Japan International Cooperation Agency (JICA)

Ministry of Natural Resources and Environment Protection
Almaty City Government
Republic of Kazakhstan

The Study on

Solid Waste Management for

Almaty City in the Republic of Kazakhstan

Final Report

DATA BOOK

January 2000

Yachiyo Engineering Co., Ltd.
CTI Engineering International Co., Ltd.

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FINAL REPORT COMPOSITION

The Final Report is composed of the following reports:

1. SUMMARY REPORT
2. MAIN REPORT
3. SUPPORTING REPORT
4. DATA BOOK
5. ENVIRONMENTAL IMPACT ASSESSMENT REPORT

This report is the DATA BOOK

EXCHANGE RATE
US$ 1.00 = KZT 115 (May 3, 1999)
US$ 1.00 = Yen 121.10 (May 6, 1999)

Abbreviations

ACDEP	Almaty City Department of Environmental Protection
(Akim)	Head of Local Government, Mayor, Governor, or Head of District
(Akimate)	Local Government Office
(Maslikhat)	Parliament, Council of Local Government
(Oblast)	Province
AMC	Territorial Committee on Regulating Natural Monopoly and Protecting Competition – Anti Monopoly Committee
Alt.	Alternative
BH	Block housing
C/N	Carbon-Nitrogen factor
CIS	Commonwealth of Independent States
D/S, DS	Disposal site
EIA	Environmental Impact Assessment
EIU	Economic Intelligence Unit
EL	Elevation
FDI	Foreign Direct Investment
FSU	Former Soviet Union
GDP	Gross Domestic Product
GKI	Territorial Committee of State Property and Privatization
GRDP	Gross Regional Domestic Product
IC/P	Incineration Plant
IEE	Initial Environmental Examination
IH	Individual housing
JICA	Japan International Cooperation Agency
JSC	Joint Stock Company
KSD (PKSK)	Cooperatives for individual house community management
KSK (PKSK)	Cooperatives for block housing management
KZT, T	Kazakhstan Tenge (Exchange rate at May 3, 1999 US$ 1.00 = KZT 115.0)
Kcal/kg	Kilo calorie per kilogram
Kg, kg	Kilogram
Kg/cap/d	Kilogram per capita per day
Km, km	Kilometer
NEAP/SD	National Environment Action Plan for Sustainable Development
NEC	National Environment Center of the Ministry
RMB	Road Management Board
SWM	Solid Waste Management
T/S, TS	Transfer station
The (Study) Team	The JICA Study Team of the Study
The Ministry	Ministry of Natural Resource and Environmental Protection

The Study	The Study on Solid Waste Management in Almaty City
USD	United States Dollar
USSR	Union of Soviet Socialist Republics
bn	Billion
m^3	Volume in cubic meters
t/a	Ton per annum
t/d	Ton per day

DATA BOOK

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COLLECTION AND TRANSPORTATION

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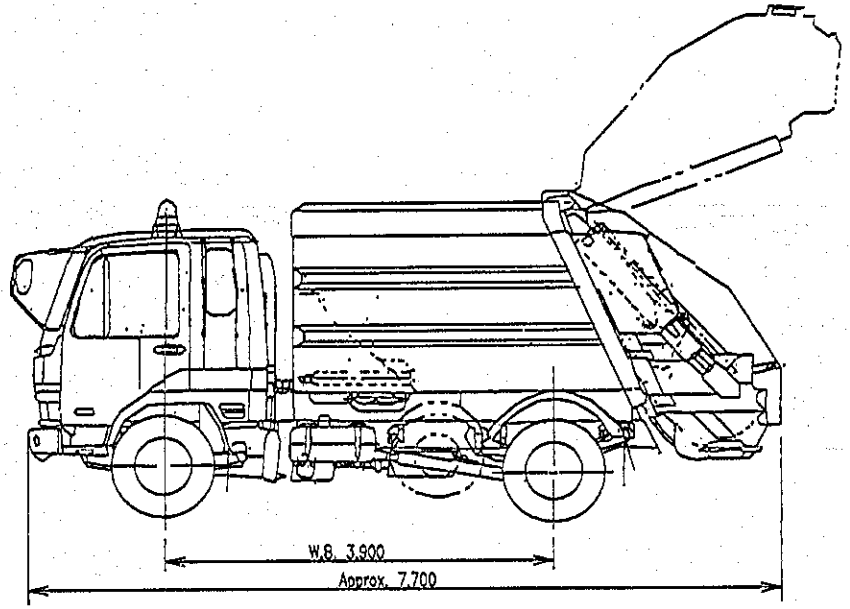
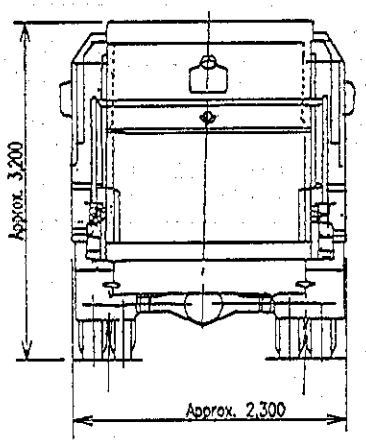
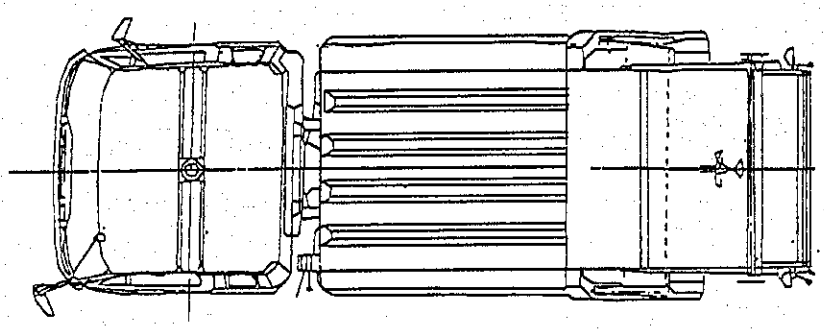
COLLECTION AND TRANSPORTATION







