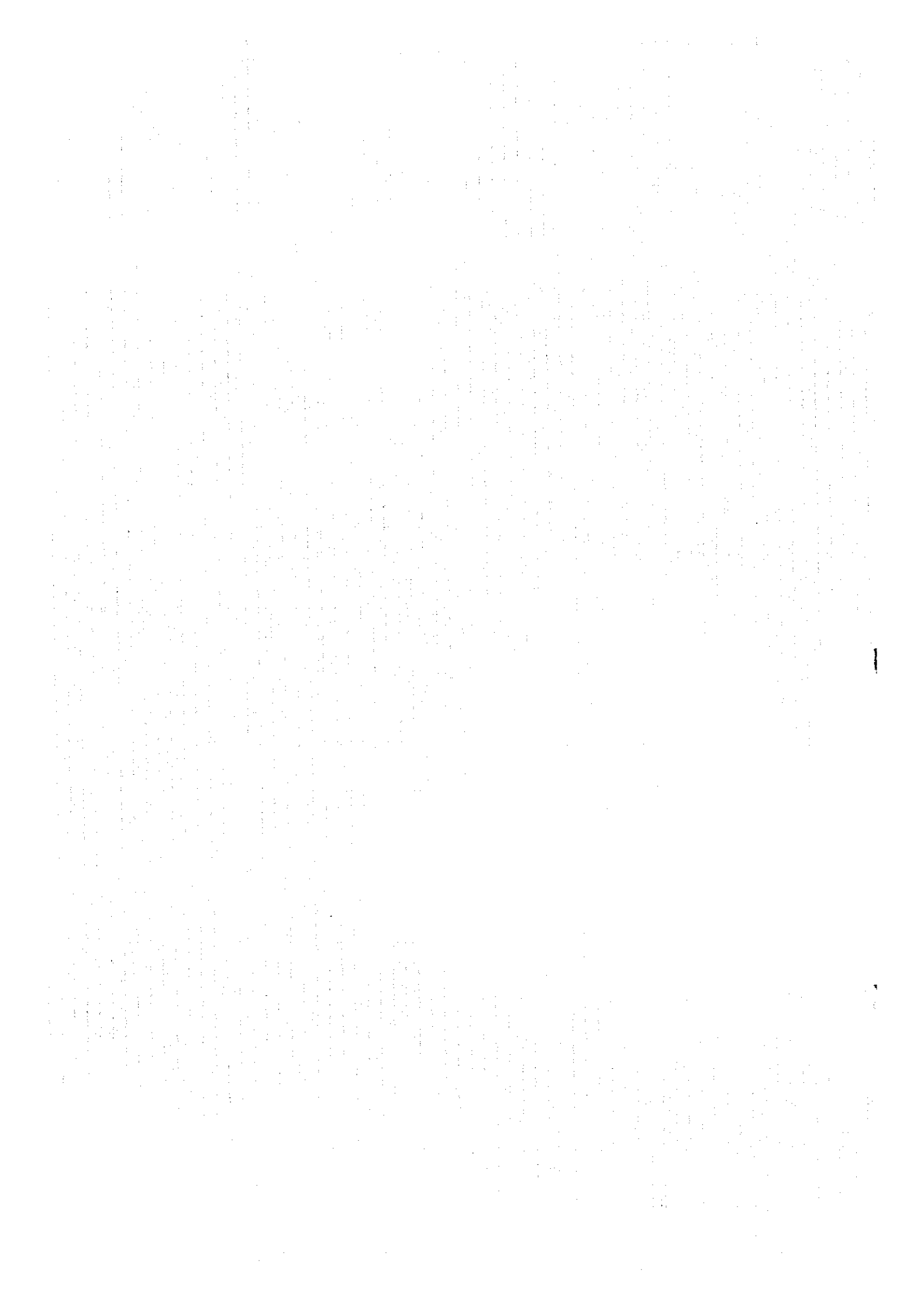
I.P. 3
 IA 90°00'00"
 R 20.00
 T.L 20.00
 C.L 31.42