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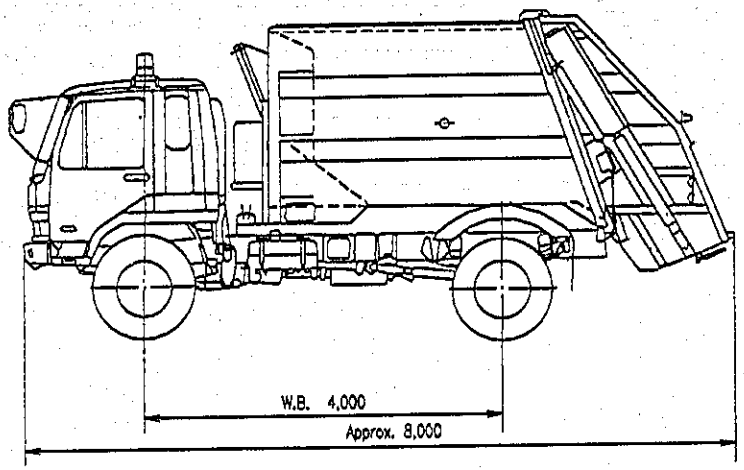
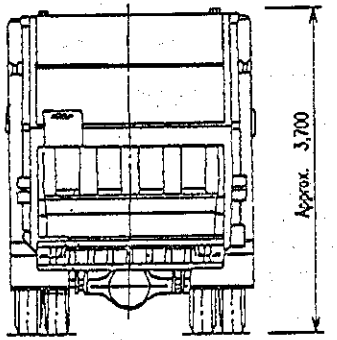
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

Figure 1.1
Compacter 8m^3

SCALE	

JAPAN INTERNATIONAL COOPERATION AGENCY





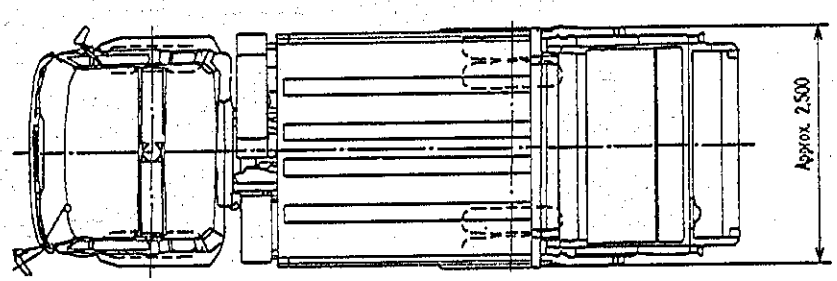


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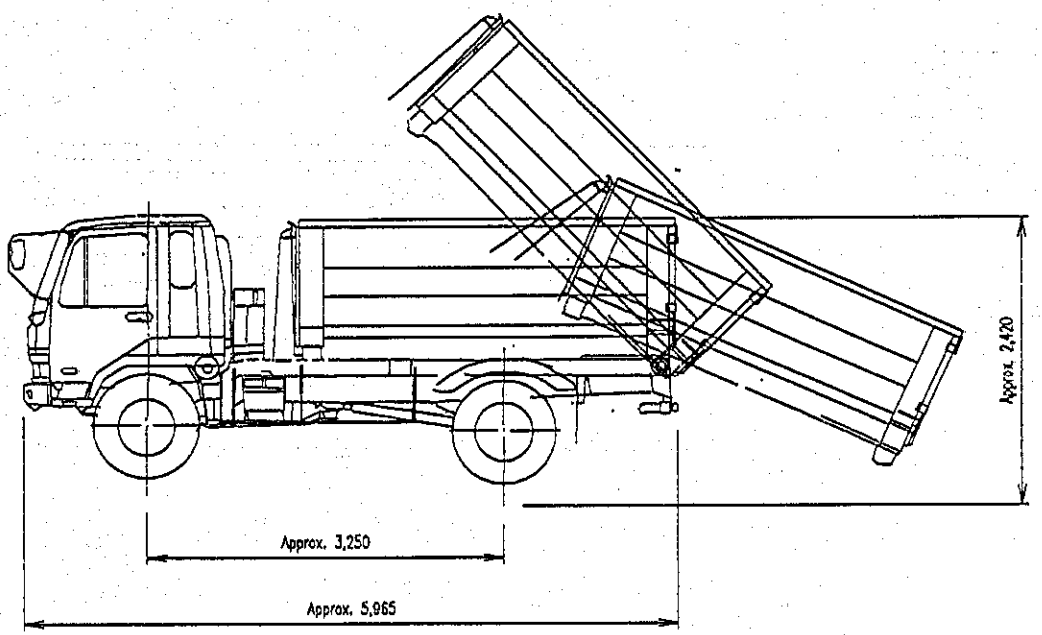
Figure 1.2
Compacter 12m^3

SCALE	

JAPAN INTERNATIONAL COOPERATION AGENCY



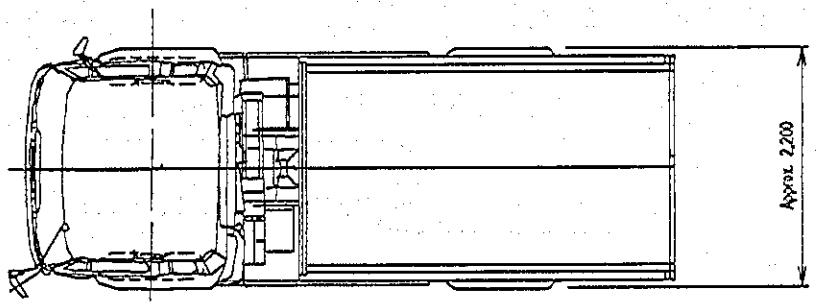


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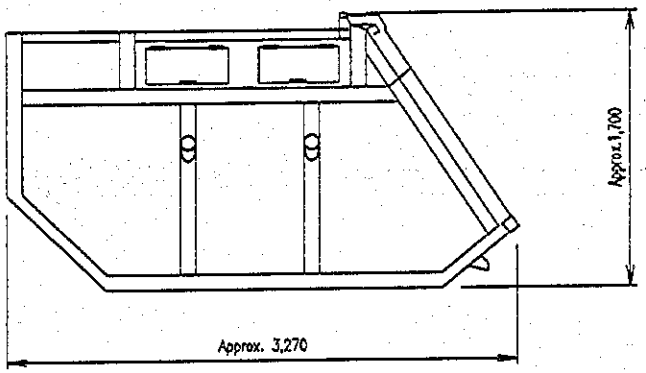
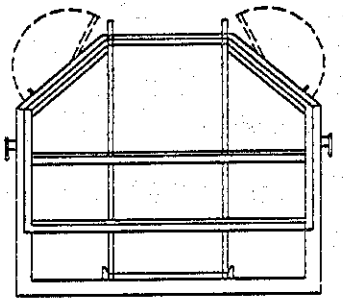
Figure 1.3
Arm roll 6m^3

SCALE	

JAPAN INTERNATIONAL COOPERATION AGENCY





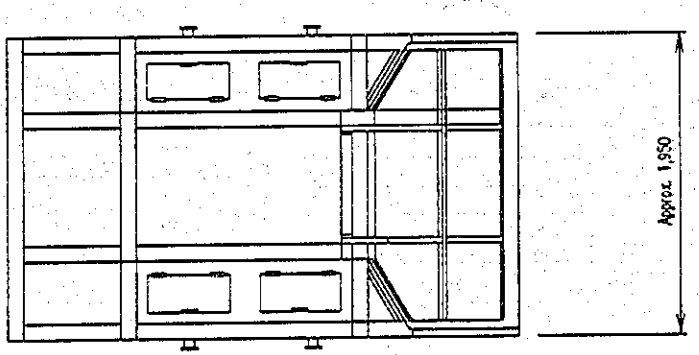


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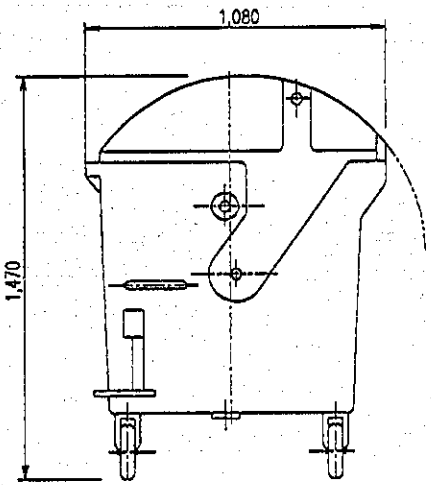
Figure 1.4
Container 6m^3

SCALE	

JAPAN INTERNATIONAL COOPERATION AGENCY



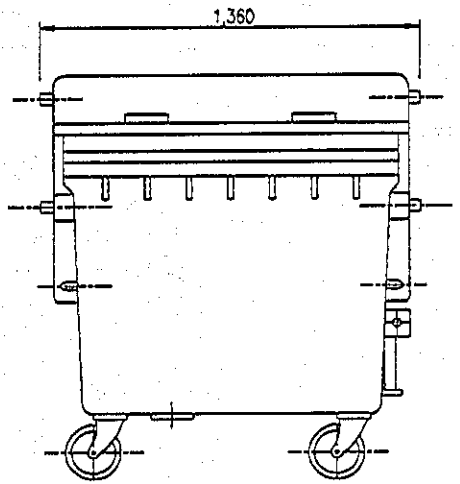


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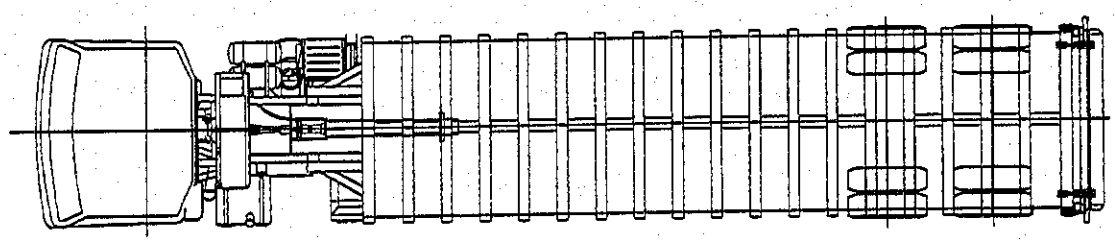
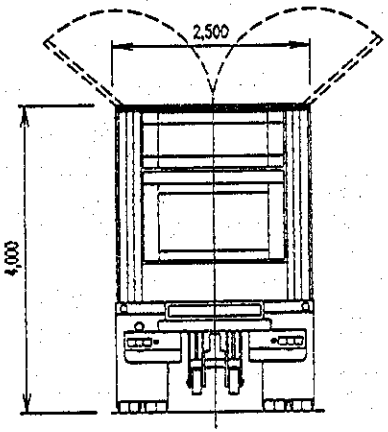
Figure 1.5
Container 1.1m^3

SCALE	

JAPAN INTERNATIONAL COOPERATION AGENCY





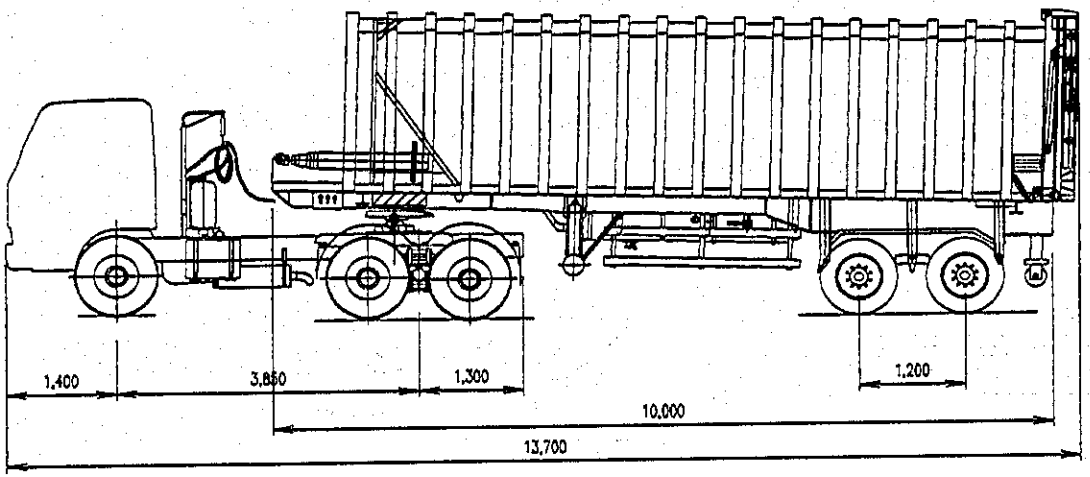


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Figure 1.6
Semi-trailer 40m^3