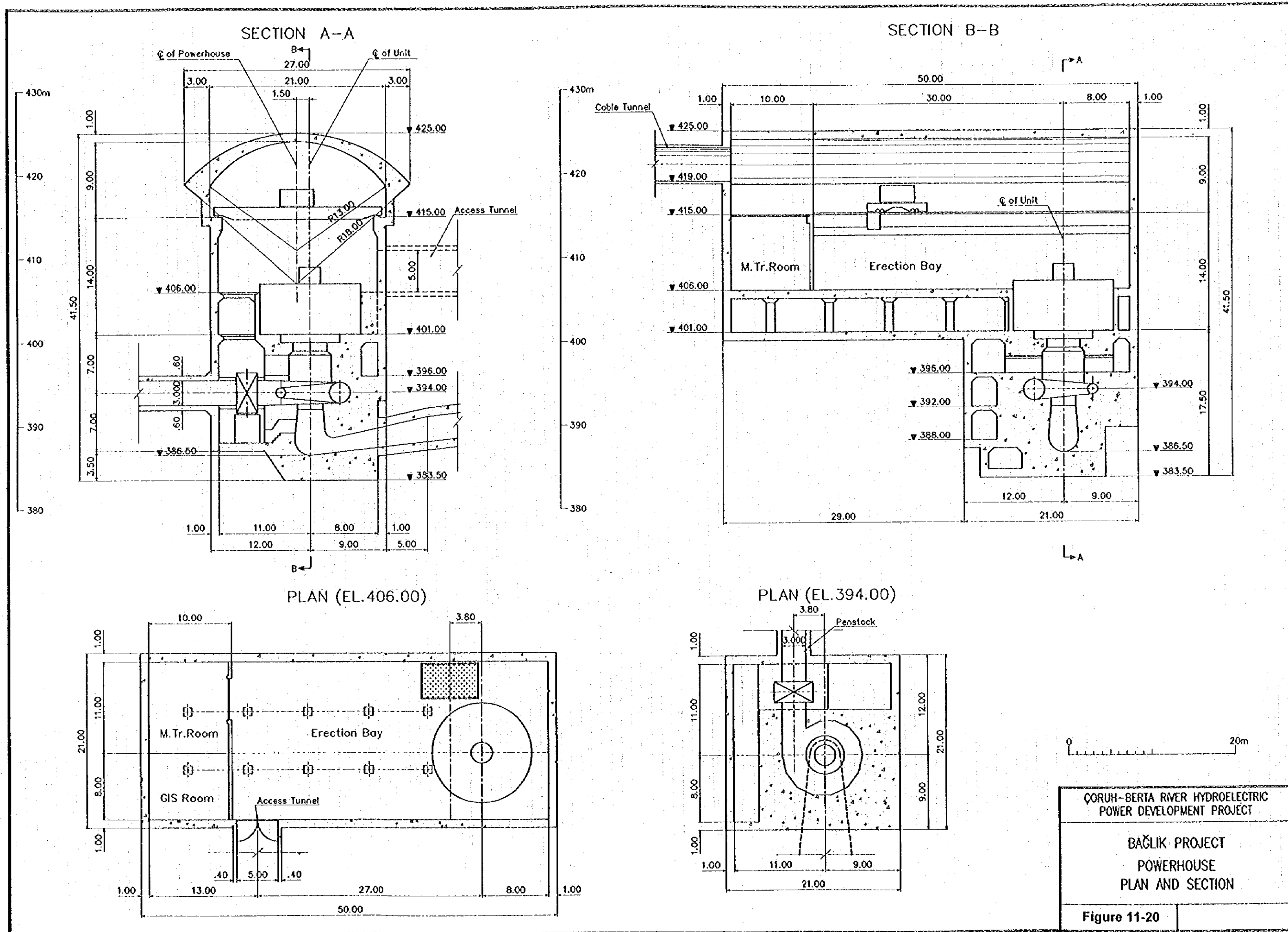
ÇORUH-BERTA RIVER HYDROELECTRIC
 POWER DEVELOPMENT PROJECT

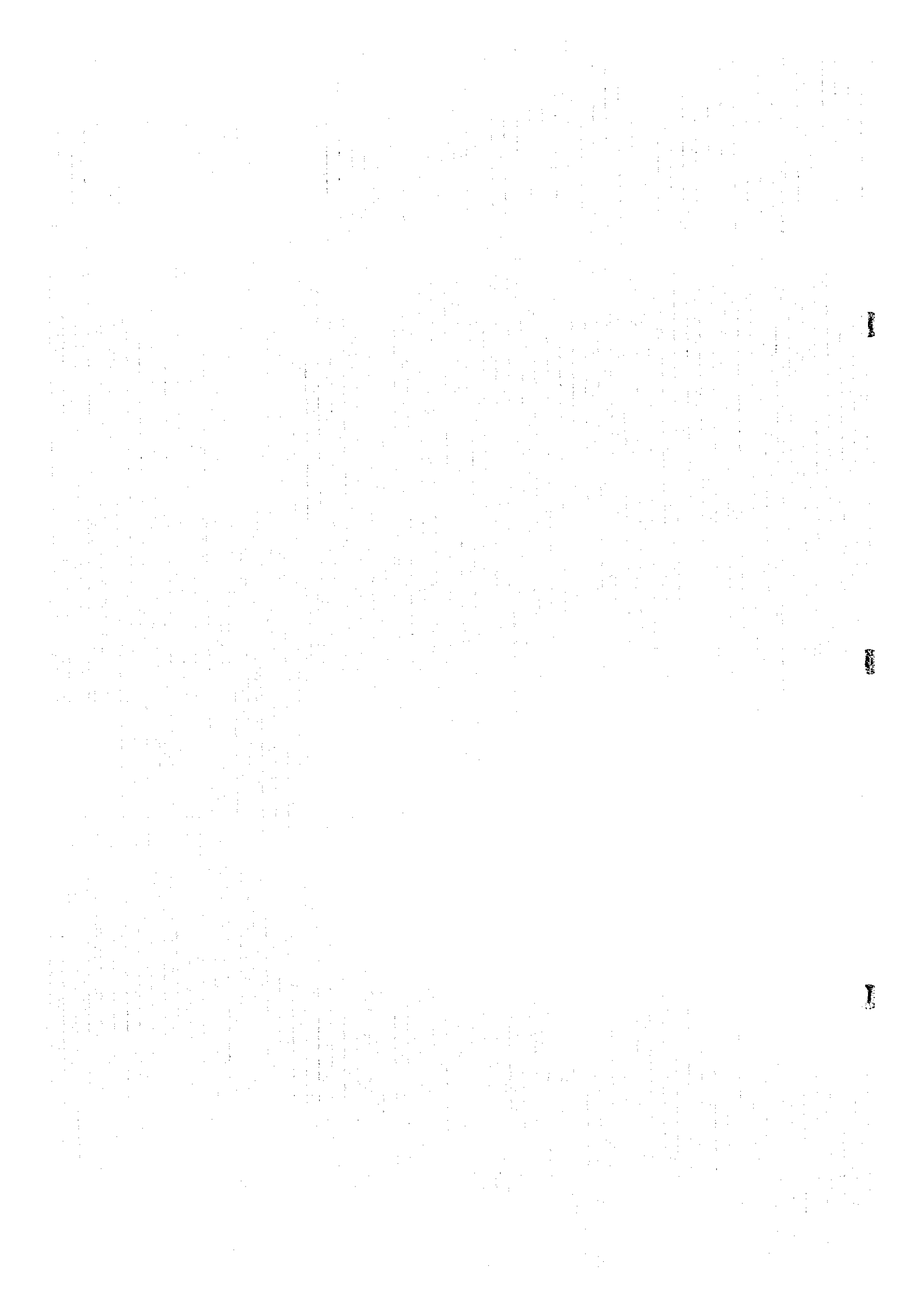
BAÇLIK PROJECT
 PENSTOCK AND POWERHOUSE
 PROFILE AND SECTION

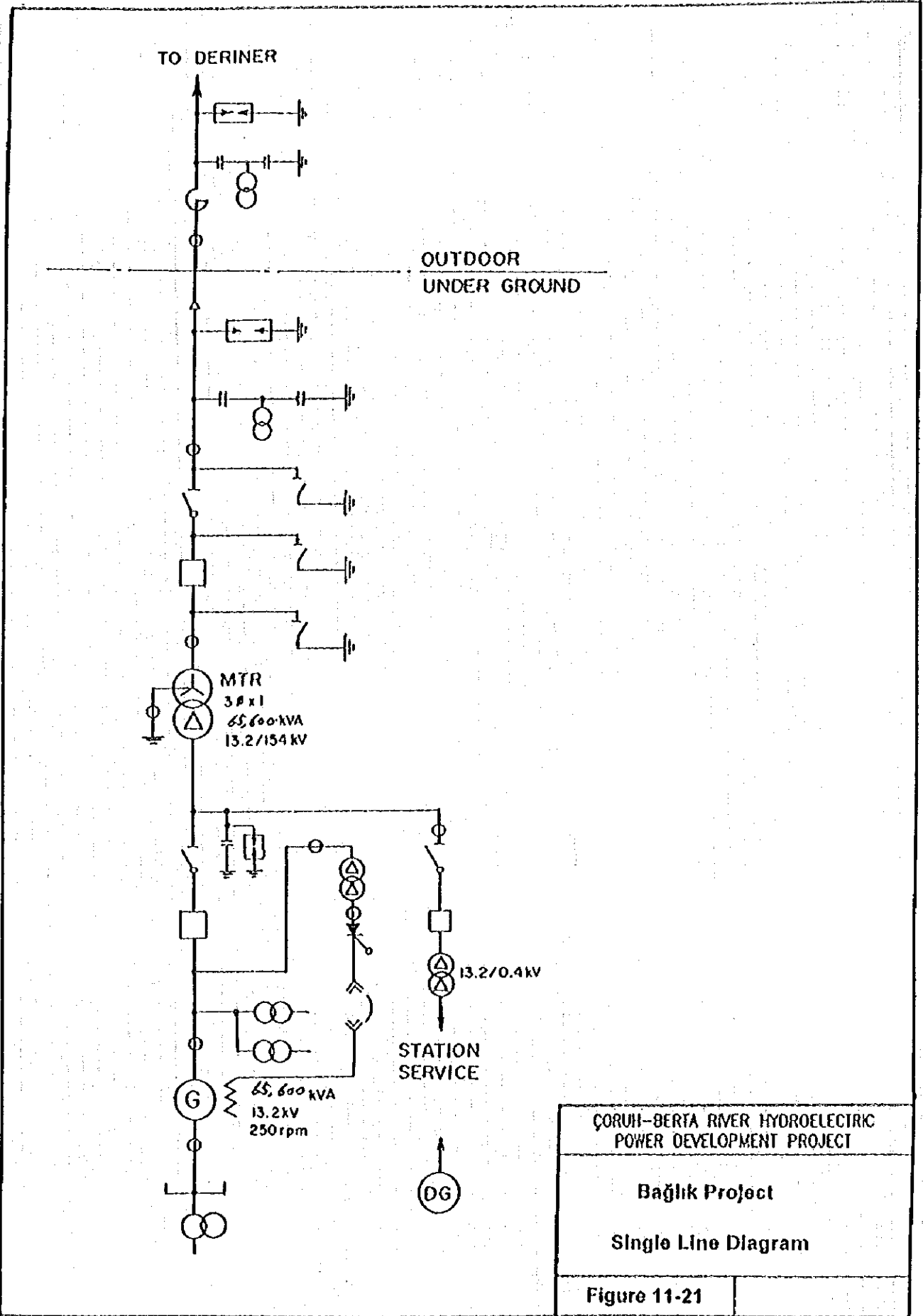
Figure 11-19



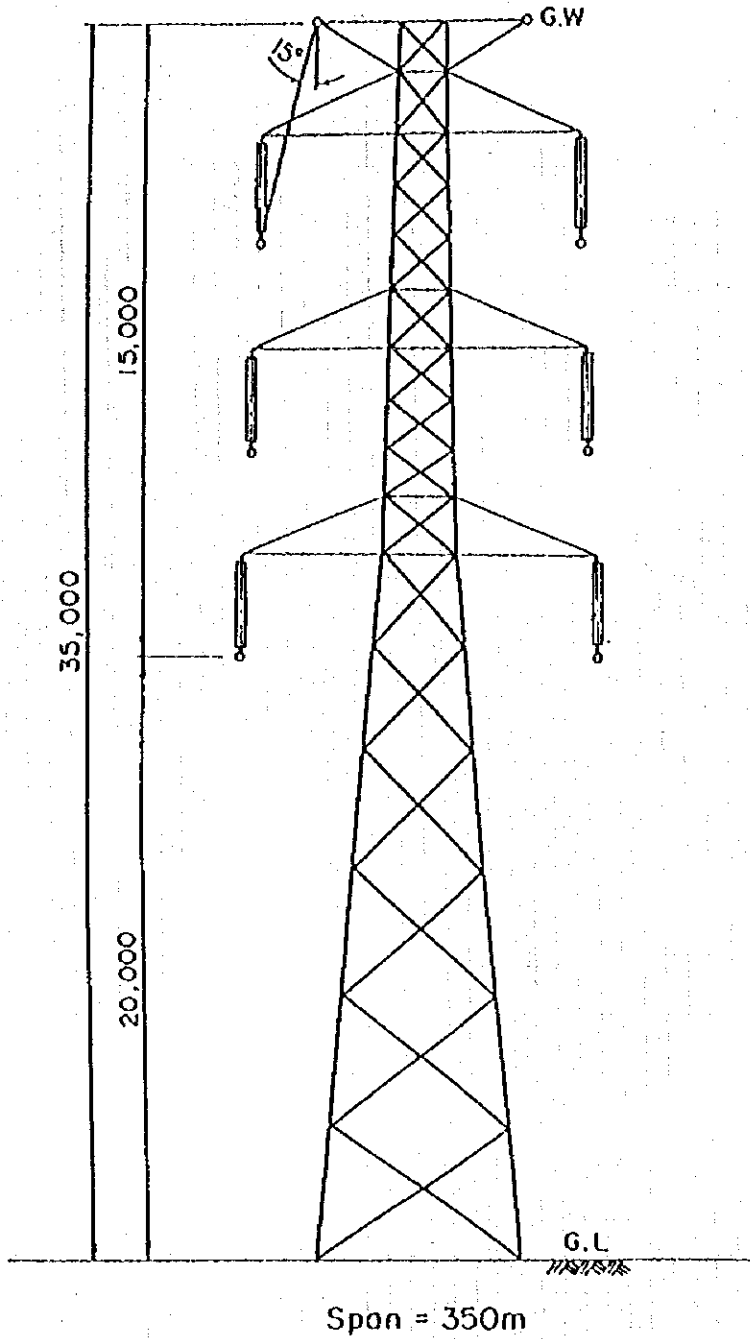








154 kV 2cct Standard Suspension Tower

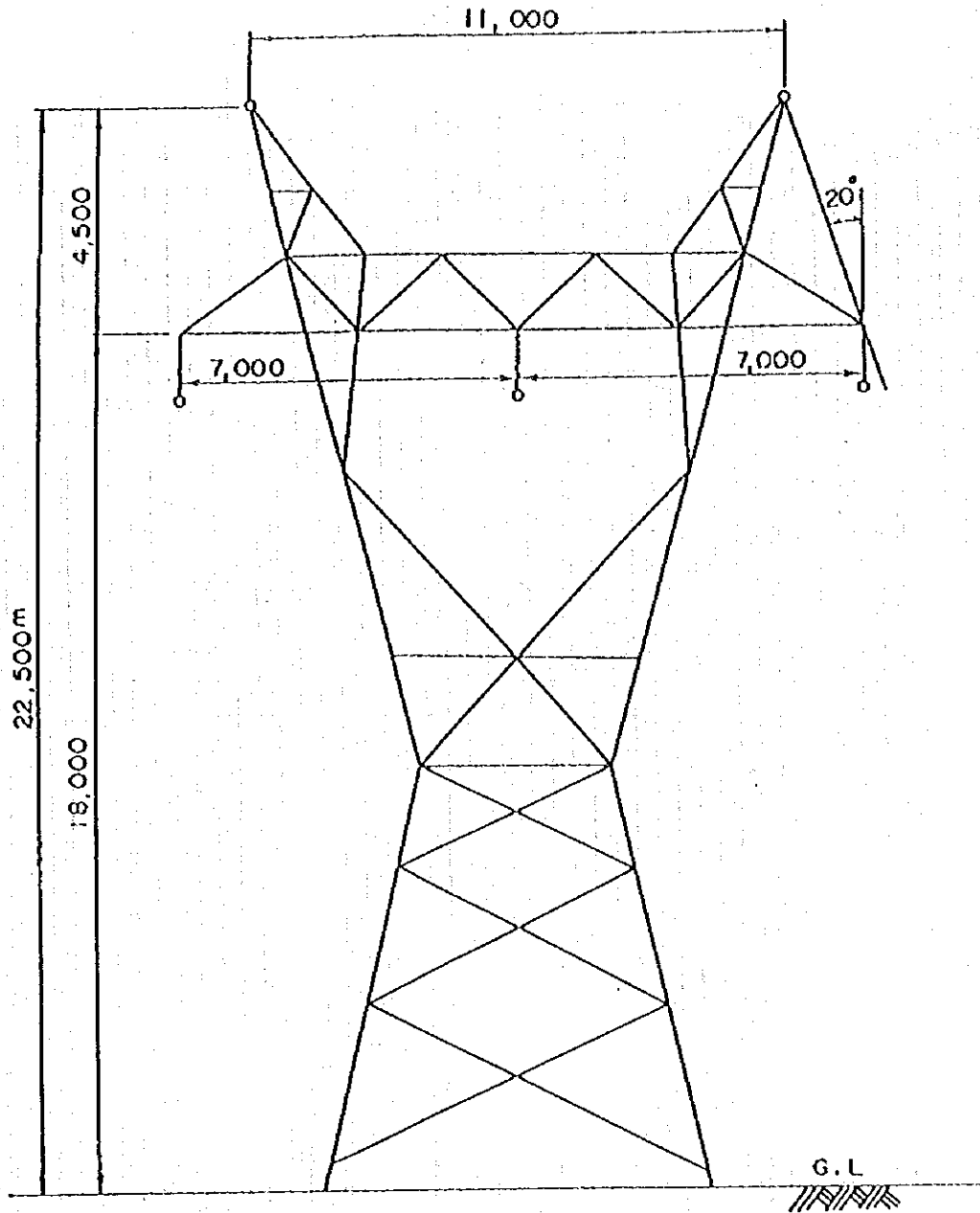


ÇORUH-BERTA RIVER HYDROELECTRIC
POWER DEVELOPMENT PROJECT

Standard Suspension Tower
(154 kV 2cct)

Figure 11-22

154kV 1cct Standard Suspension Tower



Span = 350m

ÇORUH-BERTA RIVER HYDROELECTRIC
POWER DEVELOPMENT PROJECT

Standard Suspension Tower
(154 kV 1cct)

Figure 11-23

Table 11-1 Comparison Study of Dam Type Bayram Project

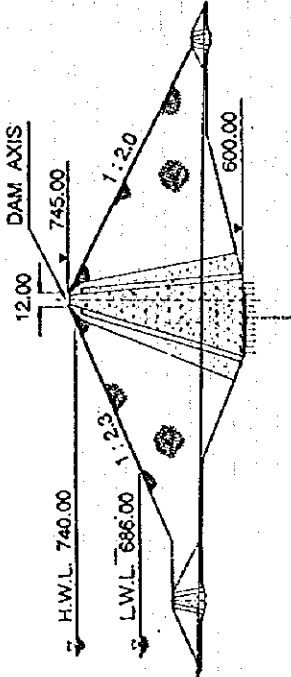
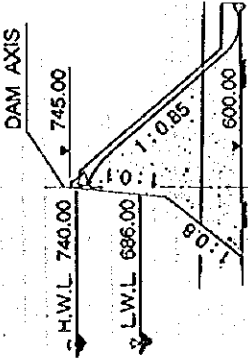
Item	Rockfill Type (Spillway : Chote)	Concrete Gravity Type (Spillway : Center overflow)
Typical Section	 <p style="text-align: center;">Dam Height 145 m</p>	 <p style="text-align: center;">Dam Height 145 m</p>
Slope	Upstream	1 : 0.1 / 0.8
	Downstream	1 : 0.85
Care of River	Diversion Tunnel L = 795 m	Diversion Tunnel L = 580 m
Dam Volume	6,200,000 m ³	1,724,000 m ³
Construction Cost (Care of River, Dam, Spillway)	58,307 × 10 ³ \$	77,673 × 10 ³ \$
Ratio of Construction Cost	100	134

Table 11-2 Comparison Study on Berta Project for Optimization of Number of Unit

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L. = 740m with Baglik H.W.L. = 530.00m 2 Unit 1 Unit

Description Dam Site	Unit	Bayram	Baglik	Total	Bayram	Baglik	Total
		2 Unit	2 Unit		1 Unit	1 Unit	
High Water Level	m	740.00	530.00		740.00	530.00	
Normal Water Level	m	722.00	528.50		722.00	528.50	
Low Water Level	m	686.00	527.00		686.00	527.00	
Available Drawdown	m	54.00	3.00		54.00	3.00	
Gross Storage Capacity	m ³ *10 ⁶	133.00	7.30		133.00	7.30	
Effective Storage Capacity	m ³ *10 ⁶	113.00	1.00		113.00	1.00	
Dam Type		Rockfill	Con-Gra.		Rockfill	Con-Gra.	
Dam Hight	m	145	74		145	74	
Dam Volume	m ³	6,144	195		6,144	195	
Tailwater Level	m	530.00	392.00		530.00	392.00	
Effective Head	m	182.90	130.90		182.90	130.90	
Maximum Discharge	m ³ /s	43.00	52.00		43.00	52.00	
Installed Capacity	MW	67.18	59.00	126.18	68.00	59.00	127.00
Firm Peak Power	MW	57.30	55.72	113.03	58.00	56.40	114.40
Energy Production							
Average Energy	GWh	244.93	218.74	463.67	237.24	211.88	449.12
Firm Energy	GWh	139.70	122.71	262.41	135.32	118.86	254.18
Secondary Energy	GWh	105.22	96.03	201.26	101.92	93.02	194.94
Unit Benefit Value		0.00	0.00		0.00	0.00	
Firm Peak Power	US\$/kW	180.45	180.45		180.45	180.45	
Firm Energy	US\$/kWh	0.027	0.027		0.027	0.027	
Secondary Energy	US\$/kWh	0.022	0.022		0.022	0.022	
Benefit							
Firm Peak Power	US\$*10 ⁶	9.86	9.59	19.45	9.98	9.71	19.69
Firm Energy	US\$*10 ⁶	3.71	3.26	6.96	3.59	3.15	6.75
Secondary Energy	US\$*10 ⁶	2.27	2.07	4.33	2.19	2.00	4.20
Total	US\$*10 ⁶	15.83	14.91	30.75	15.77	14.86	30.63
Investment Cost							
Civil Facilities	US\$*10 ⁶	148.96	54.38	203.33	147.74	53.78	201.51
Hydrau. and Ele.-Mech.Eq.	US\$*10 ⁶	27.52	25.69	53.20	24.32	25.69	50.01
Total	US\$*10 ⁶	176.47	80.06	256.54	172.06	79.46	251.52
Annual Cost							
Civil Facilities	US\$*10 ⁶	15.04	5.49	20.54	14.92	5.43	20.35
Hydrau. and Ele.-Mech.Eq.	US\$*10 ⁶	3.14	2.93	6.07	2.77	2.93	5.70
Total	US\$*10 ⁶	18.18	8.42	26.60	17.69	8.36	26.05
Annual Surplus Benefit(B-C)	US\$*10 ⁶	-2.35	6.49	4.15	-1.93	6.50	4.58
Benefit Cost Ratio(B/C)		0.87	1.77	1.16	0.89	1.78	1.18
Unit Annual Cost (Firm)	US\$/kWh	0.130	0.069	0.101	0.131	0.070	0.103
Unit Annual Cost (Average)	US\$/kWh	0.074	0.038	0.057	0.075	0.039	0.058

Table 11-3 Major Item of Bayram Power Station

Equipment	Item	Data
Hydraulic Turbine	Type	Vertical shaft, Francis
	Number of units	1
	Normal Effective head	182.90 m
	Maximum discharge	43 m ³ /s
	Turbine output	69,500 kW
Generator	Revolving speed	300 rpm
	Type	Three phases, alternating current, synchronous
	Number of units	1
	Output	75,400 kVA
	Power factor	0.9
Main Transformer	Voltage	13.2 kV
	Frequency	50 Hz
	Revolving speed	300 rpm
	Type	Outdoor, three phases, forced-oil-forced-air cooled type
	Number of units	1
Outdoor Switchyard	Capacity	75,400 kVA
	Primary voltage	13.2 kV
	Secondary voltage	154kV
	Connection	Delta/Star
	Bus system	Single bus + transfer bus
	Bus system	Aluminium pipe
	Lines connected	154 kV 1cct

Table 11-4 Comparison Study of Dam Axis Bağlık Project

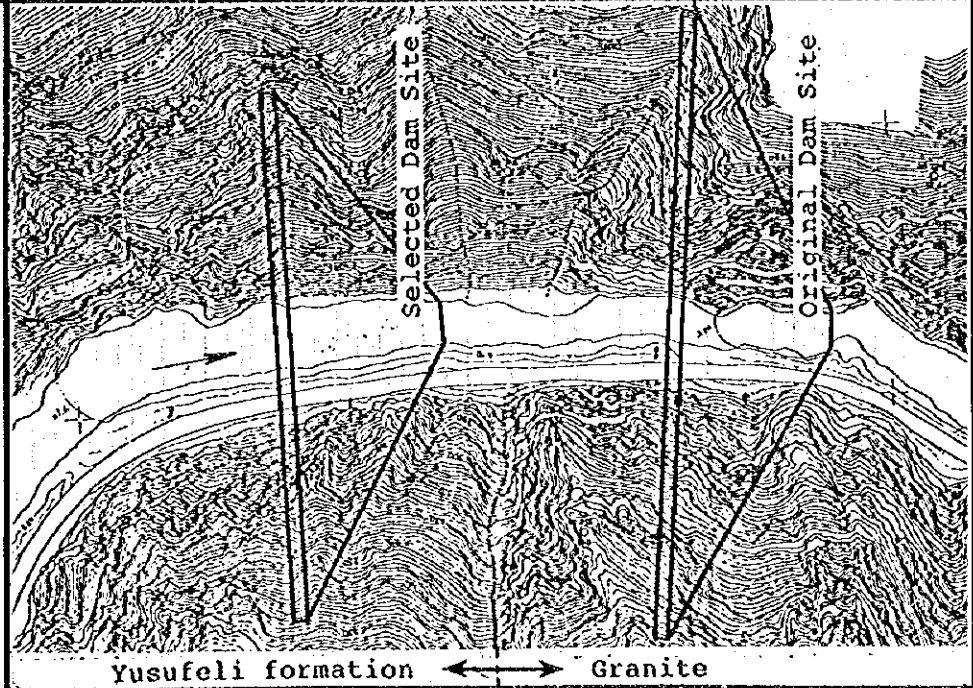
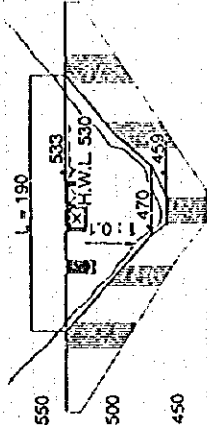
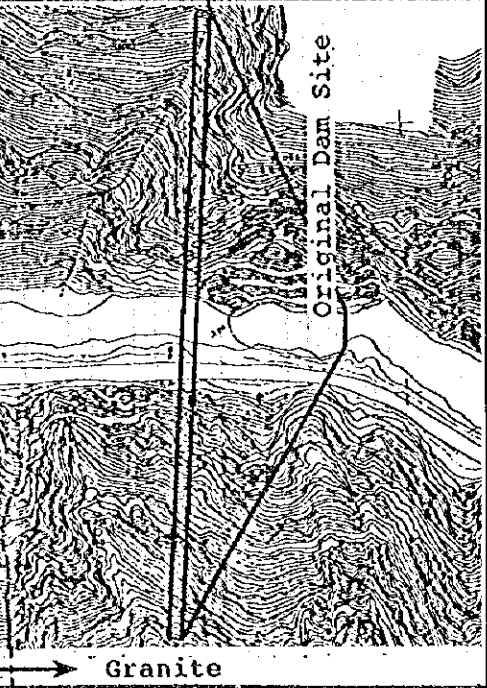
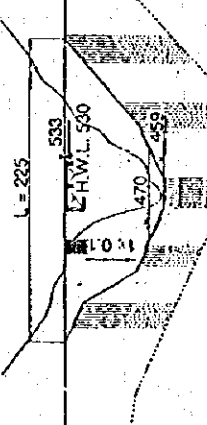
LOCATION	PROFILE	MENU	Dam Height 74 m
	<p>Selected Dam Site</p> 	<p>Dam Volume</p> <p>195,000 m³</p> <p>Construction Cost (Care of River, Dam, Spillway)</p> <p>20,765,000 \$</p> <p>Ratio of Construction Cost</p> <p>100</p>	
	<p>Original Dam Site</p> 	<p>Dam Volume</p> <p>240,000 m³</p> <p>Construction Cost (Care of River, Dam, Spillway)</p> <p>14,131,000 \$</p> <p>Ratio of Construction Cost</p> <p>132</p>	

Table 11-5 Comparison Study of Dam Type Bağlık Project

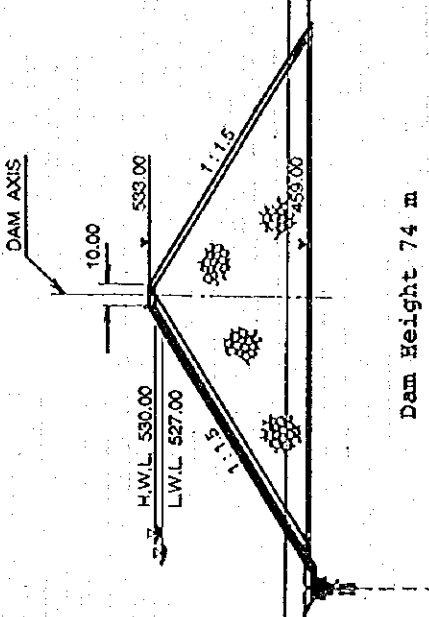
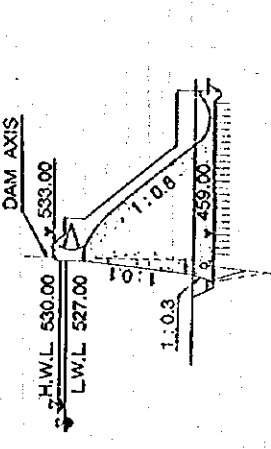
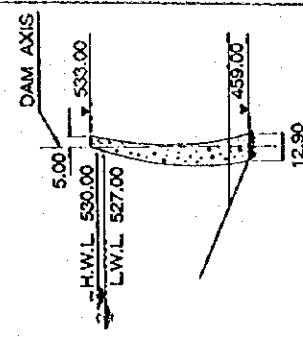
Item	Concrete-facing Rockfill Type (Spillway : Chute)	Concrete Gravity Type (Spillway : Center overflow)	Concrete Arch Type (Spillway : Center overflow)
Typical Section	 <p style="text-align: center;">Dam Height 74 m</p>	 <p style="text-align: center;">Dam Height 74 m</p>	 <p style="text-align: center;">Dam Height 74 m</p>
Slope	Upstream	1 : 0.1 / 0.3	-
	Downstream	1 : 0.8	-
Care of River	Diversion Tunnel L = 320 m	Partial River Closing	Diversion Tunnel L = 185 m
Dam Volume	523,000 m ³	195,000 m ³	137,000 m ³
Construction Cost (Care of River, Dam, Spillway)	13,818 × 10 ³ \$	10,765 × 10 ³ \$	11,464 × 10 ³ \$
Ratio of Construction Cost	129	100	107

Table 11-6 Major Item of Bağlık Power Station

Equipment	Item	Data
Hydraulic Turbine	Type	Vertical shaft, Francis
	Number of units	1
	Normal Effective head	130.90 m
	Maximum discharge	52 m ³ /s
	Turbine output	60,500 kW
Generator	Revolving speed	250 rpm
	Type	Three phases, alternating current, synchronous
	Number of units	1
	Output	65,600 kVA
	Power factor	0.9
Main Transformer	Voltage	13.2 kV
	Frequency	50 Hz
	Revolving speed	250 rpm
	Type	Inddor, three phases, forced-oil-forced-water cooled type
	Number of units	1
Switchyard Equipment	Capacity	65,600 kVA
	Primary voltage	13.2kV
	Secondary voltage	154kV
	Connection	Delta/Star
Type	Gas Insulated Metal Enclosed Switchgear (GIS)	

**CHAPTER 12 CONSTRUCTION PROGRAM AND
CONSTRUCTION COST**

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Table 12-12	Construction Cost of Hydraulic Equipment Bağlık Project

1

2

3

CHAPTER 12 CONSTRUCTION PROGRAM AND CONSTRUCTION COST

12.1 Construction Program and Construction Schedule

The Berta Project comprises two projects of Bayram and Bağlık. Of these two projects, Bağlık Project is planned and designed based on the prior development of Bayram Project. Therefore, it will be necessary for Bağlık Project not to develop prior to Bayram Project. In this study, construction programs and construction schedules were set up considering the simultaneous start of two project's construction.