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY

DATA BOOK 2

WEST TRANSFER STATION

DATA BOOK 2

WEST TRANSFER STATION

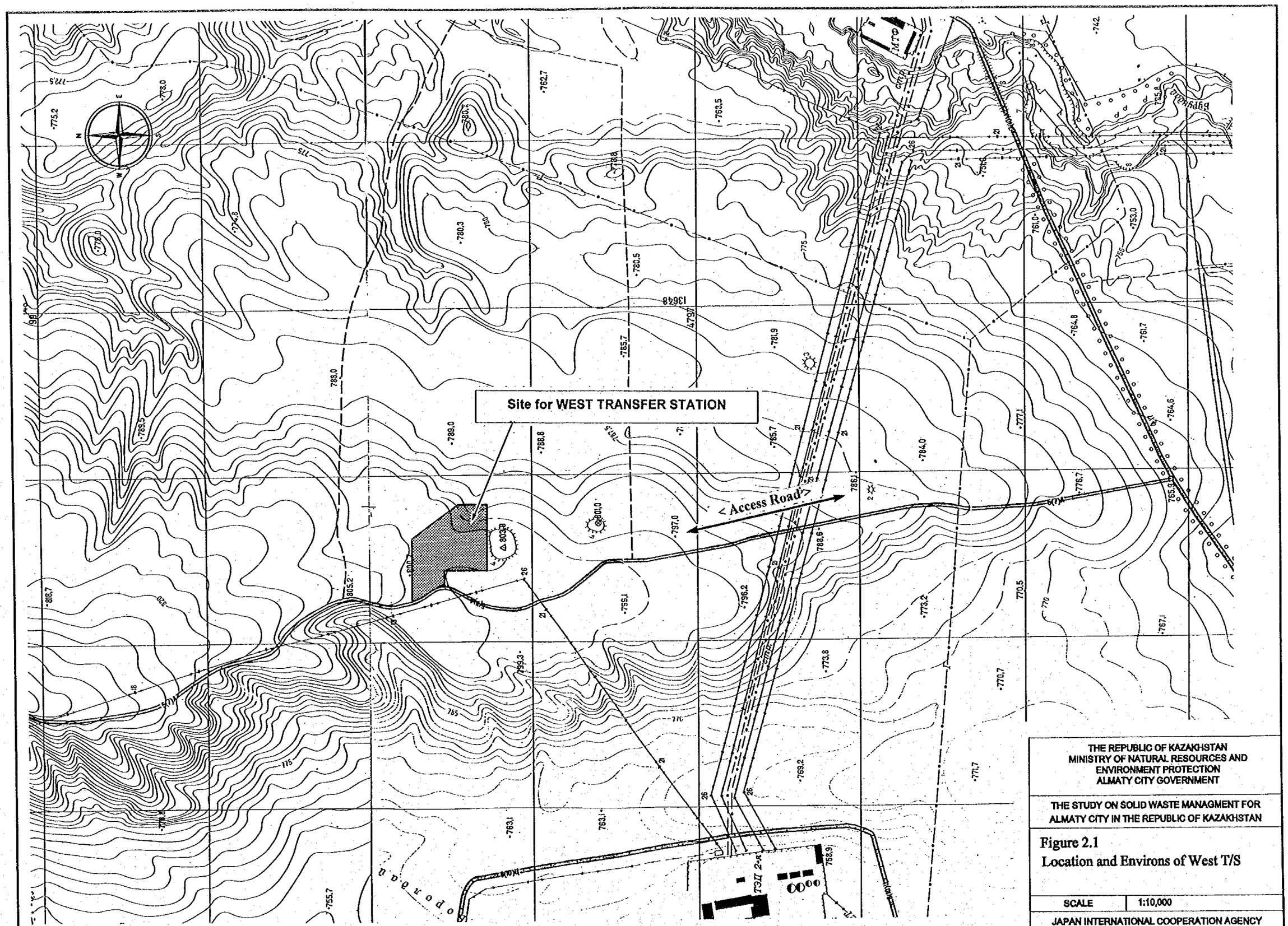

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Figure 2.1
Location and Environs of West T/S

SCALE	1:10,000

JAPAN INTERNATIONAL COOPERATION AGENCY

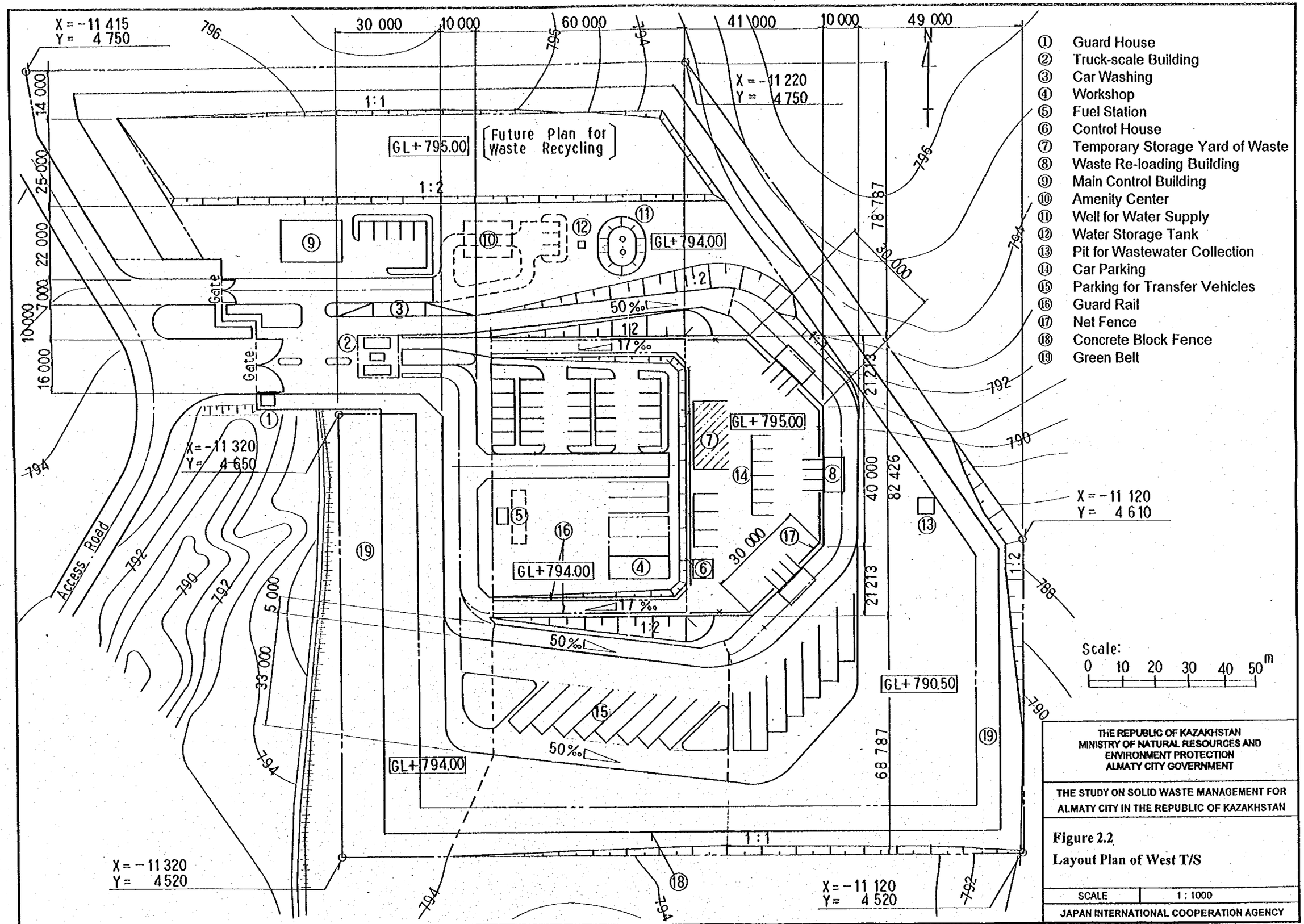

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Figure 2.2
Layout Plan of West T/S