12.1.1 Basic Conditions

Matters on the construction programs and construction schedules in relation to construction of the power stations are as described below.

(1) Meteorology

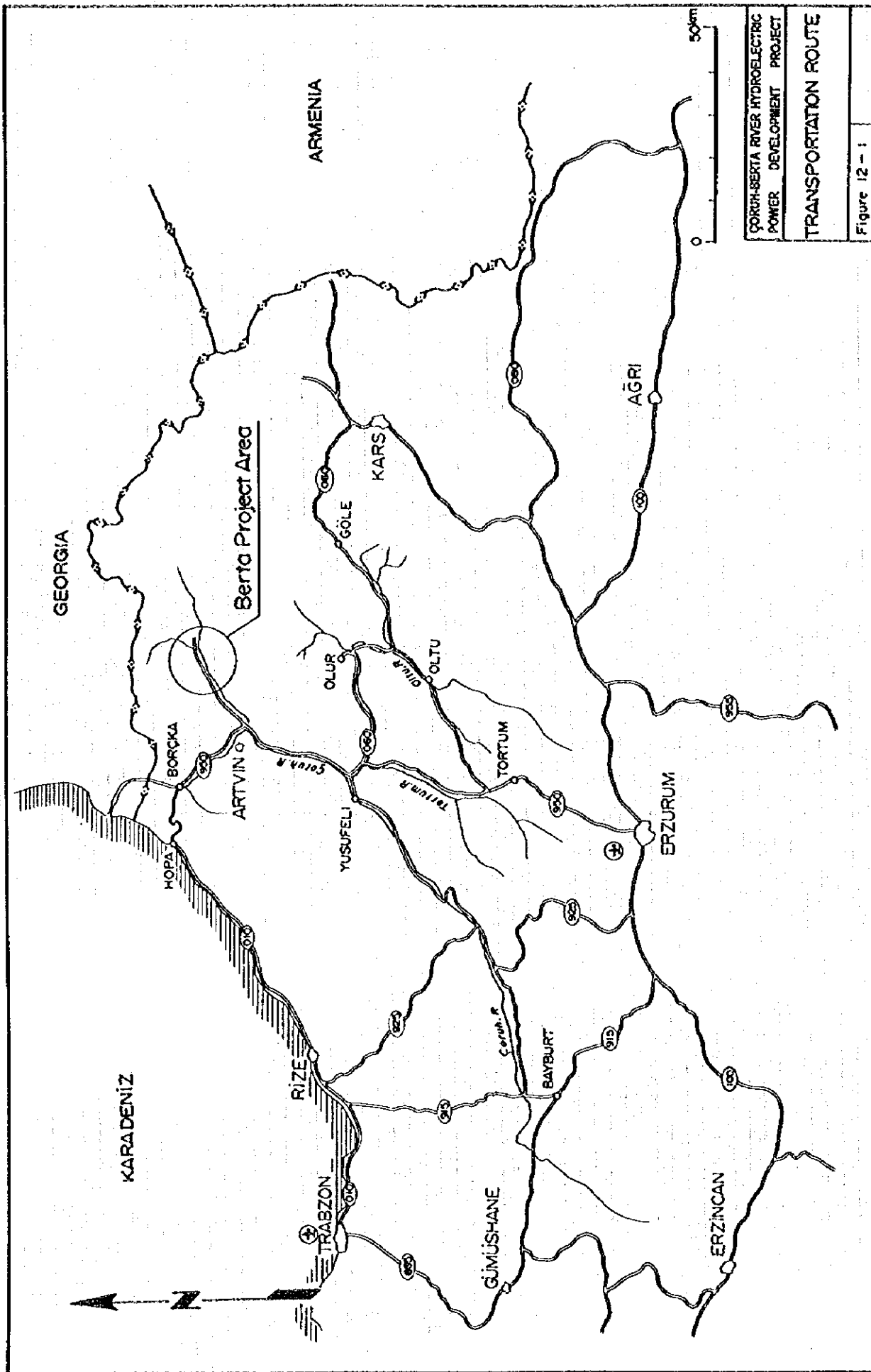
The meteorological conditions of the project area are as described in Chapter 6. In setting up the construction schedules, it was assumed that core embankment for the rockfill dam and placement of dam concrete in construction in this area would be possible 9 months out of the year, while with regard to other works, it would be possible to perform them throughout the year since there is not very much snow cover in this area.

(2) Transportation

The transportation routes to the project site consist of combinations of air, sea, rail transportation with highway.

Airports close to the project area are Trabzon and Erzurum, while seaports nearby are Trabzon and Hopa. The nearest railway stations are at Erzurum and Kars.

The roads from these nearby points to the project sites are as shown in Figure 12-1. From the direction of Trabzon and Hopa, National Highways No. 10 and No. 950 would be used to reach the Berta River confluence via Artvin, to reach the project sites along the Berta River.



ÇORUH-BERTA RIVER HYDROELECTRIC
POWER DEVELOPMENT PROJECT

TRANSPORTATION ROUTE

Figure 12 - 1

From the direction of Erzurum and Kars, the Berta River confluence is reached by National Highways No. 950 and No. 60, respectively, and from the confluence, the project sites are reached along the Berta River.

(3) Construction Materials

(a) Cement

For cement, the two cement mills in Kars and Erzurum are contemplated as the main sources of supply.

(b) Steel

For the main steel materials such as reinforcing bars and structural steel, the plants at Iskenderun or Karabak, both approximately about 1,000 km from the Berta project site would be the main supply factories.

(c) Concrete Aggregate

Concrete aggregate would be manufactured collecting and classifying the river-bed sand-gravel distributed upstream and downstream of Bayram dam.

(d) Embankment Materials

(i) Bayram Dam

Core material is to be collected from extruded deposits at the borrow area at the left bank immediately downstream of the dam and this is to be transported and banked.

Of filter materials, fine-particled filter is to be excavated river-bed sand-gravel upon classification and manufacture for dam embankment. As coarse-particled filter, river-bed sand-gravel and comparatively fine-particled excavation muck are to be used for embankment.

Rock materials are to be obtained from a quarry planned at the right bank upstream of the dam, upon which they are to be transported and banked.

(4) Electric Power for Construction

Electric power for construction would be supplied branching off from the transmission line which passes by the two project sites.

(5) Hydraulic Equipment

Hydraulic equipment, except for steel penstock pipes and steel conduits, are to be manufactured in the outskirts of Istanbul, transported by sea to Hopa, and then transported overland by trailer from Hopa to project sites, or transported overland all the way from Istanbul (or a factory somewhere else) to project sites.

For steel penstock pipes and steel conduits, temporary factories are to be constructed in the field, where fabrication is to be done, and installation carried out at the sites.

(6) Electromechanical Equipment

The main items of electromechanical equipment are to be manufactured overseas, unloaded at either of the ports of Hopa or Trabzon, transported overland by trailer to the field, and installed at the power stations.

12.1.2 Construction Program and Construction Schedule

The preparations to be made for the start of construction based on the rough schedule are as follows.

1995. 11 ~ 1997.12	Feasibility Study
1998.1 ~ 1998.6	Provision and Award of Final Design (0.5 years)
1998.7 ~ 1999.12	Final Design (1.5 years)
2000.1 ~ 2000.12	Financial Formulation (1 year)
2001.1 ~ 2001.12	Bidding and Award of Contract for Construction (1 year)
2002.1 ~ 2006.12	Construction (5 years)

(1) Bayram Project

The outline of the project and the quantities of civil works are as given in Summary and Table 12-1.

The time schedule of construction work for the Bayram Project was studied taking into consideration construction scale, construction methods, etc., and as a result, it was determined that construction period of approximately 5 years would be required including preparations such as temporary facilities.

The layout plan for temporary facilities and work schedule for construction are shown in Figure 12-2 and Figure 12-3, respectively.

The critical path in the construction schedule of this project is the dam construction work. The construction program and the construction schedule would be described below.

First Year:

For smooth execution of construction work, it is indispensable to secure land necessary for various structure works by such measures as relocating part of National Highway so that the traffic of vehicles in general will not be obstructed at the stretch of the highway from the end of the backwater of Deriner reservoir to the surroundings of Bayram dam, and constructing access roads as necessary for dam and powerhouse works by means of preparatory works before starting the construction work proper. Simultaneously with start of construction, materials procurement is to be done, the offices and quarters of the owner and contractor, materials yard, etc. are to be constructed, and site development and apparatus installation for temporary facilities such as the machinery repair factory, concrete plant, aggregate plant, etc. are to be started.

Table 12-1 Main Civil Works of Bayram Project

Item	Description	Amount of Works
Diversion Tunnel	Type: Horseshoe Pressure	
	D: 5.70 m L: 795 m	Tunnel Ex. 28,000 m ³ Lining Conc. 6,600 m ³
Cofferdam	Type: Rockfill	Em 109 x 10 ³ m ³
Dam	Type: Rockfill	Ex. In open 745 x 10 ³ m ³
	Height: 145 m	Em. of Core 868 x 10 ³ m ³
		Em. of Filter 802 x 10 ³ m ³
		Em. of Rock 4,367 x 10 ³ m ³
		Total Approx. 6,200 x 10 ³ m ³ (including coffer dam)
Spillway	Type: Shute with Gates	
	Gate: 2 x 10.0 B x 12.5 H	Ex. In open 595 x 10 ³ m ³ Concrete 47,800 m ³ Gate 2 sets
Intake	Type: Horizontal	
		Ex. In open 103,000 m ³ Concrete 6,200 m ³ Gate 1 set
Intake Tunnel	Type: Circular Pressure	
	D: 3.3 m L: 65 m	Tunnel Ex. 2,000 m ³ Lining Conc. 700 m ³
Penstock	Type: Steel Embedded	
	D: 3.3~2.5m	Tunnel Ex. 5,000 m ³
	L: 321 m	Filling Conc. 2,300 m ³ Steel 600 t
Power house	Type: Underground	
	B: 19.0 m	Cavern Ex. 27,000 m ³
	H: 41.0 m	Concrete 9,100 m ³
	L: 44.5 m	Gate 1 set
Tailrace Tunnel	Type: Horseshoe Non Pressure	
	D: 4.6 m	Tunnel Ex. 212,000 m ³
	L: 7,930 m	Lining Conc. 37,600 m ³ Gate 1 set

Second Year:

For the diversion tunnel, concrete placement is to be done in succession to excavation.

Excavation for the dam, including spillway excavation, is to be started from the upper parts at the right and left banks. Open excavation for the inlet portion of the intake will be done.

After completion of concrete lining and grouting work for diversion tunnel, switching of the river to the diversion tunnel is to be carried out immediately. After diversion, construction of the upstream and downstream cofferdams is to be started.

For works such as the cable tunnel to serve as a work adit for the powerhouse (arch portion work adit), powerhouse access tunnel (midheight work adit), tailrace work adit, etc., excavation is to be started as soon as temporary facilities have been completed.

Third Year:

Excavation of the river-bed portion of the dam is to be completed, foundation treatment grouting done, and embankment started, but prior to this embankment, the road for embankment materials transportation is to be constructed and the preparatory works for the various material collection points completed.

Grouting of the right- and left-bank wings, and of deep parts is to be done providing grouting tunnels, and the grouting is to be performed simultaneously with dam embankment work.

For the spillway, concrete placement work is to be carried out after completion of excavation.

Excavation works are to be started on the vertical shaft of the intake gate chamber and the inclined shaft of the penstock to be executed by the raise borer method. As the method of mucking out, for both the vertical shaft and the inclined shaft, after pilot reaming excavation, the reaming holes are to be used for enlargement, the enlargement muck is to be dropped down the vertical shaft and inclined shaft, and is to be hauled out by the intake tunnel and penstock work adit which have been connected to the shafts beforehand.

In powerhouse excavation, after excavation of the cable tunnel, excavation for enlargement of the arch section is to be done and muck is to be hauled out from the tunnel by truck.

At the powerhouse, arch concrete is to be placed immediately after excavation of the arch. After completion of concrete placement, bench cutting is to be done for excavation of the lower portion of the powerhouse. In bench cutting, a glory hole is to be provided and muck dropped down, and after working from the midheight work adit making use of the powerhouse access tunnel, muck is to be hauled out by truck.

Placement of concrete is to be started as excavation progresses. Liners of the draft tube are to be installed while foundation concrete is being placed.

Excavation of the tailrace tunnel is to be continued from maximum of six excavation faces using two work adits.

Fourth Year:

In dam construction, embankment works of core materials, filter materials and rock materials, and foundation treatment grouting are to be continued.

At the spillway, concrete for the pier, side walls, and invert are to be placed.

At the penstock, installation of steel pipe and placement of backfill concrete are to be performed, and in succession to this, lining concrete of the intake tunnel is to be placed.

At the intake, concrete for the inlet and gate chamber vertical shaft are to be placed. Side wall and slab concrete of the powerhouse are to be more or less completed, and after installing crane girders, an overhead traveling crane is to be installed. When the crane has been installed, installation of electromechanical equipment such as the turbine and generator would be started.

Excavation of the tailrace tunnel is to be completed and lining concrete placed. Construction of the transmission line is to be started.

Fifth Year:

Embankment work of the dam and installation of gates at the spillway and intake are to be completed. Lining concrete work of the tailrace tunnel is to be completed, and following

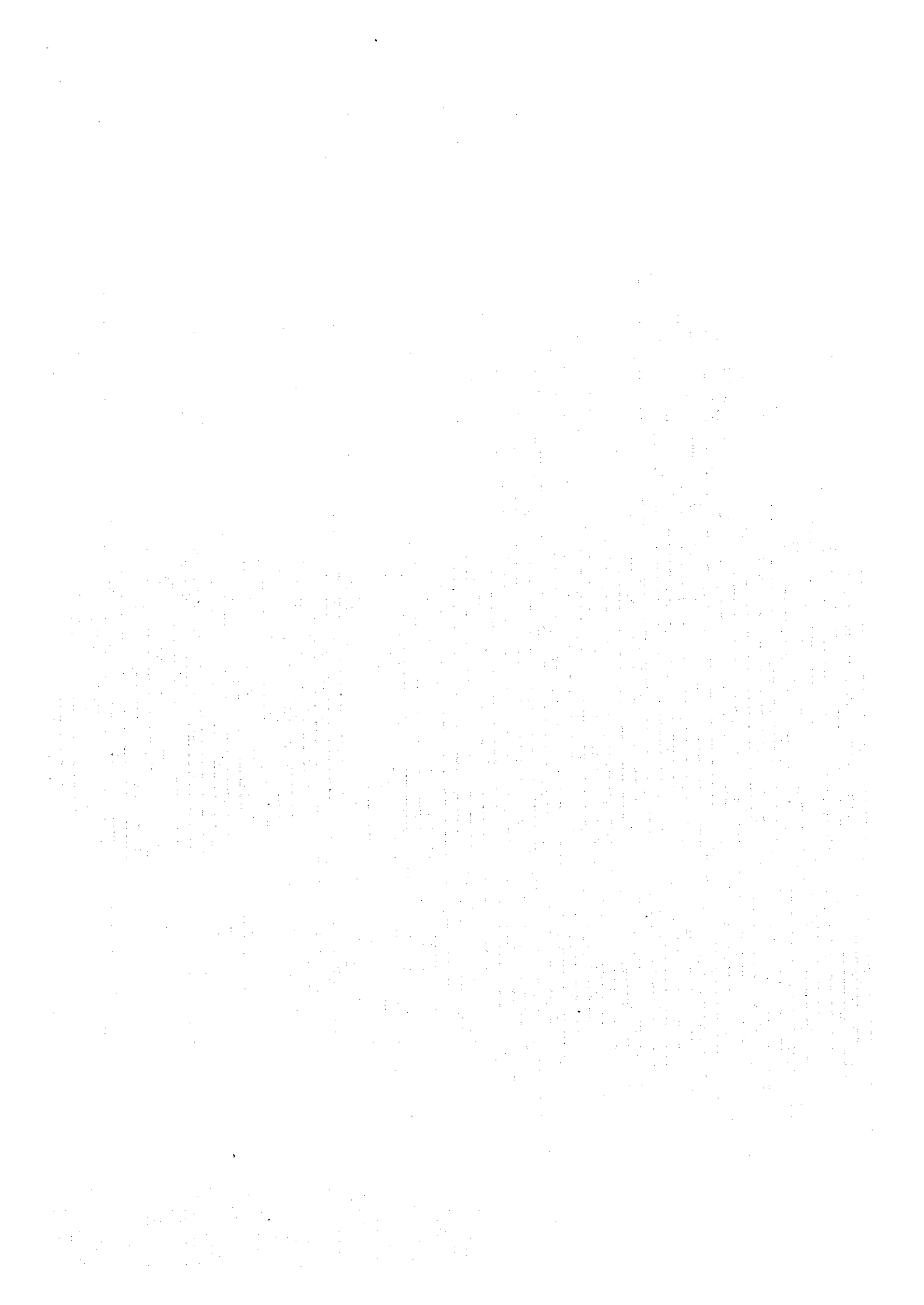
mortar injection work, the work adits are to be plugged. In order to begin impoundment of water in the reservoir, installation of the discharge valve to be provided in the diversion tunnel is to be carried out, and plugging of the diversion tunnel is to be completed.