SCALE	1 : 1000

JAPAN INTERNATIONAL COOPERATION AGENCY

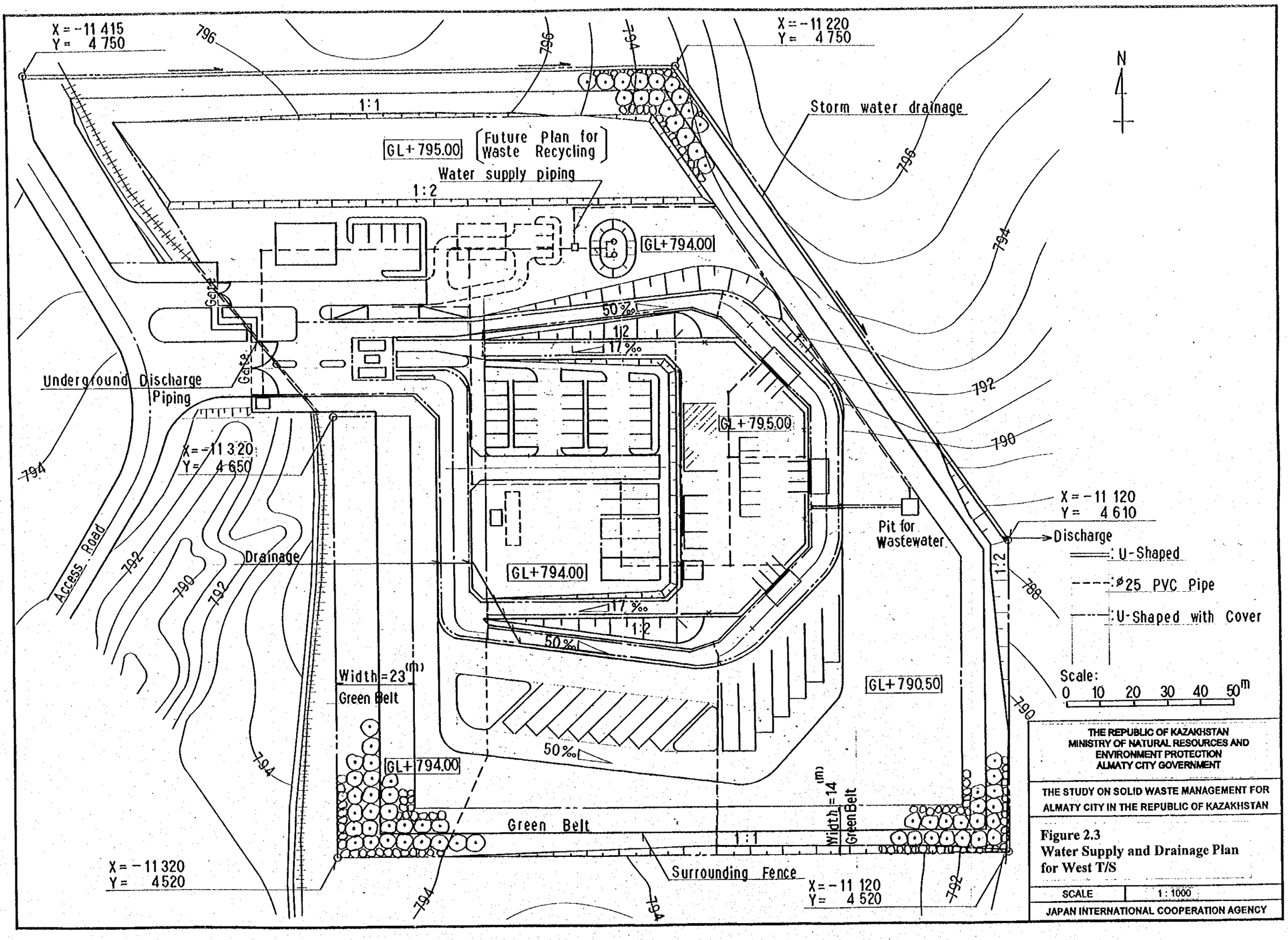

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Figure 2.3
Water Supply and Drainage Plan for West T/S

SCALE	1 : 1000

JAPAN INTERNATIONAL COOPERATION AGENCY

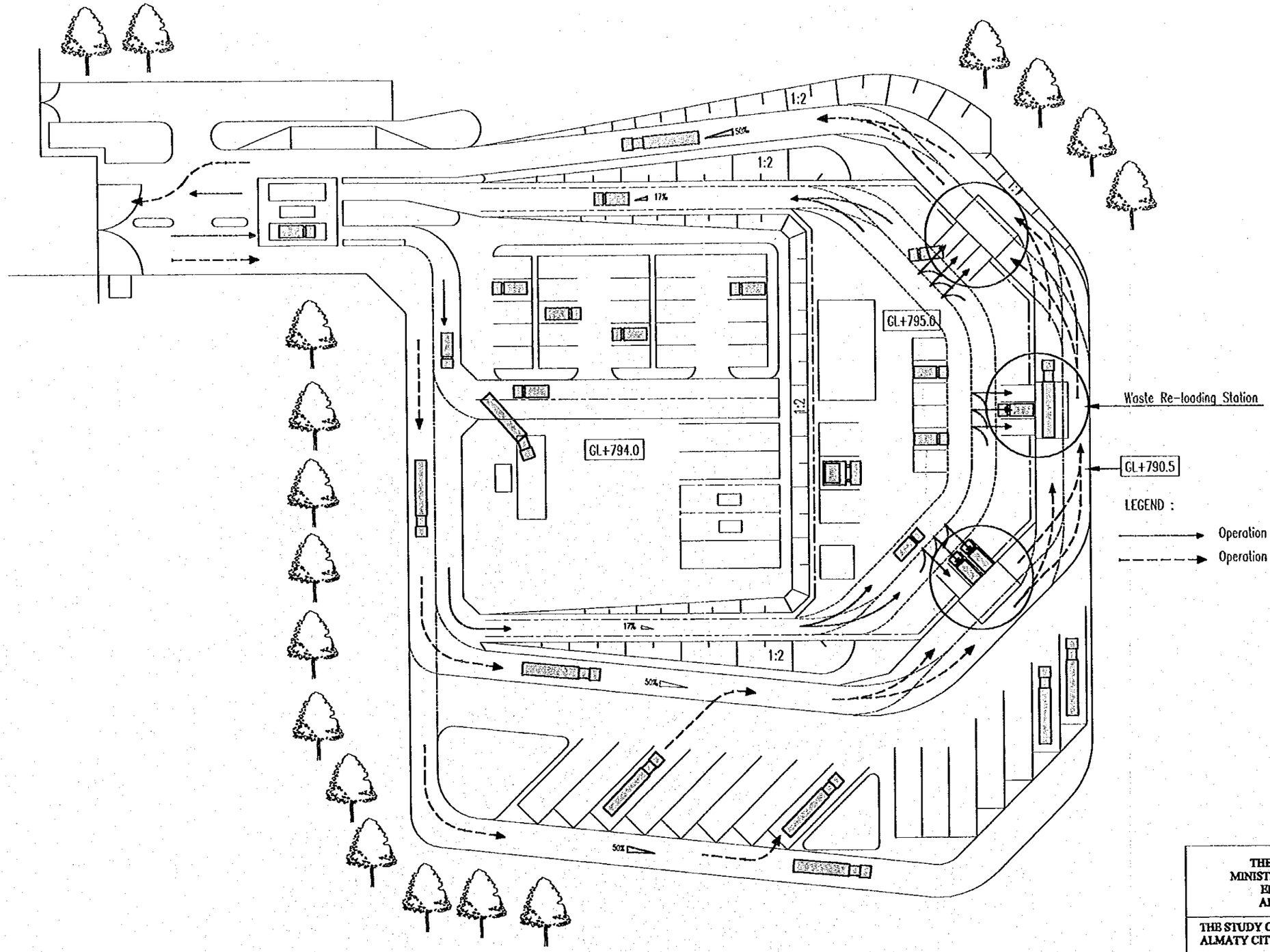

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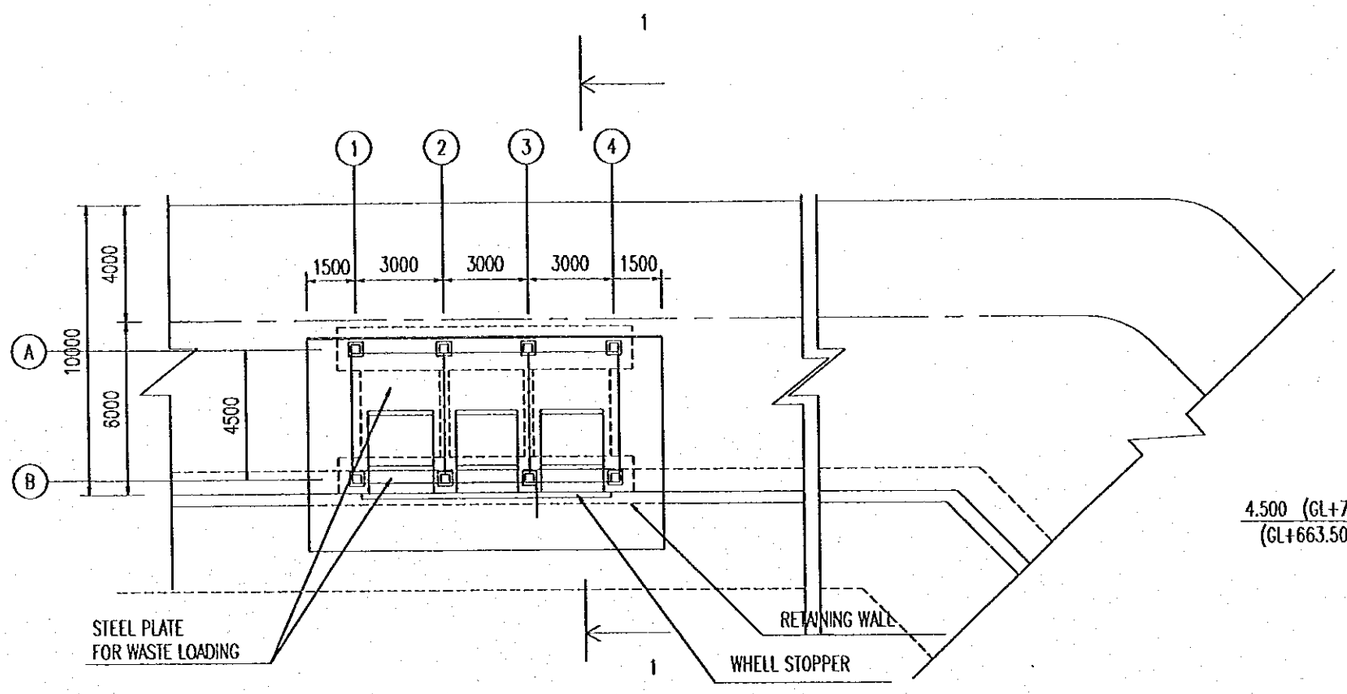
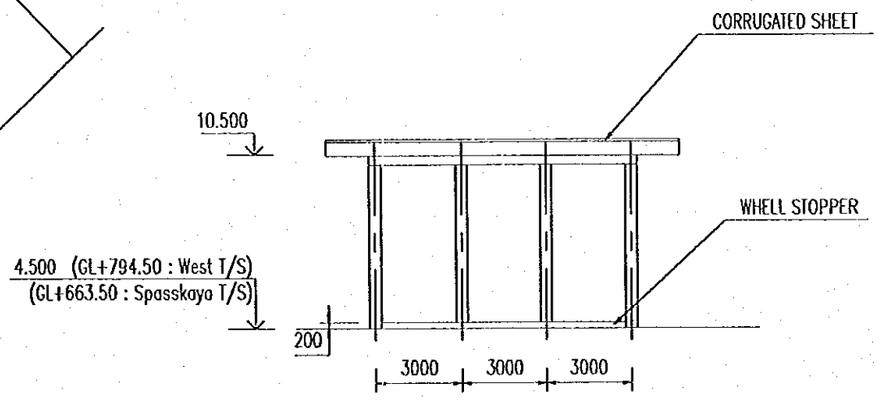
Figure 2.4
Site Operation of West T/S

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN



ELEVATION 1--4

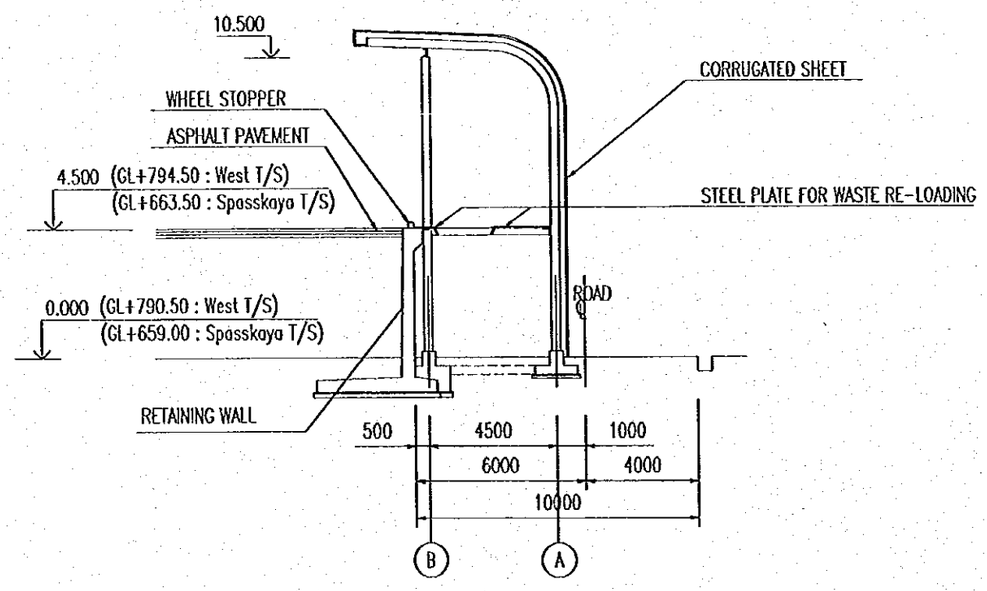


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Figure 2.5
Waste Re-Loading Station of West & Spasskaya T/S