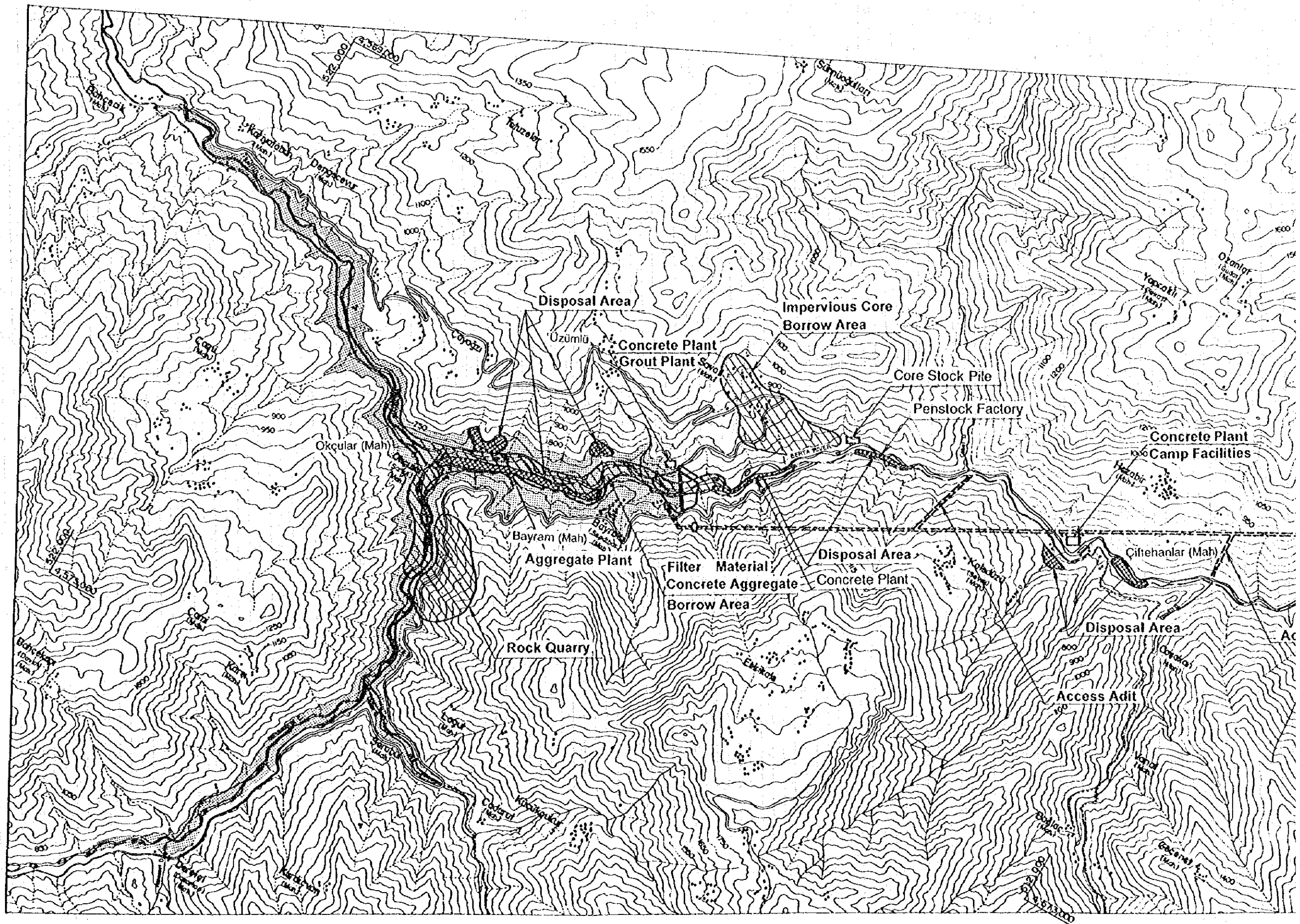
At the powerhouse and outdoor switchyard, installations of the turbine, generator, transformer equipment, are to be continued in aiming for start of operation. After completion of installation, dry tests and wet tests are to be conducted, and commercial operation is to be commenced at the end of the year. Construction of the transmission line is to be finished by the time of starting wet tests.

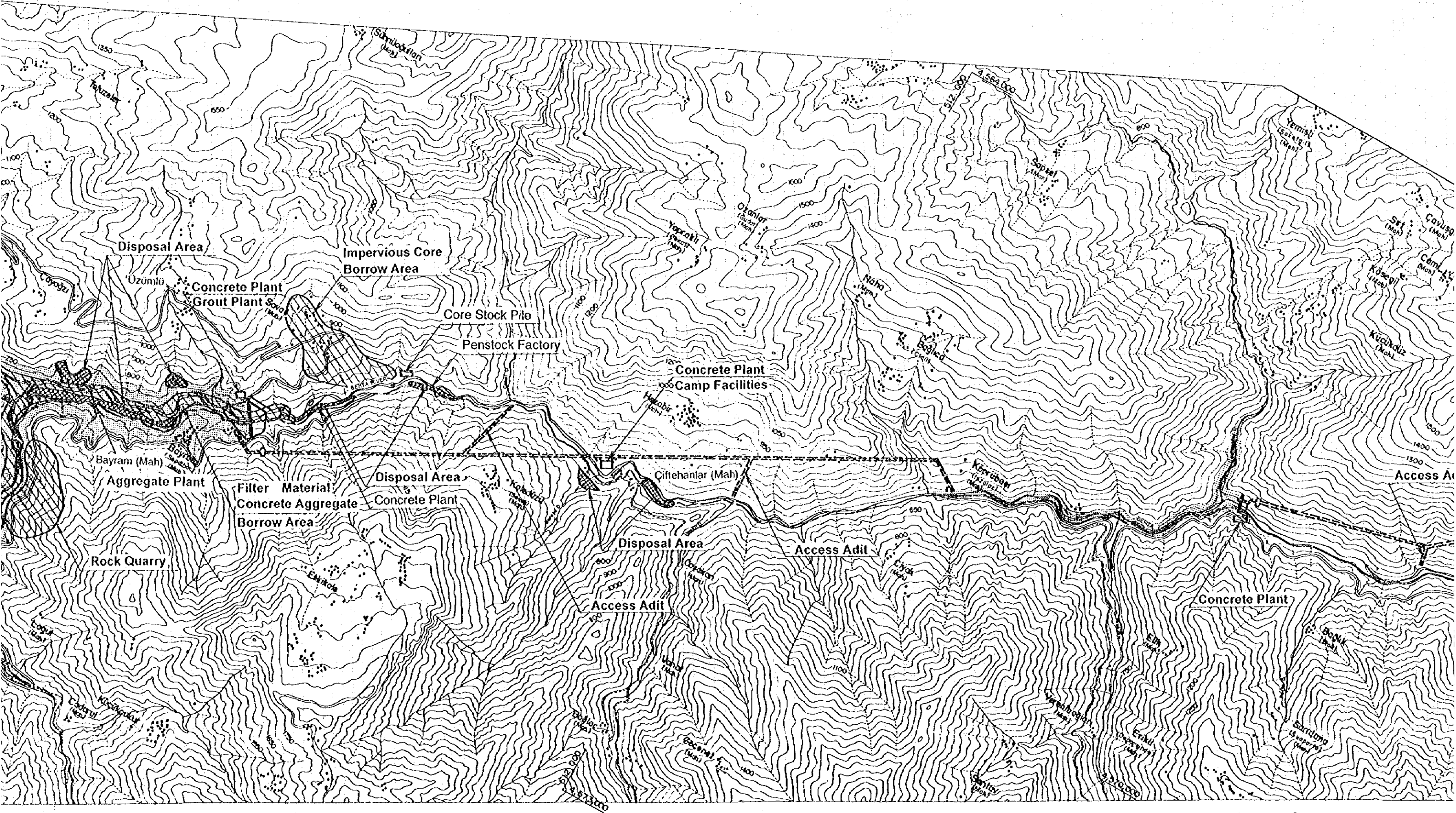
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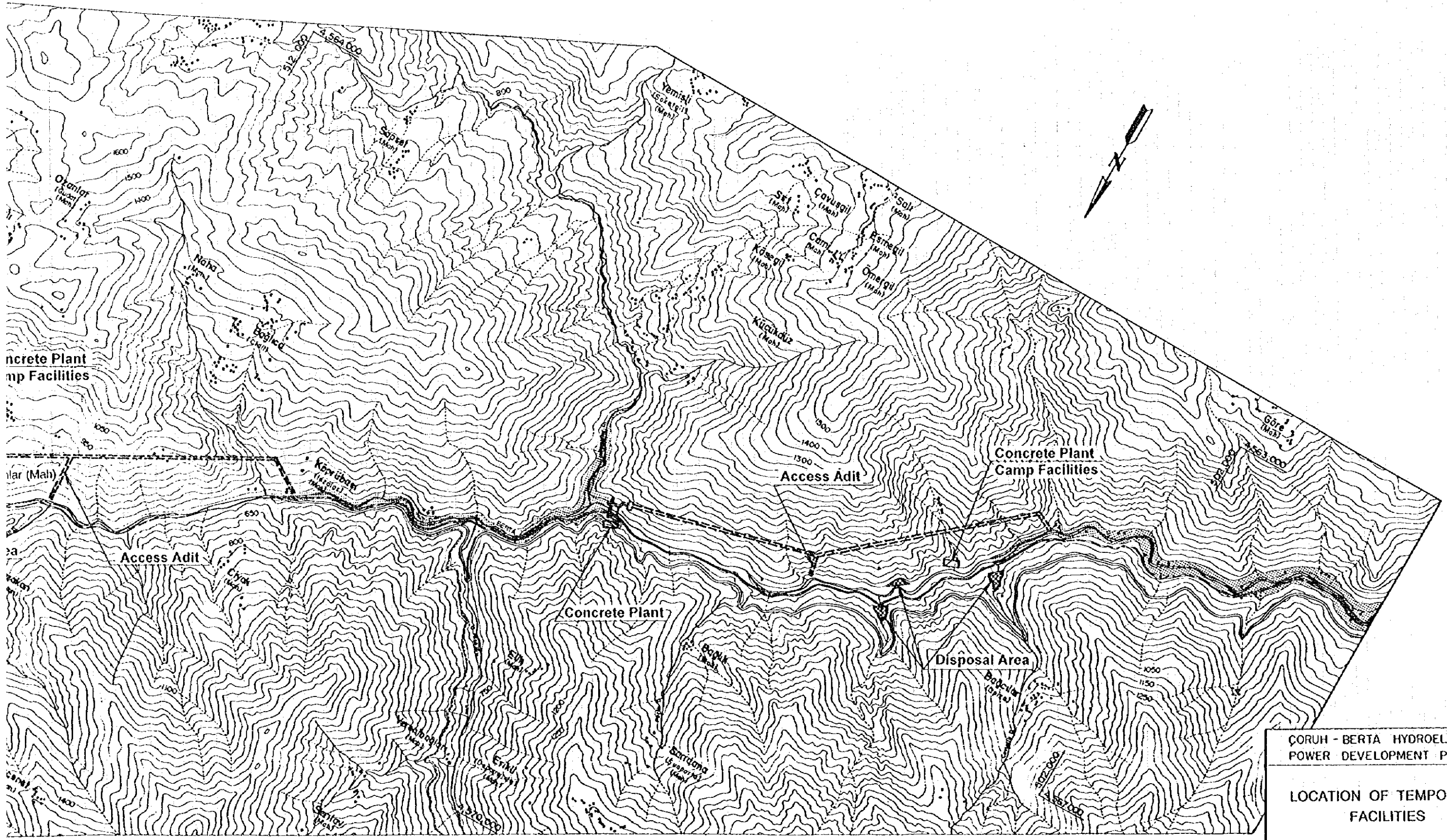
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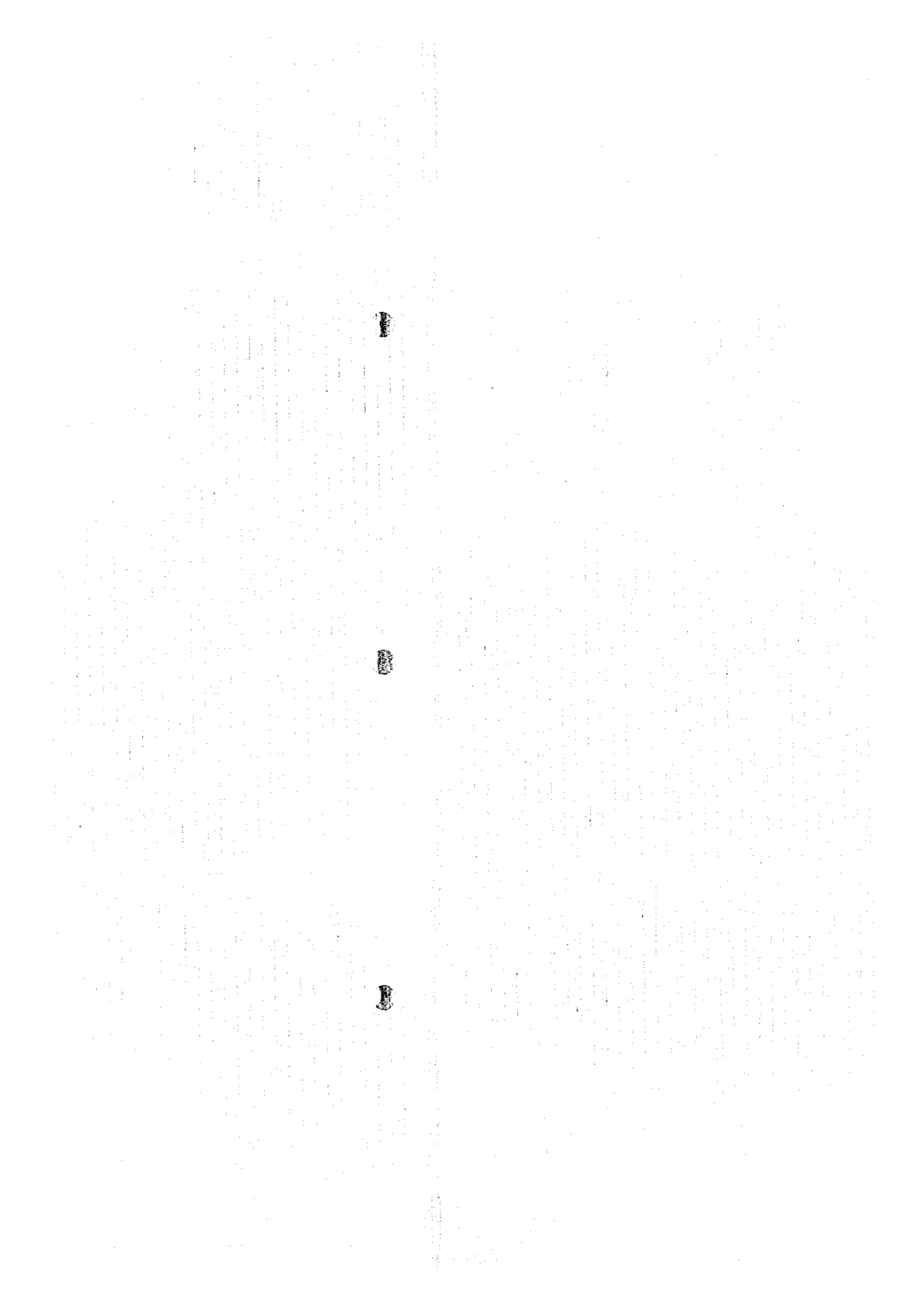




ÇORUH - BERTA HYDROELECTRIC
POWER DEVELOPMENT PROJECT

LOCATION OF TEMPORARY
FACILITIES

Figure 12-2



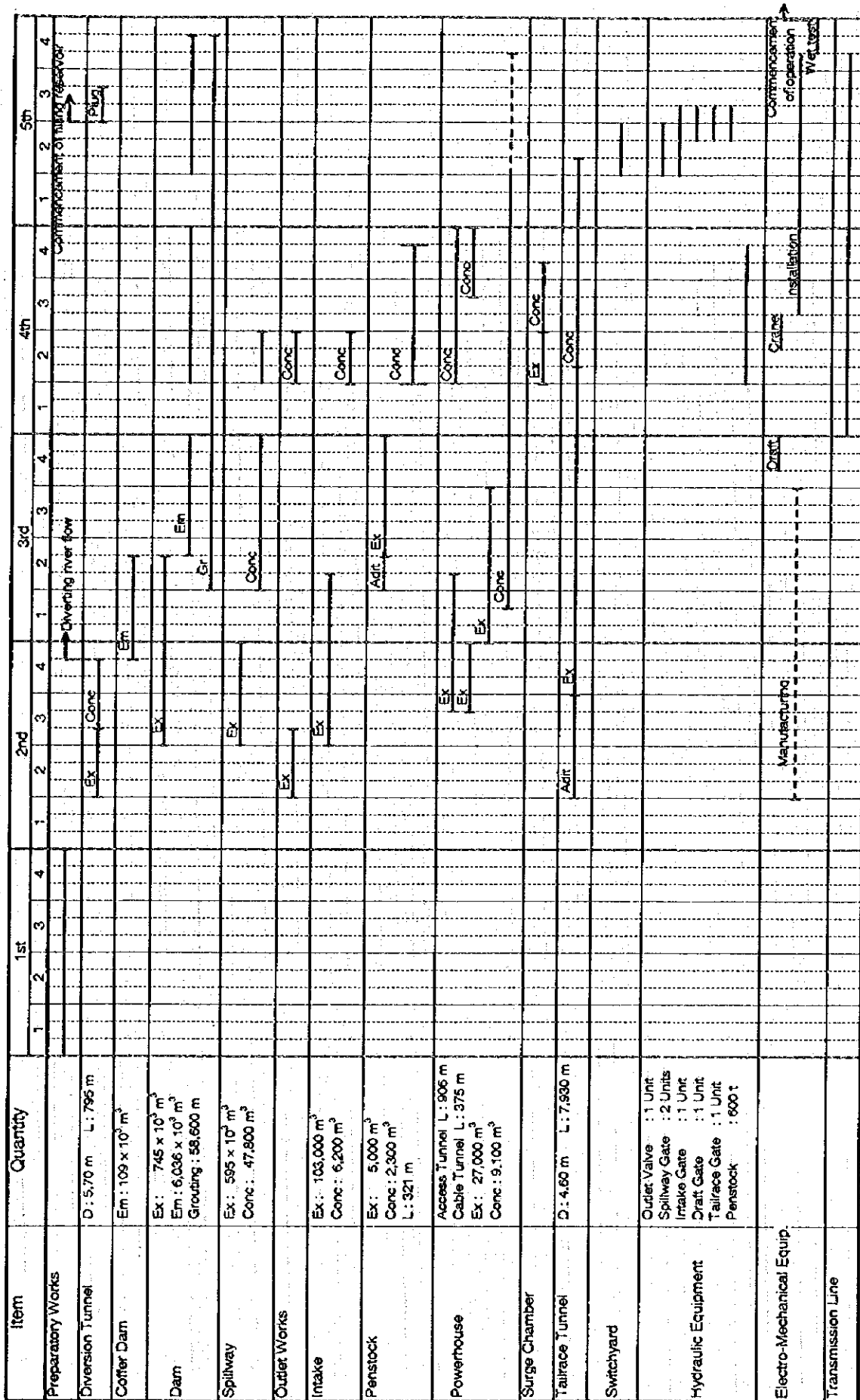


Figure 12-3 Construction Schedule of Bayram Project

(2) Bağlık Project

The outline of the project and quantities of civil works are as given in Summary and Table 12-2, respectively.

The time schedule of construction work for the Bağlık project was studied taking into consideration construction scale, construction methods, etc., and as a result, it was determined that construction period of approximately 5 years would be required including preparations such as temporary facilities.

The layout plan for temporary facilities and work schedule for construction are shown in Figure 12-2 and Figure 12-4, respectively.

Table 12-2 Main Civil Works of Bağlık Project

Item	Description	Amount of Works	
Dam	Type: Concrete Gravity	Ex. In open	147 x 10 ³ m ³
		Concrete	195 x 10 ³ m ³
	Height: 74 m		
Spillway	Type: Center Overflow with Gates		
	Gate: 2 x 14.0 B x 11.0 H	Ex. In open	21,000 m ³
		Concrete	9,600 m ³
		Gate	2 sets
Intake	Type: Attached to	Concrete	500 m ³
	Dam body	Gate	1 set
Penstock	Type: Steel Embedded		
	D: 3.6~3.0 m	Tunnel Ex.	3,000 m ³
	L: 213 m	Filling Conc.	1,300 m ³
		Steel	350 t
Power house	Type: Underground		
	B: 21.0 m	Cavern Ex.	33,000 m ³
	H: 41.5 m	Concrete	10,500 m ³
	L: 50.0 m	Gate	1 set
Tailrace Tunnel	Type: Horseshoe Non Pressure		
	D: 4.9 m	Tunnel Ex.	141,000 m ³
	L: 4,454 m	Lining Conc.	15,100 m ³
		Gate	1 set

The critical path in the construction schedule of this project is the powerhouse work. The construction program and the construction schedule will be described below.

First Year:

For smooth execution of construction work, it is indispensable to secure land necessary for various structure works by such measures as relocating part of National Highway so that traffic of vehicles in general will not be obstructed at the stretch of the highway from the end of the backwater of Deriner Reservoir to the surroundings of Bayram Dam, and constructing access roads as necessary for dam and powerhouse works by means of preparatory works before starting the construction work proper. Simultaneously with start of construction, materials procurement is to be done, the offices and quarters of the owner and contractor, materials yard, etc. are to be constructed, and site development and apparatus installation for temporary facilities such as the machinery repair factory, concrete plant, aggregate plant, etc., are to be started.

Second Year:

Care of river for dam construction is to be done by partial river closing method with part of the river partitioned off surrounded by a retaining wall or other means and foundation excavation started at that part.

Placement of dam concrete is to be started by the cable crane method, but prior to that, concrete placement facilities are to be provided around the crest of the dam at the right and left banks.

Excavation of the river-bed portion of the dam is to be completed, and foundation treatment grouting is to be started. Fundamentally, curtain grouting is to be done from the dam inspection gallery at the same time as dam concrete placement works after excavation of the foundation.. Grouting of the wings at right and left banks is to be done providing separate grouting tunnels.

For works such as the cable tunnel to serve as a work adit for the powerhouse (arch portion work adit), powerhouse access tunnel (midheight work adit), tailrace work adit, etc., excavation is to be started as soon as temporary facilities have been completed.

In powerhouse excavation, after excavation of the cable tunnel, excavation for enlargement of the arch section is to be done and muck is to be hauled out from the tunnel by truck.

Third Year:

Vertical shaft excavation for the penstock at the back face of the dam is to be started by the raise borer method. As the method of mucking out, after pilot reaming excavation, the reaming holes are to be used for enlargement, the enlargement muck dropped down the vertical shaft and hauled out by the penstock work adit which has been connected to the shafts beforehand.

At the powerhouse, arch concrete is to be placed immediately after excavation of the arch. After completion of concrete placement, bench cutting is to be started for excavation of the lower portion of the powerhouse. In bench cutting, a glory hole is to be provided and muck dropped down, and after working from the midheight work adit making use of the powerhouse access tunnel, muck is to be hauled out by truck.

Placement of concrete is to be started as excavation progresses. Liners of the draft tube are to be installed while foundation concrete is being placed.

Excavation of the tailrace tunnel is to be continued from maximum of four excavation faces using one work adit and after completion of excavation, concrete lining work is to be started.

Fourth Year:

Placement of dam concrete is to be completed. Placement is to be done carrying out pipe cooling to prevent temperature rise. Installation of penstock and placement of backfill concrete in shaft part of penstock, tower crane would be used for these works. For the intake, concrete at the inlet is to be placed. Side wall and slab concrete of the powerhouse are to be more or less completed, and after installing crane girders, an overhead traveling crane is to be installed. When the crane has been installed, installation of electromechanical equipment such as the turbine and generator would be started.

Lining concrete placed, and construction of the outdoor transmission line is to be started.

Fifth Year:

Gate installation at the spillway and intake are to be done. Concrete lining work at the tailrace tunnel is to be completed, and after mortar injection, the work adit is to be plugged.

In order to begin the impoundment of water in the reservoir, diversion channel in dam body for diversion is to be plugged.

At the powerhouse, installations of the turbine, generator and transformer equipment are to be continued in aiming for start of operation. After completion of installation, dry tests and wet tests are to be conducted, and commercial operation is to be commenced at the end of the year. Construction of the transmission line is to be finished by the time of starting wet tests.

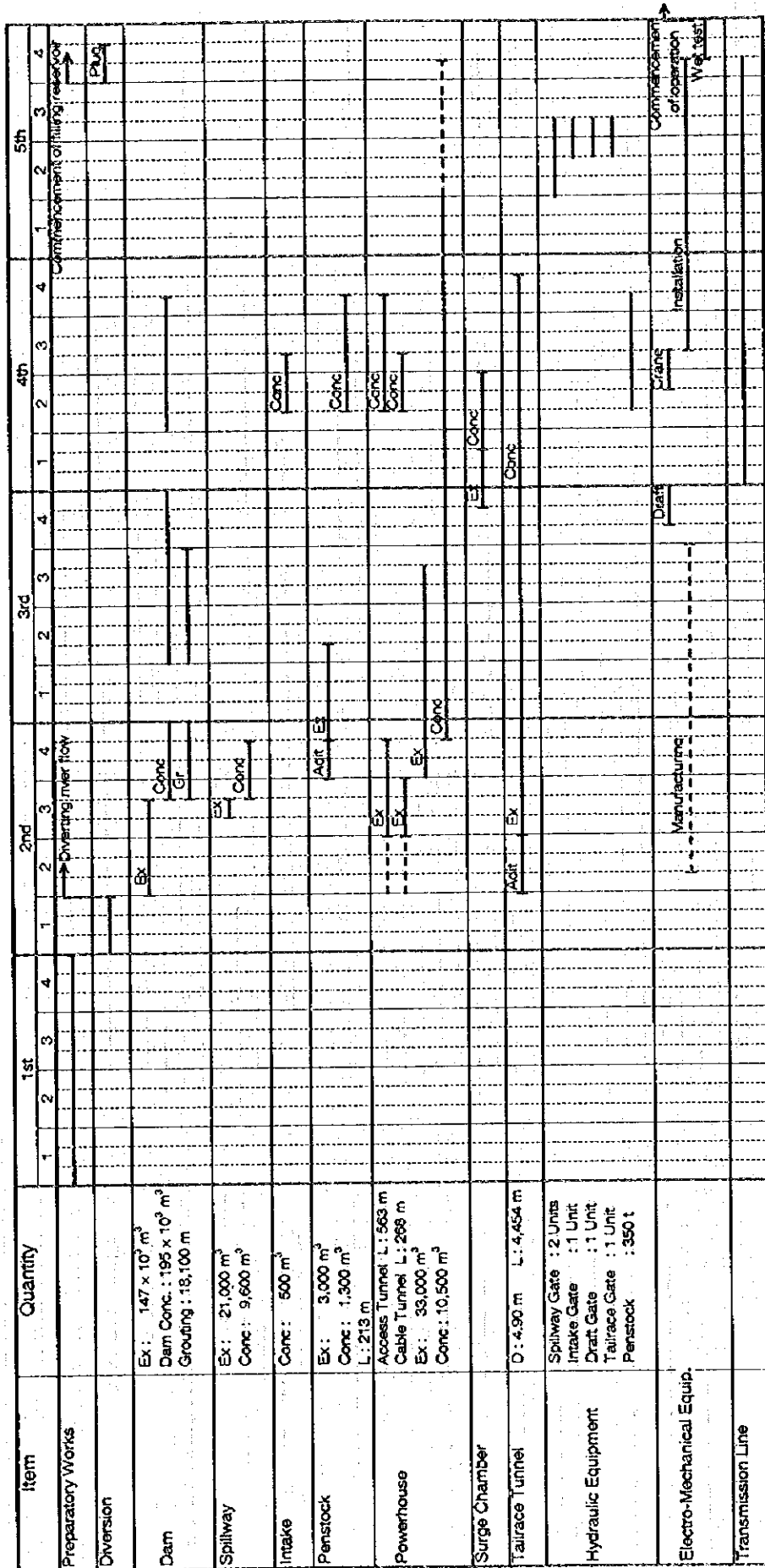


Figure 12-4 Construction Schedule of Bağlık Project

12.2 Construction Cost

The construction cost of the project was estimated carrying out studies based on design, construction methods and construction materials, etc., and commensurate with the engineering level as of the present time, taking into consideration the hydrological, geological, regional conditions of the project site, and project scale as well. The construction cost is to be calculated based on the price in January 1996. 1 US\$ = 61,000 TL.

12.2.1 Fundamental Items

(1) Items for Estimation of Construction Cost

(a) Civil Works

Care of river	:	Diversion tunnel, upstream and downstream cofferdams
Dam	:	Dam proper and foundation treatment (includes spillway and outlet facilities)
Waterway	:	Intake, penstock, surge chamber, tailrace and outlet
Powerhouse and switchyard	:	Civil and architectural works
Access road	:	Powerhouse access tunnel and others
Relocated road	:	

(b) Hydraulic equipment : Gates, penstock, etc.

(c) Electromechanical equipment : Turbine, generator, transformer, etc.

(d) Camp facilities : Camp facility, telecommunication facility and electric power facility for construction

(e) Administrative expense : Expenses required for engineering guidance concerning project, coordination and management of project, etc.

- (f) Compensation cost : Compensation for land, buildings, etc. in water impoundment area
- (g) Transmission line
- (h) Interest during construction
- (i) Contingency
- (2) Criteria of Cost Estimate
 - (a) Civil Works

Unit construction costs were determined with laborers' wages and prices of materials as bases upon comparison studies with unit construction costs of hydroelectric power stations in Turkey existing, under construction, and at sites for which feasibility studies have been completed, and referring to unit construction costs at similar sites in Japan.

(l) Unit Labor and Material Cost

As unit costs of labor and material, the primary unit costs listed in 1996 YILINA AIT AND İNŞAAT BİRİM FİYATLARINA ESAS İŞÇİLİK-ARAÇ VE GEREÇ RAYIÇ LİSTELERİ were used. The main unit costs are given in Table 12-3 and Table 12-4 and labor cost in civil works was calculated in local currency.

Table 12-3 Labor Cost

Item	Labor Cost TL/day
Foreman	919,800
Operator A	729,900
Operator B	512,900
Mechanic	641,100
Labor	419,500
Carpenter	612,600
Electrician	612,600

Table 12-4 Construction Material Cost

Item	Unit	Cost TL
Cement (bag)	t	2,000,000
Cement (bulk)	t	1,920,000
Gasoline	kg	42,500
Diesel oil	kg	26,300
Dynamite	kg	198,000
Reinforcement	t	15,587,000

Costs related to transportation of cement, reinforcing bars, and structural steel are to be calculated referring to the calculation method for transportation costs in DSI BIRIM FIYAT CETVELI 1996 and these construction material can be obtained domestically, so costs were calculated in local currency.

(II) Construction Machinery

The main construction machines such as dump trucks, bulldozers, loading machines, concrete pumps, aggregate plant, batching plant, cranes, boring machines, and grouting machines are all considered will be imported and machinery costs are calculated based on CIF Hopa Port prices, and their costs were calculated in foreign currency.

(III) Relocated Road and Access Road

The construction costs of relocated roads and access roads are calculated based on unit construction costs of the Highway Department, and their costs were calculated in local currency.

(b) Hydraulic Equipment

Penstock pipes, spillway gates, discharge facilities, intake gates, outlet gates, etc. are considered as being fabricated in Turkey, and almost equipments can be obtained domestically, so costs were calculated in local currency.

(c) Electromechanical Equipment

Electromechanical equipment such as turbines, generators, and transformers are to be imported from overseas. Transportation costs to the powerhouse site, installation costs, insurance, etc. are to be included in these costs. Electrical equipments are to be all considered as imported ones and their costs were calculated in foreign currency. But, the costs for inland transportation, installation and insurance were all in local currency.

(d) Camp Facilities

Camp Facilities include the facility for camp, telecommunication and electric power for construction.

Cost for camp facility is for offices and accommodation, telecommunication facility for wireless communication and electric power facility for transformer and its operation and maintenance for construction works. And these costs were all calculated in local currency.

But as to aggregate plant, concrete plant, roads and bridges for construction and facilities of air and water supply for construction, they are all to be included in civil work unit price as temporary equipment costs.

(e) Administrative Cost

Administrative cost including engineering fee of the project is to be 10% of the construction cost.

(f) Compensation Cost

Compensation cost such as for land acquisition was calculated based on data furnished by EIE and its cost was calculated in local currency.

The cost of relocated roads was included separately in civil works construction cost in local currency.

(g) Transmission Line Construction Cost

Transmission line construction cost was calculated referring to unit cost of TEAŞ in local currency.

(h) Import Duties and Various Taxes

Custom duties on electromechanical equipment such as turbines and generators to be imported was not considered.

(i) Contingency Cost

Contingency cost was added for each construction cost, 15% contingency cost for civil work, 10% for hydraulic equipment and 5% electro mechanical equipment including transmission line.

(j) Interest during Construction

Interest ratio 9.5% was applied for local and foreign currency, respectively. And the influence of inflation was not considered for the construction cost.

(k) Construction Cost

Table 12-5, 6 show fund requirement of each year of project and Table 12-7~12 show construction cost of civil works and hydraulic equipment.

Table 12-5 Fund Requirement of Each Year of Bayram Project

Item	Total		1st Year		2nd Year		3rd Year		4th Year		5th Year		Unit, 10 ³
	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	
Relocation Road	11,655	0	11,655	0	2,331	0	2,331	0	2,331	0	2,331	0	0
Camp Facilities	800	0	800	0	0	0	0	0	0	0	0	0	0
Civil Works	51,567	91,546	83,113	0	9,263	4,572	17,515	10,211	16,003	9,484	8,786	7,279	0
Dam	24,333	22,948	47,281	0	2,433	2,295	7,300	6,884	7,300	6,884	7,300	6,884	0
Care of River (coffer dam)	554	528	1,082	0	0	0	554	528	0	0	0	0	0
Diversion Tunnel	1,764	657	2,421	0	1,764	657	0	0	0	0	0	0	0
Outlet works	723	295	1,018	0	362	147	0	0	362	147	0	0	0
Spillway	5,617	1,905	7,523	0	1,685	572	2,809	953	1,123	381	0	0	0
Intake	623	342	965	0	187	103	125	68	312	171	0	0	0
Intake adit	95	27	122	0	0	0	95	27	0	0	0	0	0
Penstock	330	98	428	0	0	0	165	49	165	49	0	0	0
Penstock adit	93	25	118	0	0	0	93	25	0	0	0	0	0
Powerhouse	1,929	316	2,245	0	0	0	1,157	190	579	95	193	32	0
Access tunnel	1,629	455	2,083	0	407	114	407	114	814	227	0	0	0
Cable tunnel	444	123	566	0	222	61	0	0	222	61	0	0	0
Drainage tunnel	155	42	197	0	0	0	155	42	0	0	0	0	0
Surge chamber	452	131	583	0	0	0	0	0	452	131	0	0	0
Surge chamber access tunnel	20	4	24	0	0	0	0	0	0	0	0	0	0
Tailrace tunnel, outlet	11,637	3,329	14,965	0	1,164	333	4,655	1,331	4,655	1,331	1,164	333	0
Tailrace adit	1,040	291	1,330	0	1,040	291	0	0	0	0	0	0	0
Switch yard	130	31	161	0	0	0	0	0	0	0	130	31	0
Hydraulic Equipment	3,697	1,033	4,730	0	0	0	0	0	1,848	516	1,848	516	0
Electro-Mechanical Equipment	2,063	11,806	13,869	0	0	0	313	1,771	0	0	1,770	10,035	0
Transmission Line	1,140	0	1,140	0	0	0	0	0	570	0	570	0	0
Construction Cost	70,942	44,385	115,327	3,131	11,594	4,572	20,159	11,982	20,752	10,000	15,306	17,831	0
Contingency	10,134	5,426	15,560	470	1,739	686	2,992	1,620	2,963	1,474	1,969	1,645	0
Engineering and Administration Cost	8,108	4,981	13,089	360	1,333	526	2,315	1,360	2,372	1,147	1,727	1,948	0
Land Acquisition	2,242	0	2,242	2,242	0	0	0	0	0	0	0	0	0
Project Cost	91,426	54,792	146,218	6,203	14,667	5,784	25,466	14,962	26,087	12,621	19,002	21,424	0
Interest during Construction	16,100	7,742	23,842	295	1,286	275	3,192	1,260	5,641	2,570	7,686	3,637	0
Investment cost (x 10 ³ US\$)	109,525	62,534	172,060	6,498	15,953	6,059	28,658	16,222	31,728	15,191	26,688	25,061	0
Investment cost (x 10 ⁵ TL)	6,681,044	3,814,560	10,495,634	396,363	973,107	369,583	1,748,120	989,569	1,935,382	926,675	1,627,979	1,528,694	0