SCALE 1 : 200

JAPAN INTERNATIONAL COOPERATION AGENCY

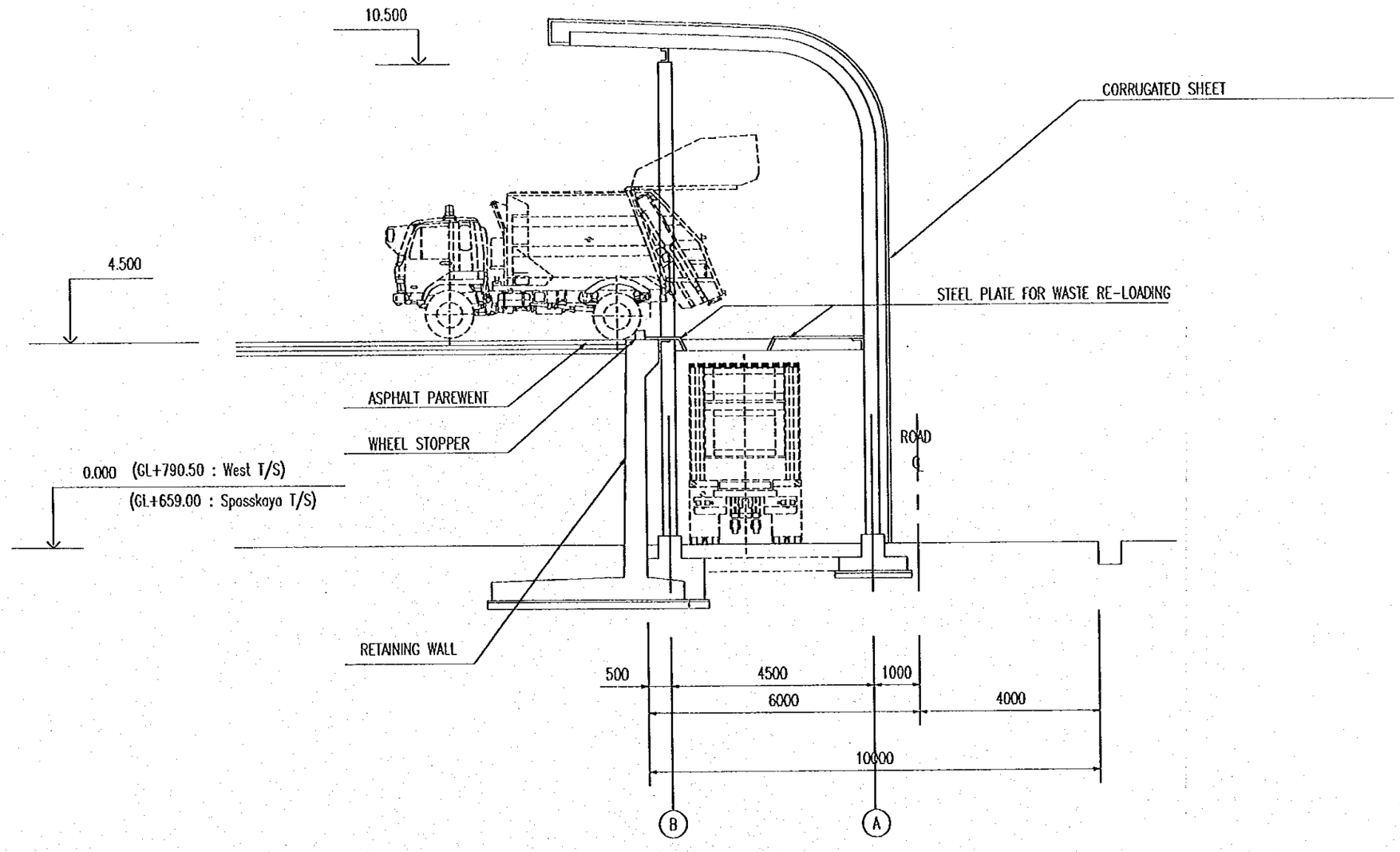

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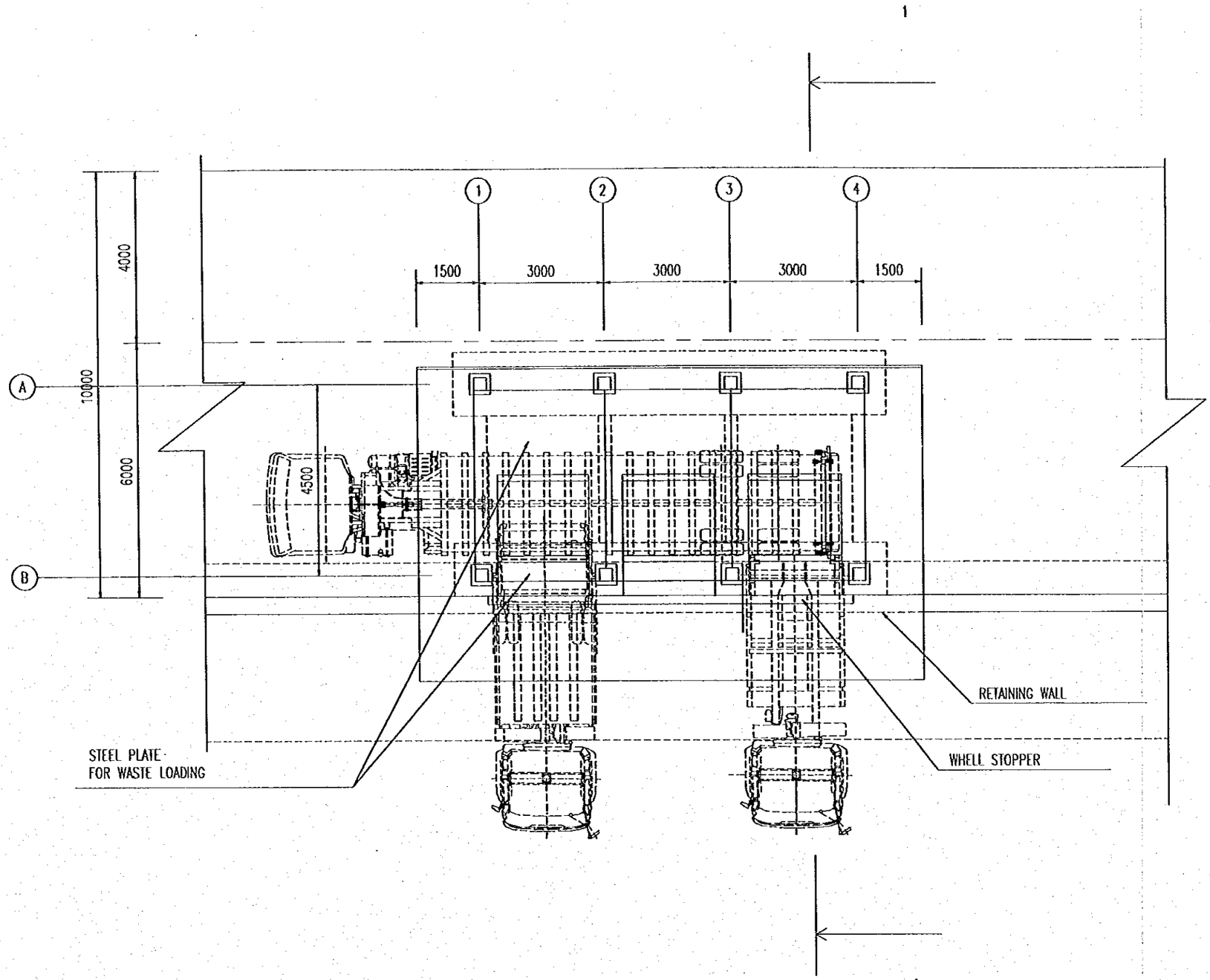
Figure2.6 Waste Re-Loading (1/2) : Section	
SCALE	1 : 100
JAPAN INTERNATIONAL COOPERATION AGENCY	