Table 12-6 Fund Requirement of Each Year of Bağlık Project

Item	Total		1st Year		2nd Year		3rd Year		4th Year		5th Year		Unit 10's	
	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Local Currency	Foreign Currency	Year	
Relocation Road	6,759	0	6,759	0	1,351	0	1,351	0	1,351	0	1,351	0	1,355	0
Camp Facilities	800	0	800	0	0	0	0	0	0	0	0	0	0	0
Civil Works	19,284	6,699	25,983	0	7,065	2,666	6,500	2,337	5,488	1,758	222	0	222	37
Dam	6,662	3,321	9,983	0	2,665	1,329	2,665	1,329	1,332	664	0	0	0	0
Spillway	602	178	780	0	602	178	0	0	0	0	0	0	0	0
Intake	34	6	40	0	0	0	0	0	34	6	0	0	0	0
Penstock	199	58	258	0	0	0	100	29	100	29	0	0	0	0
Penstock edit	93	25	118	0	93	25	0	0	0	0	0	0	0	0
Powerhouse	2,225	373	2,598	0	222	37	890	149	890	149	222	0	222	37
Access tunnel	1,259	357	1,616	0	1,259	357	0	0	0	0	0	0	0	0
Cable tunnel	365	106	471	0	365	106	0	0	0	0	0	0	0	0
Drainage tunnel	172	47	219	0	172	47	0	0	0	0	0	0	0	0
Surge chamber	443	128	572	0	0	0	89	26	354	103	0	0	0	0
Surge chamber access tunnel	20	4	24	0	0	0	4	1	16	4	0	0	0	0
Tailrace tunnel/outlet	6,906	2,008	8,914	0	1,381	402	2,762	803	2,762	803	0	0	0	0
Tailrace edit	306	85	391	0	306	85	0	0	0	0	0	0	0	0
Hydraulic Equipment	2,487	136	2,622	0	0	0	0	0	1,482	81	995	0	995	54
Electro-Mechanical Equipment	2,108	11,943	14,051	0	0	0	316	1,792	0	0	1,792	10,151	1,792	10,151
Transmission Line	4,250	0	4,250	0	0	0	0	0	2,125	0	2,125	0	2,125	0
Construction Cost	35,688	18,777	54,465	0	8,416	2,566	8,176	4,129	10,456	1,840	6,489	10,243	6,489	10,243
Contingency	4,593	1,616	6,209	0	1,262	385	1,195	440	1,281	272	532	519	532	519
Engineering and Administration Cost	4,028	2,039	6,067	0	968	295	937	457	1,174	211	702	1,076	702	1,076
Land Acquisition	598	0	598	0	0	0	0	0	0	0	0	0	0	0
Project Cost	44,907	22,432	67,339	0	10,646	3,246	10,308	5,020	12,911	2,323	7,720	11,838	7,720	11,838
Interest during Construction	9,515	2,609	12,124	0	821	154	1,816	547	2,919	896	3,801	1,012	3,801	1,012
Investment cost (x 10 ⁶ US\$)	54,422	25,041	79,463	0	11,467	3,400	12,124	5,573	15,630	3,219	11,524	12,850	11,524	12,850
Investment cost (x 10 ⁶ TL)	3,319,751	1,527,517	4,847,268	0	699,459	207,419	739,572	339,938	965,650	196,336	702,974	783,823	702,974	783,823

Table 12-7 Construction Cost of Civil Works (Summary) Bayram Project

NUMBER	DESCRIPTION	COST (UNIT: TL)			COST (UNIT: US\$)			TOTAL	FC	LC	TOTAL	FC	TOTAL
		IC	FC	TOTAL	IC	FC	TOTAL						
1	DAM	1,484,309,079,225	1,399,809,041,505	2,884,118,120,730	24,332,935	22,947,689	47,280,625						
2	COFFER DAM	33,782,514,310	32,212,199,545	65,994,713,855	553,811	528,069	1,081,880						
3	DIVERSION TUNNEL	107,609,117,595	40,078,666,215	147,687,783,810	1,764,084	657,027	2,421,112						
4	OUTLET WORKS	44,106,495,300	17,972,718,225	62,079,213,525	723,057	294,635	1,017,693						
5	SPILLWAY	342,655,727,610	116,227,333,320	458,883,060,930	5,617,307	1,905,367	7,522,674						
6	INTAKE	38,019,663,675	20,849,043,600	58,868,707,275	623,275	341,789	965,061						
6'	INTAKE ADIT	5,810,475,090	1,634,306,205	7,444,781,295	95,253	26,791	122,044						
7	PENSTOCK	20,113,863,670	5,964,939,290	26,078,802,960	329,735	97,786	427,521						
7'	PENSTOCK ADIT	5,658,932,790	1,542,035,775	7,200,968,565	92,769	25,279	118,048						
8	POWER HOUSE	117,673,204,425	19,299,052,815	136,972,257,240	1,929,069	316,380	2,245,447						
9	ACCESS TUNNEL	99,339,999,990	27,732,279,330	127,072,279,320	1,628,524	454,628	2,083,152						
10	CABLE TUNNEL	27,057,064,230	7,497,769,860	34,554,834,090	443,559	122,914	566,473						
11	DRAINAGE TUNNEL	9,482,756,220	2,556,389,220	12,039,145,440	155,456	41,908	197,363						
12	SURGE CHAMBER	27,563,782,995	8,021,154,435	35,584,937,430	451,865	131,495	583,359						
13	SURGE CHAMBER ACCESS TUNNEL	1,220,933,910	268,766,610	1,489,700,520	20,015	4,406	24,421						
14	TAILRACE TUNNEL. OUTLET	709,845,750,075	203,044,994,670	912,890,744,745	11,636,816	3,328,606	14,965,421						
14'	TAILRACE ADIT	63,414,239,700	17,742,279,135	81,156,518,835	1,039,577	290,857	1,330,435						
15	SWITCH YARD	7,924,880,880	1,870,926,120	9,795,807,000	129,916	30,671	160,587						
		3,145,588,481,690	1,924,323,895,875	5,069,912,377,565	51,567,023	31,546,297	83,113,316						

Table 12-8 Construction Cost of Civil Works (Summary) Bağlık Project

NUMBER	DESCRIPTION	COST (UNIT: TL)			COST (UNIT: US\$)		
		LC	FC	TOTAL	LC	FC	TOTAL
1	DAM	406,378,777,980	202,610,485,875	608,989,263,855	6,661,948	3,321,484	9,983,431
2	SPILLWAY	36,718,135,650	10,871,219,310	47,589,354,960	601,937	178,217	780,153
3	INTAKE	2,053,852,920	370,055,280	2,423,908,200	33,669	6,067	39,736
4	PENSTOCK	12,141,843,210	3,567,149,460	15,708,992,670	199,046	58,478	257,524
4*	PENSTOCK ADIT	5,658,932,790	1,542,035,775	7,200,968,565	92,769	25,279	118,048
5	POWERHOUSE	135,705,591,630	22,747,242,210	158,452,833,840	2,224,683	372,906	2,597,588
6	ACCESS TUNNEL	76,796,473,380	21,763,146,900	98,559,620,280	1,258,960	356,772	1,615,732
7	CABLE TUNNEL	22,248,045,050	6,483,933,390	28,731,978,440	364,723	106,293	471,016
8	DRAINAGE TUNNEL	10,504,968,600	2,873,001,180	13,377,969,780	172,214	47,098	219,311
9	SURGE CHAMBER	27,030,233,685	7,833,347,025	34,863,580,710	443,119	128,416	571,534
10	SURGE CHAMBER ACCESS TUNNEL	1,220,933,910	268,766,610	1,489,700,520	20,015	4,406	24,421
11	TAILRACE TUNNEL-OUTLET	421,255,005,360	122,487,394,575	543,742,399,935	6,905,820	2,007,992	8,913,810
11*	TAILRACE TUNNEL ADIT	18,637,352,265	5,195,563,065	23,832,915,330	305,530	85,173	390,703
	TOTAL	1,176,350,146,430	408,613,340,655	1,584,963,487,085	19,284,433	6,698,581	25,983,007

Table 12-9 Construction Cost of Civil Works Bayram Project (1)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:ITL)		TOTAL	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
Riverbed gravel excavation	m3	1.12	1.24	581,280	643,560	1,224,840	35,458,080,000	39,257,160,000	74,715,240,000
Common excavation	m3	1.12	1.24	49,504	54,808	104,312	3,019,744,000	3,343,288,000	6,363,032,000
Rock excavation	m3	4.41	2.12	799,533	384,356	1,183,889	48,771,513,000	23,445,716,000	72,217,229,000
Grout trench excavation	m3	6.08	3.15	31,616	16,380	47,996	1,928,576,000	999,180,000	2,927,756,000
Grout tunnel excavation	m3	22.10	16.47	121,550	90,585	212,135	7,414,550,000	5,525,685,000	12,940,235,000
Embankment impervious core	m3	2.20	3.96	1,908,060	3,434,598	5,342,658	116,391,660,000	209,504,988,000	325,896,648,000
Embankment fine filter	m3	1.60	2.93	431,520	790,221	1,221,741	26,322,720,000	48,203,481,000	74,526,201,000
Embankment coarse filter	m3	2.72	2.76	1,445,408	1,466,664	2,912,072	88,169,888,000	89,466,504,000	177,636,392,000
Embankment rockfill	m3	3.21	2.68	13,605,816	11,150,944	24,756,760	829,954,776,000	680,207,584,000	1,510,162,360,000
Embankment rip rap	m3	4.18	5.01	568,898	691,861	1,260,759	34,702,778,000	41,593,521,000	76,296,299,000
Embankment backfill	m3	1.07	2.15	74,793	150,285	225,078	4,562,373,000	9,167,385,000	13,729,758,000
Grout gallery concrete	m3	4.480	9.98	65,408	44,710	110,118	3,989,888,000	2,727,334,400	6,717,222,400
Grout tunnel concrete	m3	2.690	10.10	26,89	27,169	72,334	2,755,071,100	1,657,309,000	4,412,380,100
Mortal injection	m3	36.61	7.19	43,80	18,305	21,900	1,116,605,000	219,295,000	1,335,900,000
Drilling curtain	m	46,840	35.98	68,39	1,685,303	3,203,388	102,803,495,200	92,603,148,400	195,406,643,600
Drilling blanket	m	7,850	35.98	282,443	254,419	536,862	17,429,023,000	15,519,528,500	32,748,551,500
Drilling consolidation	m	3,860	35.98	68,39	138,883	263,985	8,471,850,800	7,631,258,600	16,103,109,400
Grouting curtain	t	4,690	143.86	336.24	674,703	902,262	1,576,966	41,356,907,400	55,037,994,200
Grouting blanket	t	400	143.86	336.24	57,544	78,952	134,496	3,510,184,000	4,694,072,000
Grouting consolidation	t	200	143.86	336.24	38,476	67,248	1,755,092,000	2,347,036,000	4,102,128,000
Reinforcement	t	360	563.00	202,680	0	202,680	12,363,480,000	0	12,363,480,000
Cement (bags)	t	8,000	44.63	357,040	0	357,040	21,779,440,000	0	21,779,440,000
Others(5t)	L.S.	1		1,158,711	1,092,747	2,251,458	70,681,384,725	66,657,573,405	137,338,958,130
Total				24,332,935	22,947,689	47,280,625	1,484,309,079,225	1,399,809,041,505	2,884,118,120,730

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:ITL)		TOTAL	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
Embankment impervious core	m3	17,500	2.20	38,500	69,300	107,800	2,348,500,000	4,227,300,000	6,575,800,000
Embankment filter	m3	18,900	2.72	51,408	52,164	103,572	3,135,888,000	3,182,004,000	6,317,892,000
Embankment rockfill	m3	72,100	3.27	235,767	193,228	428,995	14,381,787,000	11,786,908,000	26,168,695,000
Drilling blanket	m	3,390	35.98	121,972	109,870	231,842	7,440,304,200	6,702,963,900	14,142,368,100
Grouting blanket	t	180	143.86	25,895	34,628	60,523	1,579,582,800	2,112,332,400	3,691,915,200
Cement (bags)	L.S.	280	44.63	8,033	0	8,033	490,037,400	0	490,037,400
Others(15t)		1		72,236	68,879	141,115	4,406,414,910	4,201,591,245	8,608,006,155
Total				553,811	528,069	1,081,880	33,782,514,310	32,212,199,545	65,994,713,855

Table 12-9 Construction Cost of Civil Works Bayram Project (2)

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TEL)		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	7,100	1.12	1.24	2.36	7,952	8,804	16,756	485,072,000	537,044,000	1,022,116,000
Rock excavation	m3	5,600	4.41	2.12	6.53	24,696	11,872	36,568	1,506,456,000	724,192,000	2,230,648,000
Tunnel excavation	m3	27,400	32.60	9.40	42.00	893,240	257,560	1,150,800	54,487,640,000	15,711,160,000	70,198,800,000
Open concrete	m3	2,330	19.44	12.56	32.00	45,295	29,265	74,560	2,763,007,200	1,785,152,800	4,548,160,000
Tunnel lining concrete	m3	6,510	31.70	19.30	51.00	206,367	125,643	332,010	12,588,387,900	7,664,223,000	20,252,610,900
Mortal injection	m3	390	36.61	7.19	43.80	14,278	2,804	17,082	870,951,900	171,050,100	1,042,002,000
Drilling curtain	m	400	35.98	32.41	68.39	14,392	12,964	27,356	877,912,000	790,804,000	1,668,716,000
Drilling consolidation	m	2,860	35.98	32.41	68.39	102,903	92,693	195,595	6,277,070,800	5,654,248,600	11,931,319,400
Grouting curtain	t	40	143.86	192.38	336.24	5,754	7,695	13,450	351,018,400	469,407,200	820,425,600
Grouting consolidation	t	290	143.86	192.38	336.24	41,719	55,790	97,510	2,544,863,400	3,403,202,200	5,948,065,600
Rock bolt(2m)	pc	3,230	23.78	6.22	30.00	76,809	20,091	96,900	4,685,373,400	1,225,526,600	5,910,900,000
Reinforcement	t	220	563.00	0.00	563.00	123,860	0	123,860	7,555,460,000	0	7,555,460,000
Cement (bulk)	t	3,310	41.56	0.00	41.56	137,564	0	137,564	8,391,379,600	0	8,391,379,600
Others	L.S.	1				69,254	31,847	101,101	4,224,505,895	1,942,655,715	6,167,161,610
Total						2,764,084	657,027	2,421,112	107,609,117,595	40,078,666,215	147,687,783,810

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TEL)		
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Rock excavation	m3	12,200	4.41	2.12	6.53	53,802	25,864	79,666	3,281,922,000	1,577,704,000	4,859,626,000
Shaft excavation	m3	800	21.46	12.47	33.93	17,168	9,976	27,144	1,047,248,000	608,536,000	1,655,784,000
Tunnel excavation	m3	5,900	32.60	9.40	42.00	192,340	55,460	247,800	11,732,740,000	3,368,060,000	15,115,800,000
Open concrete	m3	2,910	19.44	12.56	32.00	56,570	36,550	93,120	3,450,794,400	2,229,525,600	5,680,320,000
Tunnel lining concrete	m3	1,810	31.70	19.30	51.00	57,377	34,933	92,310	3,499,997,000	2,130,913,000	5,630,910,000
Shaft lining concrete	m3	320	16.79	10.10	26.89	5,373	3,232	8,605	327,740,800	197,152,000	524,892,800
Plug concrete	m3	3,060	16.90	10.29	27.19	51,714	31,487	83,201	3,154,554,000	1,920,731,400	5,075,285,400
Rock bolt(2m)	pc	1,160	23.78	6.22	30.00	27,585	7,215	34,800	1,682,672,800	440,127,200	2,122,800,000
Mortal injection	m3	200	36.61	7.19	43.80	7,322	1,438	8,760	446,642,000	87,718,000	534,360,000
Drilling curtain	m	400	35.98	32.41	68.39	14,392	12,964	27,356	877,912,000	790,804,000	1,668,716,000
Drilling consolidation	m	1,170	35.98	32.41	68.39	42,097	37,920	80,016	2,567,892,600	2,313,101,700	4,880,994,300
Grouting curtain	t	40	143.86	192.38	336.24	5,754	7,695	13,450	351,018,400	469,407,200	820,425,600
Grouting consolidation	t	120	143.86	192.38	336.24	17,263	23,086	40,349	1,053,055,200	1,408,221,600	2,461,276,800
Reinforcement	t	90	563.00	0.00	563.00	50,670	0	50,670	3,090,870,000	0	3,090,870,000
Cement (bulk)	t	2,810	41.56	0.00	41.56	116,784	0	116,784	7,123,799,600	0	7,123,799,600
Others	L.S.	1				6,847	6,815	13,662	417,636,500	415,716,525	833,353,025
Total		82,40				723,057	294,635	1,017,693	44,106,495,300	17,972,718,225	62,079,213,525

Table 12-9 Construction Cost of Civil Works Bayram Project (3)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)		TOTAL		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
Common excavation	m ³	59,500	1.12	2.36	66,640	73,780	140,420	4,065,040,000	4,500,580,000	8,565,620,000
Rock excavation	m ³	534,900	4.41	6.53	2,358,909	1,133,988	3,492,897	143,893,449,000	69,173,268,000	213,066,717,000
Open concrete	m ³	47,710	19.44	32.00	927,482	599,238	1,526,720	56,576,426,400	36,553,493,600	93,129,920,000
Shotcrete	m ²	2,560	8.43	11.41	21,581	7,629	29,210	1,316,428,800	465,356,800	1,781,785,600
Reinforcement	t	2,390	563.00	0.00	1,345,570	0	1,345,570	82,079,770,000	0	82,079,770,000
Cement (bulk)	t	15,150	41.56	0.00	629,634	0	629,634	38,407,674,000	0	38,407,674,000
Others(%)	L.S.	1			267,491	90,732	358,223	16,316,939,410	5,534,634,920	21,851,574,330
Total					5,617,307	1,905,367	7,522,674	342,655,727,610	116,227,333,320	458,883,060,930

(6) INTAKE (INCLUDING INTAKE TUNNEL)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)		TOTAL		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
Common excavation	m ³	90,100	1.12	2.36	100,912	111,724	212,636	6,155,632,000	6,815,164,000	12,970,796,000
Rock excavation	m ³	12,100	4.41	6.53	53,361	25,652	79,013	3,255,021,000	1,564,772,000	4,819,793,000
Tunnel excavation	m ³	1,600	32.60	42.00	52,160	15,040	67,200	3,281,760,000	917,440,000	4,099,200,000
Shaft excavation	m ³	1,200	21.46	33.93	25,752	14,964	40,716	1,570,872,000	912,804,000	2,483,676,000
Open concrete	m ³	6,170	19.44	32.00	119,945	77,495	197,440	7,316,632,800	4,727,207,200	12,043,840,000
Tunnel lining concrete	m ³	850	31.70	51.00	26,945	16,405	43,350	1,643,645,000	1,000,705,000	2,644,350,000
Shaft lining concrete	m ³	740	16.79	26.89	12,425	7,474	19,899	757,900,600	455,914,000	1,213,814,600
Reinforcement	t	90	563.00	0.00	50,670	0	50,670	3,090,870,000	0	3,090,870,000
Rock bolt(2m)	pc	370	23.78	6.22	8,799	2,301	11,100	536,714,600	140,385,400	677,100,000
Drilling consolidation	m	1,170	35.98	68.39	42,097	37,920	80,016	2,567,892,600	2,313,101,700	4,880,994,300
Grouting consolidation	t	120	143.86	336.24	17,263	23,086	40,349	1,053,055,200	1,408,221,600	2,461,276,800
Mortal injection	m ³	50	36.61	43.80	1,831	360	2,190	111,660,500	21,929,500	133,590,000
Cement (bulk)	t	2,530	41.56	0.00	105,147	0	105,147	6,413,954,800	0	6,413,954,800
Others	L.S.	1			5,968	9,368	15,335	364,052,575	571,399,200	935,451,775
Total					623,275	342,789	966,061	38,019,663,675	20,849,043,600	58,868,707,275

Table 12-9 Construction Cost of Civil Works Bayram Project (4)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
(6.) INTAKE ADIT (1-100m)							
Tunnel excavation	m3	32.60	9.40	52,160	15,040	3,181,760,000	917,440,000
Tunnel invert concrete	m3	12.77	12.85	25,62	1,542	93,476,400	94,062,000
Shotcrete	m2	8.43	2.98	11.41	3,338	575,937,600	203,593,600
Plug concrete.	m3	16.90	10.29	27.19	2,984	298,961,000	182,030,100
Reinforcement	t	563.00	0.00	563.00	0	343,430,000	0
Rock bolt(2m)	pc	23.78	6.22	30.00	9,988	609,243,600	159,356,400
Cement (bulk)	t	41.56	0.00	41.56	0	430,977,200	0
Others(5%)	L.S.			4,535	1,275	276,689,290	77,824,105
Total				95,253	26,791	5,810,475,090	1,634,306,205

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
(7.) PENSTOCK							
Tunnel horizontal excavation	m3	32.60	9.40	42.00	20,340	2,187,460,000	630,740,000
Tunnel inclined excavation	m3	48.90	14.10	63.00	52,170	11,036,730,000	3,182,370,000
Tunnel filling concrete	m3	16.90	10.29	27.19	23,461	2,350,452,000	1,431,133,200
Rock bolt(2m)	pc	23.78	6.22	30.00	7,651	36,900	466,686,600
Cement (bulk)	t	41.56	0.00	41.56	0	1,901,370,000	0
Others(5%)	L.S.			13,994	4,164	853,638,270	254,009,490
Total				329,735	97,786	20,113,963,670	5,964,939,290

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
(7.) PENSTOCK ADIT (1-100m)							
Tunnel excavation	m3	32.60	9.40	42.00	15,040	3,181,760,000	917,440,000
Tunnel invert concrete	m3	12.77	12.85	25.62	1,542	93,476,400	94,062,000
Shotcrete	m2	8.43	2.98	11.41	3,338	575,937,600	203,593,600
Plug concrete	m3	16.90	10.29	27.19	1,544	154,635,000	94,153,500
Reinforcement	t	563.00	0.00	563.00	0	343,430,000	0
Rock bolt(2m)	pc	23.78	6.22	30.00	9,988	609,243,600	159,356,400
Cement (bulk)	t	41.56	0.00	41.56	0	430,977,200	0
Others(5%)	L.S.			4,417	1,203	269,472,990	73,430,275
Total				92,769	25,279	5,658,932,790	1,542,035,775

Table 12-9 Construction Cost of Civil Works Bayram Project (5)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:USS)			COST(UNIT:USS)			COST(UNIT:TL)		
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
		m3	31.60	9.40	42.00	195,600	56,400	252,000	11,931,600,000	3,440,400,000
Arch excavation	6,000									
m3	13.70	4.30	18.00	283,590	89,010	372,600	17,298,990,000	5,429,610,000	22,728,600,000	
Bench excavation	20,700									
m3	27.75	7.25	35.00	50,783	13,268	64,050	3,097,732,500	809,317,500	3,907,050,000	
Arch concrete	1,830									
m3	23.63	12.37	36.00	37,489	38,471	111,960	4,482,847,300	2,346,712,700	6,829,560,000	
Wall concrete	3,110									
m3	21.61	7.19	29.00	37,077	12,223	49,300	2,261,697,000	745,603,000	3,007,300,000	
Foundation concrete	1,700									
m3	32.95	7.05	40.00	33,280	7,121	40,400	2,030,049,500	434,350,500	2,464,400,000	
Slab/Pier concrete	1,010									
m3	21.81	7.19	29.00	31,188	10,282	41,470	1,902,486,300	627,183,700	2,529,670,000	
Barrel concrete	1,430									
t	563.00	0.00	563.00	422,250	0	422,250	25,757,250,000	0	25,757,250,000	
Reinforcement	750									
pc	43.60	11.40	55.00	41,420	10,830	52,250	2,526,620,000	660,630,000	3,187,250,000	
Rock bolt (5m)	950									
pc	959.23	111.77	1,071.00	105,515	12,295	117,810	6,436,433,300	749,976,700	7,186,410,000	
P.C Anchor(10m)	110									
pc	1,918.46	223.54	2,142.00	441,246	51,414	492,660	26,915,993,800	3,136,266,200	30,052,260,000	
P.C Anchor(20m)	230									
t	41.56	0.00	41.56	121,771	0	121,771	7,428,018,800	919,002,515	8,347,021,315	
Cement (bulk)	2,930									
L.S.	1									
Others(5%)										
Total				1,929,069	316,380	2,245,447	117,673,204,425	19,299,052,815	136,972,257,240	

(9) ACCESS TUNNEL

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:USS)			COST(UNIT:USS)			COST(UNIT:TL)		
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
		m3	1.12	1.24	2.36	224	248	472	13,664,000	15,128,000
Common excavation	200									
m3	4.41	2.12	6.53	7,056	3,392	10,448	430,416,000	206,912,000	637,328,000	
Rock excavation	1,600									
m3	32.60	9.40	42.00	899,980	256,620	1,146,600	54,288,780,000	15,653,820,000	69,942,600,000	
Tunnel excavation	27,300									
m3	19.44	12.56	32.00	6,998	4,522	11,520	426,902,400	275,817,600	702,720,000	
Open concrete	360									
m3	31.70	19.30	51.00	221,583	134,907	356,490	13,516,563,000	8,229,327,000	21,745,890,000	
Tunnel lining concrete	6,990									
t	563.00	0.00	563.00	163,270	0	163,270	9,959,470,000	0	9,959,470,000	
Reinforcement	290									
m3	36.61	7.19	43.80	49,790	9,778	59,568	3,037,165,600	596,482,400	3,633,648,000	
Mortal injection	1,360									
pc	23.78	6.22	30.00	89,898	23,512	113,400	5,483,192,400	1,434,207,600	6,917,400,000	
Rock bolt(2m)	3,780									
t	41.56	0.00	41.56	122,186	0	122,186	7,453,370,400	0	7,453,370,400	
Cement (bulk)	2,940									
L.S.	1									
Others(5%)										
Total				1,628,524	454,628	2,083,152	99,339,999,990	27,732,279,330	127,072,279,320	

Table 12-9 Construction Cost of Civil Works Bayram Project (6)

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TL)		
			LOCAL		FOREIGN	LOCAL		FOREIGN	LOCAL		FOREIGN
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	100	1.22	1.24	2.36	112	124	236	6,832,000	7,564,000	14,396,000
Rock excavation	m3	700	4.41	2.12	6.53	3,087	1,484	4,571	188,307,000	90,524,000	278,831,000
Tunnel excavation	m3	7,100	32.60	9.40	42.00	231,460	66,740	298,200	14,119,060,000	4,071,140,000	18,190,200,000
Open concrete	m3	230	19.44	12.56	32.00	4,471	2,889	7,360	272,743,200	176,216,800	448,960,000
Tunnel lining concrete	m3	1,730	31.70	19.30	51.00	54,841	33,389	88,230	3,345,301,000	2,036,729,000	5,382,030,000
Reinforcement	t	80	563.00	0.00	563.00	45,040	0	45,040	2,747,440,000	0	2,747,440,000
Mortal injection	m3	380	36.61	7.19	43.80	13,912	2,732	16,644	848,619,800	166,664,200	1,015,284,000
Rock bolt(2m)	pc	1,560	23.78	6.22	30.00	37,097	9,703	46,800	2,262,904,800	591,895,200	2,854,800,000
Cement (bulk)	t	780	41.56	0.00	41.56	32,417	0	32,417	1,977,424,800	0	1,977,424,800
Others(5%)	L.S.	1				21,122	5,853	26,975	1,288,431,630	357,036,660	1,645,468,290
Total						443,559	122,914	566,473	27,957,064,230	7,497,769,860	34,554,834,090

(11) DRAINAGE TUNNEL

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TL)		
			LOCAL		FOREIGN	LOCAL		FOREIGN	LOCAL		FOREIGN
			LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Tunnel excavation	m3	2,400	32.60	9.40	42.00	78,240	22,560	100,800	4,772,640,000	1,376,160,000	6,148,800,000
Tunnel lining concrete	m3	630	31.70	19.30	51.00	19,971	12,159	32,130	1,218,231,000	741,699,000	1,959,930,000
Reinforcement	t	30	563.00	0.00	563.00	16,890	0	16,890	1,030,290,000	0	1,030,290,000
Mortal injection	m3	160	36.61	7.19	43.80	5,858	1,150	7,008	357,313,600	70,174,400	427,488,000
Rock bolt(2m)	pc	650	23.78	6.22	30.00	15,457	4,043	19,500	942,877,000	246,623,000	1,189,500,000
Cement (bulk)	t	280	41.56	0.00	41.56	11,637	0	11,637	709,844,800	0	709,844,800
Others(5%)	L.S.	1				7,403	1,996	9,398	451,559,820	121,732,820	573,292,640
Total						155,456	41,908	197,363	9,482,756,220	2,556,389,220	12,039,145,440

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

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TEL)			
		LOCAL		FOREIGN	LOCAL		FOREIGN	LOCAL		FOREIGN	
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	
Tunnel excavation	m3	5,300	32.60	9.40	42.00	172,780	49,820	222,600	10,539,580,000	3,039,020,000	13,578,600,000
Tunnel lining concrete	m3	2,360	31.70	19.30	51.00	74,812	45,568	120,380	4,563,532,000	2,778,428,000	7,341,960,000
Reinforcement	t	180	563.00	0.00	563.00	101,340	0	101,340	6,181,740,000	0	6,181,740,000
Mortal injection	m3	90	36.61	7.19	43.80	3,295	647	3,942	200,988,900	39,473,100	240,462,000
Drilling consolidation	m	380	35.98	32.41	68.39	13,672	12,316	25,988	834,016,400	751,263,800	1,585,280,200
Grouting consolidation	t	60	143.86	192.38	336.24	8,632	11,543	20,174	526,527,600	704,110,800	1,230,638,400
Rock bolt(2m)	PC	550	23.78	6.22	30.00	13,079	3,421	16,500	797,819,000	208,681,000	1,006,500,000
Rock bolt(5m)	PC	170	43.60	11.40	55.00	7,412	1,938	9,350	452,132,000	118,218,000	570,350,000
Cement (bulk)	t	850	41.56	0.00	41.56	35,326	0	35,326	2,154,886,000	0	2,154,886,000
Others(5%)	L.S.	1			41.56	21,517	6,262	27,779	1,312,561,095	381,959,735	1,694,520,830
Total						451,865	131,495	583,359	27,563,782,995	8,021,154,435	35,584,937,430

(13) SURGE CHAMBER ACCESS TUNNEL

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)			COST(UNIT:US\$)			COST(UNIT:TEL)			
		LOCAL		FOREIGN	LOCAL		FOREIGN	LOCAL		FOREIGN	
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	
Tunnel excavation	m3	200	32.60	9.40	42.00	6,520	1,880	8,400	397,720,000	114,680,000	512,400,000
Tunnel lining concrete	m3	90	31.70	19.30	51.00	2,853	1,737	4,590	174,033,000	105,957,000	279,990,000
Reinforcement	t	10	563.00	0.00	563.00	5,630	0	5,630	343,430,000	0	343,430,000
Mortal injection	m3	20	36.61	7.19	43.80	732	144	876	44,664,200	8,771,800	53,436,000
Rock bolt(2m)	PC	70	23.78	6.22	30.00	1,665	435	2,100	101,540,600	26,559,400	128,100,000
Cement (bulk)	t	40	41.56	0.00	41.56	1,662	0	1,662	101,406,400	0	101,406,400
Others(5%)	L.S.	1			41.56	953	210	1,163	58,139,710	12,798,410	70,938,120
Total						20,015	4,406	24,421	1,220,933,910	268,766,610	1,489,700,520

Table 12-9 Construction Cost of Civil Works Bayram Project (8)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:USS)		COST(UNIT:USS)		COST(UNIT:TL)		TOTAL	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
Common excavation	m3	1.12	1.24	2.36	248	472	13,664,000	15,128,000	28,792,000
Rock excavation	m3	4.41	2.12	6.53	3,604	11,301	457,317,000	219,844,000	677,161,000
Tunnel excavation	m3	212,000	9.40	42.00	6,911,200	8,904,000	421,583,200,000	121,560,800,000	543,144,000,000
Open concrete	m3	450	19.44	32.00	8,748	5,652	533,628,000	344,772,000	878,400,000
Tunnel lining concrete	m3	30,180	31.70	51.00	956,706	582,474	58,359,066,000	35,530,914,000	93,889,980,000
Tunnel invert concrete	m3	7,410	12.77	25.62	94,626	95,219	5,772,167,700	5,808,328,500	11,580,496,200
Shotcrete	m2	58,330	6.43	11.41	491,722	173,823	29,995,035,900	10,603,227,400	40,598,263,300
Reinforcement	t	1,210	563.00	0.00	563.00	0	41,555,030,000	0	41,555,030,000
Mortal injection	m3	3,970	36.61	7.19	43.80	173,886	8,865,843,700	1,741,202,300	10,607,046,000
Rock bolt(2m)	pc	46,260	23.78	6.22	1,100,063	287,737	67,103,830,800	17,551,969,200	84,655,800,000
Cement (bulk)	t	16,490	41.56	0.00	685,324	0	41,804,788,400	0	41,804,788,400
Others(5%)	L.S.	1			554,134	158,505	33,802,178,575	9,668,809,270	43,470,987,845
Total					11,636,816	3,328,606	709,845,750,075	203,044,994,670	912,890,744,745

(14') TAILRACE ADIT (L=1,250m : 740+510)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:USS)		COST(UNIT:USS)		COST(UNIT:TL)		TOTAL	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN		
Tunnel excavation	m3	19,400	32.60	42.00	632,440	182,360	38,578,840,000	11,123,960,000	49,702,800,000
Tunnel invert concrete	m3	1,500	12.77	25.62	19,155	19,275	1,168,455,000	1,175,775,000	2,344,230,000
Shotcrete	m2	13,900	8.43	11.41	117,177	41,422	7,147,797,000	2,526,742,000	9,674,539,000
Plug concrete	m3	150	16.90	27.19	2,535	1,544	154,635,000	94,153,500	248,788,500
Reinforcement	t	60	563.00	0.00	33,780	0	2,060,580,000	0	2,060,580,000
Rock bolt(2m)	pc	5,210	23.78	6.22	123,894	32,406	7,557,521,800	1,976,778,200	9,534,300,000
Cement (bulk)	t	2,470	41.56	0.00	61,093	0	3,726,685,200	0	3,726,685,200
Others(5%)	L.S.	1			49,503	13,850	3,019,725,700	844,870,435	3,864,596,135
Total					1,039,577	290,857	63,414,239,700	17,742,279,135	81,156,518,835

Table 12-9 Construction Cost of Civil Works Bayram Project (9)

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT,US\$)		COST(UNIT,US\$)		COST(UNIT,TL)			
			LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN	TOTAL	
Common excavation	m3	3,400	1.12	1.24	3,808	4,216	8,024	232,288,000	257,176,000	489,464,000
Culvert concrete	m3	390	19.44	12.56	7,582	4,898	12,480	462,477,600	298,802,400	761,280,000
Foundation concrete	m3	1,600	19.44	12.56	31,104	20,096	51,200	1,897,344,000	1,225,856,000	3,123,200,000
Reinforcement	t	100	563.00	0.00	56,300	0	56,300	3,434,300,000	0	3,434,300,000
Cement (bulk)	t	600	41.56	0.00	24,936	0	24,936	1,521,096,000	0	1,521,096,000
Others(SA)	L.S.	1			6,186	1,461	7,647	377,375,280	89,091,720	466,467,000
Total					129,916	30,671	160,587	7,924,880,880	1,870,926,120	9,795,807,000

Table 12-10 Construction Cost of Hydraulic Equipment Bayram Project

HYDRAULIC EQUIPMENT ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)		TOTAL			
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN				
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL				
Diversion gate	t	10	4,000.00	0.00	4,000.00	40,000	0	40,000	2,440,000,000	0	2,440,000,000
Spillway gate	t	150	5,440.00	0.00	5,440.00	816,000	0	816,000	49,776,000,000	0	49,776,000,000
Outlet Valve1	t	30	2,112.00	8,448.00	10,560.00	63,360	253,440	316,800	3,864,960,000	15,459,840,000	19,324,800,000
Outlet Valve2	t	20	2,112.00	8,448.00	10,560.00	42,240	168,960	211,200	2,576,640,000	10,305,560,000	12,882,200,000
Intake gate	t	90	1,696.00	6,784.00	8,480.00	152,640	610,560	763,200	9,311,040,000	37,244,160,000	46,555,200,000
Drift gate	t	20	6,080.00	0.00	6,080.00	121,600	0	121,600	7,417,600,000	0	7,417,600,000
Steel penstock	t	600	4,000.00	0.00	4,000.00	2,400,000	0	2,400,000	146,400,000,000	0	146,400,000,000
Tailrace gate	t	10	6,080.00	0.00	6,080.00	60,800	0	60,800	3,708,800,000	0	3,708,800,000
Total						3,696,640	1,032,960	4,729,600	225,495,040,000	63,010,560,000	288,505,600,000

Table 12-11 Construction Cost of Civil Works Bağlık Project (1)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)		TOTAL		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL			
Common excavation	m3	6.300	1.12	1.24	7.056	7.812	14.868	430,416,000	476,532,000	906,948,000
Rock excavation	m3	139,800	4.41	2.12	616,518	296,376	912,894	37,607,598,000	18,078,936,000	55,686,534,000
Dam Concrete	m3	194,960	15.80	10.20	3,080,368	1,988,592	5,068,960	187,902,448,000	121,304,112,000	309,206,560,000
Grout tunnel excavation	m3	500	22.10	16.47	11,050	8,235	19,285	674,050,000	502,335,000	1,176,385,000
Grout tunnel concrete	m3	150	16.79	10.10	2,519	1,515	4,034	153,628,500	92,415,000	246,043,500
Drilling curtain	m	10,370	35.98	32.41	368,339	336,092	704,431	22,759,868,600	20,501,593,700	43,261,462,300
Drilling consolidation	m	7,690	35.98	32.41	275,686	249,233	524,919	16,877,858,200	15,203,206,900	32,081,065,100
Grouting curtain	t	1,040	143.86	192.38	199,958	200,075	399,933	9,126,478,400	12,204,587,200	21,331,065,600
Grouting consolidation	t	390	143.86	192.38	56,529	75,028	131,557	3,422,429,400	4,576,720,200	7,999,149,600
Reinforcement	t	10	563.00	0.00	5,630	0	5,630	343,430,000	0	343,430,000
Mortal injection	m3	50	36.61	7.19	1,831	360	2,191	111,660,500	21,929,500	133,590,000
Cement (bulk)	t	42,450	41.56	0.00	1,764,222	0	1,764,222	107,617,542,000	0	107,617,542,000
Others(%)	L.S.	1			317,236	158,166	475,401	19,351,370,380	9,648,118,375	28,999,488,755
Total					6,661,948	3,321,484	9,983,431	406,378,777,980	202,610,485,875	608,989,263,855

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)		TOTAL		
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL			
Common excavation	m3	10,200	1.12	1.24	11,424	12,648	24,072	696,864,000	771,528,000	1,468,392,000
Rock excavation	m3	10,400	4.41	2.12	45,864	22,048	67,912	2,797,704,000	1,344,928,000	4,142,632,000
Backfill	m3	6,900	1.07	2.15	7,383	14,835	22,218	450,363,000	904,935,000	1,355,298,000
Open concrete	m3	9,570	19.44	12.56	186,041	120,199	306,240	11,348,488,800	7,332,152,200	18,680,640,000
Reinforcement	t	350	563.00	0.00	197,050	0	197,050	12,020,050,000	0	12,020,050,000
Cement (bulk)	t	3,020	41.56	0.00	125,511	0	125,511	7,656,183,200	0	7,656,183,200
Others(%)	L.S.	1			28,664	8,487	37,151	1,748,482,650	517,677,110	2,266,159,760
Total					601,937	178,217	780,153	36,718,135,650	10,871,219,310	47,589,354,960

Table 12-11 Construction Cost of Civil Works Bağlık Project (2)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
Open concrete	m3	19.44	12.56	8,942	5,778	14,720	545,486,400
Reinforcement	t	563.00	0.00	16,890	0	16,890	1,030,290,000
Cement (bulk)	t	41.56	0.00	6,234	0	6,234	380,274,000
Others(5%)	L.S.			1,603	289	1,892	97,802,520
Total				33,669	6,067	39,736	2,053,852,920
							370,055,280
							2,423,908,200

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
Tunnel excavation	m3	32.60	9.40	29,340	8,460	37,800	1,789,740,000
Shaft excavation	m3	48.90	14.10	97,800	28,200	126,000	5,965,800,000
Tunnel filling concrete	m3	16.90	10.29	21,970	13,377	35,347	1,340,170,000
Mortal Injection	m3	36.61	7.19	2,197	431	2,628	133,992,600
Rock bolt(2m)	pc	23.78	6.22	19,975	5,225	25,200	1,218,487,200
Cement (bulk)	t	41.56	0.00	18,286	0	18,286	1,115,470,400
Others(5%)	L.S.			9,478	2,785	12,263	578,183,010
Total				199,046	58,478	257,524	12,141,843,210
							3,567,149,460
							15,708,992,670

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
Tunnel excavation	m3	32.60	9.40	52,160	15,040	67,200	3,181,760,000
Tunnel invert concrete	m3	12.77	12.85	1,532	1,542	3,074	93,476,400
Shotcrete	m2	8.43	2.98	9,442	3,338	12,779	575,937,600
Plug concrete	m3	16.90	10.29	2,535	1,544	4,079	154,635,000
Reinforcement	t	563.00	0.00	5,630	0	5,630	343,430,000
Rock bolt(2m)	pc	23.78	6.22	9,988	2,612	12,600	609,243,600
Cement (bulk)	t	41.56	0.00	7,065	0	7,065	430,977,200
Others(5%)	L.S.			4,417	1,203	5,621	269,472,990
Total				92,769	25,279	118,048	5,658,932,790
							1,542,035,775
							7,200,968,565

Table 12-11 Construction Cost of Civil Works Bağlık Project (3)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)				COST(UNIT:US\$)				COST(UNIT:TTL)			
		LOCAL		FOREIGN		LOCAL		FOREIGN		LOCAL		FOREIGN	
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Arch excavation	m3	9,000	32.60	9.40	42.00	260,800	75,200	336,000	15,908,800,000	4,587,200,000	20,496,000,000		
Bench excavation	m3	24,600	13.70	4.30	18.00	337,020	105,780	442,800	20,558,220,000	6,452,580,000	27,010,800,000		
Arch concrete	m3	2,130	27.75	7.25	35.00	59,108	15,443	74,550	3,605,557,500	941,992,500	4,547,550,000		
Wall concrete	m3	3,380	23.63	12.37	36.00	79,869	41,811	121,680	4,872,033,400	2,550,446,600	7,422,480,000		
Foundation concrete	m3	2,150	21.81	7.19	29.00	46,892	15,459	62,350	2,860,381,500	942,968,500	3,803,350,000		
Slab/Pier concrete	m3	1,220	32.95	7.05	40.00	40,199	8,601	48,800	2,452,139,000	524,661,000	2,976,800,000		
Barrel concrete	m3	1,580	21.81	7.19	29.00	34,460	11,360	45,820	2,102,047,800	692,972,200	2,795,020,000		
Reinforcement	t	850	563.00	0.00	563.00	478,550	0	478,550	29,191,550,000	0	29,191,550,000		
Rock bolt (5m)	pc	1,070	43.60	11.40	55.00	46,852	12,198	58,850	2,845,772,000	744,078,000	3,589,850,000		
P.C Anchor(10m)	pc	120	939.23	111.77	1,071.00	115,108	13,412	128,520	7,021,569,600	818,156,400	7,839,720,000		
P.C Anchor(20m)	pc	250	1,918.46	223.54	2,142.00	479,615	55,885	535,500	29,256,515,000	3,408,985,000	32,665,500,000		
Cement (bulk)	t	3,380	41.56	0.00	41.56	140,473	0	140,473	8,568,840,800	0	8,568,840,800		
Others(5%)	L.S.	1				105,937	17,757	123,695	6,462,171,030	1,083,202,010	7,545,373,040		
Total						2,224,683	372,906	2,597,588	135,705,591,630	22,747,242,210	158,452,833,840		

(6) ACCESS TUNNEL

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)				COST(UNIT:US\$)				COST(UNIT:TTL)			
		LOCAL		FOREIGN		LOCAL		FOREIGN		LOCAL		FOREIGN	
		LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Common excavation	m3	600	1.12	1.24	2.36	672	744	1,416	40,992,000	45,384,000	86,376,000		
Rock excavation	m3	5,200	4.41	2.12	6.53	22,932	11,024	33,956	1,398,852,000	672,464,000	2,071,316,000		
Tunnel excavation	m3	17,000	32.60	9.40	42.00	554,200	159,800	714,000	33,806,200,000	9,747,800,000	43,554,000,000		
Open concrete	m3	490	19.44	12.56	32.00	9,526	6,154	15,680	581,061,600	375,418,400	956,480,000		
Tunnel lining concrete	m3	4,350	31.70	19.30	51.00	137,895	83,955	221,850	8,411,595,000	5,121,255,000	13,532,850,000		
Reinforcement	t	180	563.00	0.00	563.00	101,340	0	101,340	6,181,740,000	0	6,181,740,000		
Mortal injection	m3	850	36.61	7.19	43.80	31,119	6,111	37,230	1,898,228,500	372,801,500	2,271,030,000		
Rock bolt(2m)	pc	2,350	23.78	6.22	30.00	55,883	14,617	70,500	3,408,863,000	891,637,000	4,300,500,000		
Cement (bulk)	t	1,900	41.56	0.00	41.56	78,964	0	78,964	4,816,804,000	0	4,816,804,000		
Others	L.S.	1				266,429	74,367	340,796	16,252,137,280	4,536,387,000	20,788,524,280		
Total						1,258,960	356,772	1,615,732	76,796,673,380	21,763,146,900	98,559,820,280		

Table 12-11 Construction Cost of Civil Works Bağlık Project (4)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)				
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL			
Common excavation	m3	1.12	1.24	2.36	560	620	1,180	34,160,000	37,820,000	71,980,000
Rock excavation	m3	4.42	2.12	6.53	19,404	9,328	28,732	1,183,648,000	569,098,000	1,752,652,000
Tunnel excavation	m3	5.100	9.40	42.00	166,260	47,940	214,200	10,141,860,000	2,924,340,000	13,066,200,000
Open concrete	m3	470	19.44	32.00	9,137	5,903	15,040	557,348,800	360,095,200	917,440,000
Tunnel lining concrete	m3	1,240	31.70	51.00	39,308	23,932	63,240	2,397,788,000	1,459,852,000	3,857,640,000
Reinforcement	t	60	563.00	0.00	33,780	0	33,780	2,060,580,000	0	2,060,580,000
Mortal injection	m3	270	36.61	43.80	9,885	1,941	11,826	602,966,700	118,419,300	721,386,000
Rock bolt(2m)	pc	1,120	23.78	30.00	26,634	6,966	33,600	1,624,649,600	424,950,400	2,049,600,000
Cement (bulk)	t	640	41.56	41.56	26,598	0	26,598	1,622,502,400	0	1,622,502,400
Others(10%)	L.S.	1			33,157	9,663	42,820	2,022,549,550	589,448,490	2,611,998,040
Total					364,723	106,293	471,016	22,248,045,050	6,483,933,390	28,731,978,440

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)				
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN			
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL			
Tunnel excavation	m3	2,700	32.60	42.00	88,020	25,980	113,400	5,369,220,000	1,548,180,000	6,917,400,000
Tunnel lining concrete	m3	710	31.70	51.00	22,507	13,703	36,210	1,372,927,000	835,883,000	2,208,810,000
Reinforcement	t	30	563.00	0.00	16,890	0	16,890	1,030,290,000	0	1,030,290,000
Mortal injection	m3	180	36.61	43.80	6,590	1,294	7,884	401,977,800	78,946,200	480,924,000
Rock bolt(2m)	pc	720	23.78	30.00	17,122	4,478	21,600	1,044,417,600	273,182,400	1,317,600,000
Cement (bulk)	t	310	41.56	41.56	12,884	0	12,884	785,899,600	0	785,899,600
Others(5%)	L.S.	1			8,201	2,243	10,443	500,236,600	136,809,580	637,046,180
Total					172,214	47,098	219,311	10,504,968,600	2,873,001,180	13,377,969,780

Table 12-11 Construction Cost of Civil Works Bağlık Project (5)

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
Tunnel excavation	m3	32.60	9.40	169,520	48,680	218,400	2,981,680,000
Tunnel lining concrete	m3	31.70	19.30	71,642	43,618	115,260	2,660,698,000
Reinforcement	t.	563.00	0.00	101,340	0	101,340	0
Mortal injection	m3	36.61	7.19	3,295	647	3,942	39,473,100
Drilling consolidation	m	35.98	32.41	13,672	12,316	25,988	751,263,800
Grouting consolidation	t	143.86	192.38	336.24	8,632	20,174	704,110,800
Rock bolt(2m)	pc	23.78	6.22	12,841	3,359	16,200	204,886,800
Rock bolt(5m)	pc	43.60	11.40	7,412	1,938	9,350	118,218,000
Cement (bulk)	t	41.56	0.00	33,664	0	33,664	0
Others(%)	L.S.	1		21,401	6,115	27,216	373,016,525
Total				443,119	128,416	571,534	7,833,347,025

ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)	
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN
Tunnel excavation	m3	32.60	9.40	6,520	1,880	8,400	114,680,000
Tunnel lining concrete	m3	31.70	19.30	2,853	3,737	4,590	105,957,000
Reinforcement	t	563.00	0.00	5,630	0	5,630	0
Mortal injection	m3	36.61	7.19	732	144	876	8,771,800
Rock bolt(2m)	pc	23.78	6.22	1,665	455	2,100	26,559,400
Cement (bulk)	t	41.56	0.00	1,662	0	1,662	0
Others(%)	L.S.	1		953	210	1,163	12,798,410
Total				20,015	4,406	24,421	268,766,610

Table 12-11 Construction Cost of Civil Works Bağlık Project (6)

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)			
			LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN	TOTAL	
(11) TAILRACE TUNNEL, OUTLET										
Common excavation	m3	200	1.12	1.24	2.36	248	472	13,664,000	15,128,000	28,792,000
Rock excavation	m3	2,500	4.41	2.12	6.53	3,180	9,795	403,515,000	193,980,000	597,495,000
Tunnel excavation	m3	140,800	32.60	9.40	42.00	4,590,080	3,223,520	279,994,880,000	80,734,720,000	360,729,600,000
Open concrete	m3	560	19.44	12.56	32.00	10,886	7,034	664,070,400	429,049,600	1,093,120,000
Tunnel lining concrete	m3	7,870	31.70	19.30	51.00	249,479	151,891	15,218,219,000	9,285,351,000	24,503,570,000
Tunnel invert concrete	m3	7,150	12.77	12.85	25.62	91,306	91,878	5,569,635,500	5,604,527,500	11,174,163,000
Shotcrete	m2	55,870	8.43	2.98	11.41	470,984	166,493	28,730,030,100	10,156,048,600	38,886,078,700
Reinforcement	t	320	563.00	0.00	563.00	180,160	0	10,989,760,000	0	10,989,760,000
Mortar injection	m3	900	36.61	7.19	43.80	32,949	6,471	2,009,889,000	394,731,000	2,404,620,000
Rock bolt(2m)	pc	25,990	23.78	6.22	30.00	618,042	161,658	37,700,574,200	9,861,125,800	47,561,700,000
Cement (bulk)	t	7,850	41.56	0.00	41.56	326,246	0	19,901,006,000	0	19,901,006,000
Others(5%)	L.S.	1				328,849	95,619	20,059,762,160	5,832,733,075	25,892,495,235
Total						6,905,820	2,007,992	421,255,005,360	122,487,394,575	543,742,399,935

(11) TAILRACE ADIT (1-360m)

ITEM	UNIT	QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:TL)			
			LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN	TOTAL	
Tunnel excavation	m3	5,600	32.60	9.40	42.00	182,560	52,640	11,136,160,000	3,211,040,000	14,347,200,000
Tunnel invert concrete	m3	440	12.77	12.85	25.62	5,619	5,654	342,746,800	344,894,000	687,640,800
Shotcrete	m2	4,010	8.43	2.98	11.41	33,804	11,950	2,062,062,300	728,937,800	2,791,000,100
Plug concrete	m3	150	16.90	10.29	27.19	2,535	1,544	154,635,000	94,153,500	248,788,500
Reinforcement	t	20	563.00	0.00	563.00	11,260	0	686,860,000	0	686,860,000
Rock bolt(2m)	pc	1,500	23.78	6.22	30.00	35,670	9,330	2,175,870,000	569,130,000	2,745,000,000
Cement (bulk)	t	470	41.56	0.00	41.56	19,533	0	1,191,525,200	0	1,191,525,200
Others(5%)	L.S.	1				14,549	4,055	887,492,965	247,407,765	1,134,900,730
Total						305,530	85,173	18,637,352,265	5,195,563,065	23,832,915,330

Table 12-12 Construction Cost of Hydraulic Equipment Bağlık Project

HYDRAULIC EQUIPMENT ITEM	UNIT QUANTITY	UNIT PRICE(UNIT:US\$)		COST(UNIT:US\$)		COST(UNIT:EL)		TOTAL			
		LOCAL	FOREIGN	LOCAL	FOREIGN	LOCAL	FOREIGN				
		TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL				
Spillway gate	t	160	5,440.00	0.00	5,440.00	870,400	0	870,400	53,094,400,000	0	53,094,400,000
Intake gate	t	20	1,696.00	6,784.00	8,480.00	33,920	135,680	169,600	2,069,120,000	8,276,480,000	10,345,600,000
Draft gate	t	20	6,080.00	0.00	6,080.00	121,600	0	121,600	7,417,600,000	0	7,417,600,000
Steel penstock	t	350	4,000.00	0.00	4,000.00	1,400,000	0	1,400,000	85,400,000,000	0	85,400,000,000
Tailrace gate	t	10	6,080.00	0.00	6,080.00	60,800	0	60,800	3,708,800,000	0	3,708,800,000
Total						2,486,720	135,680	2,622,400	151,689,920,000	8,276,480,000	159,966,400,000