PLAN

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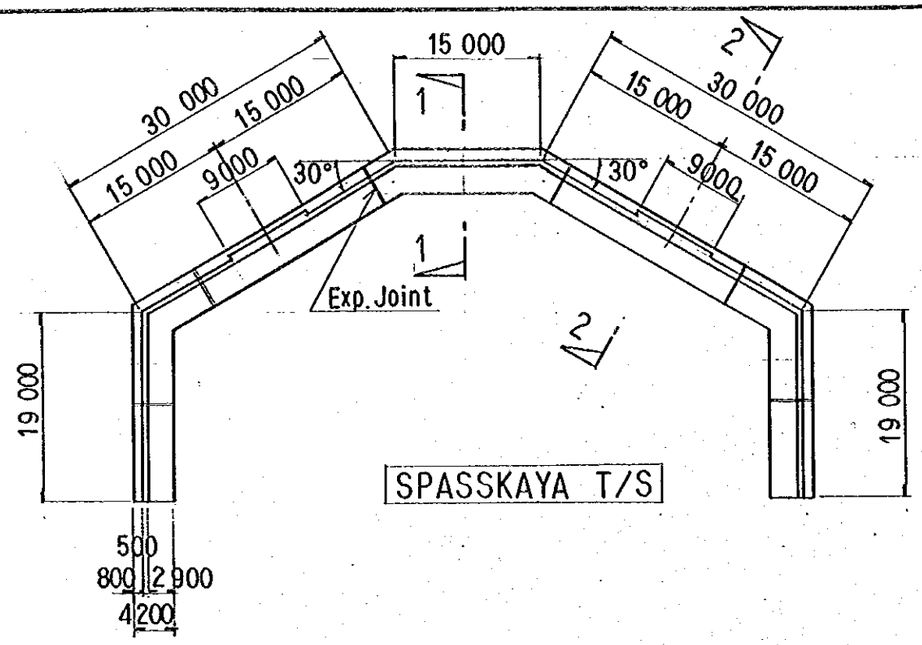
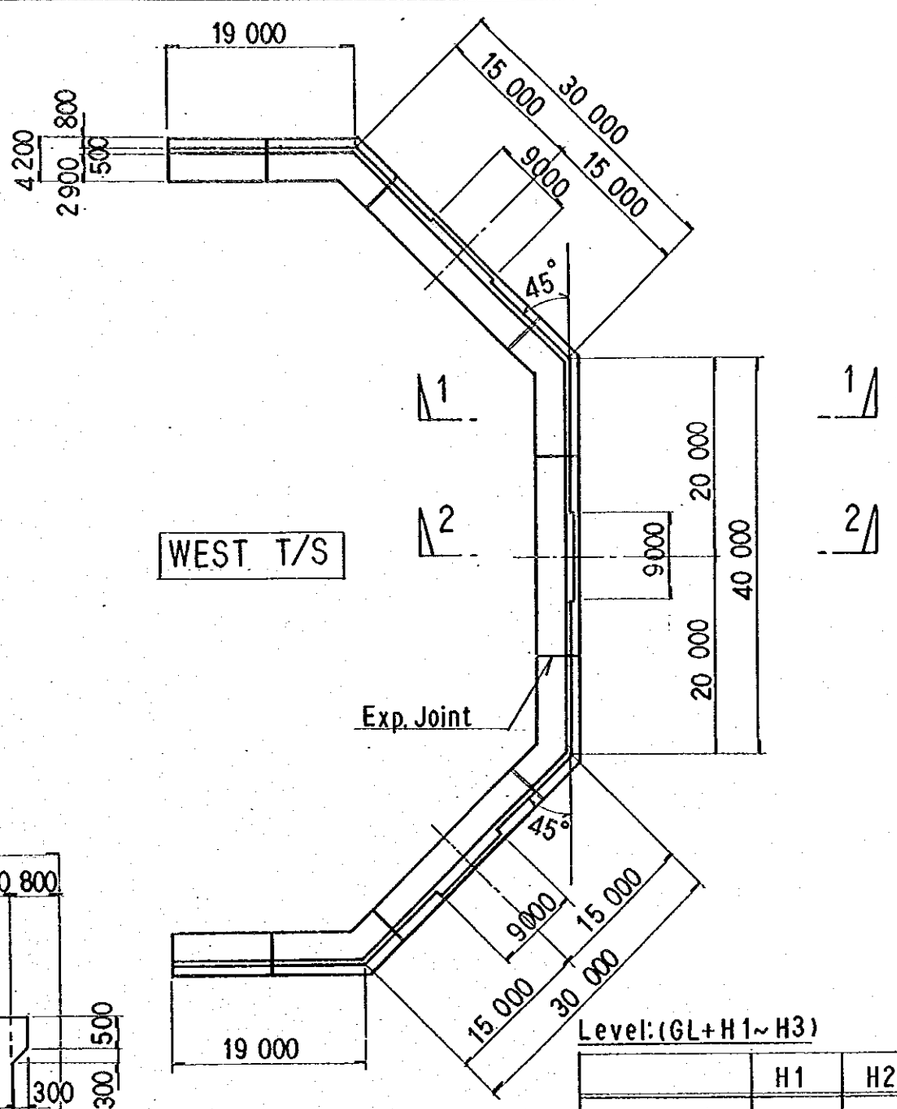
Figure 2.7
Waste Re-Loading (2/2) : Plan

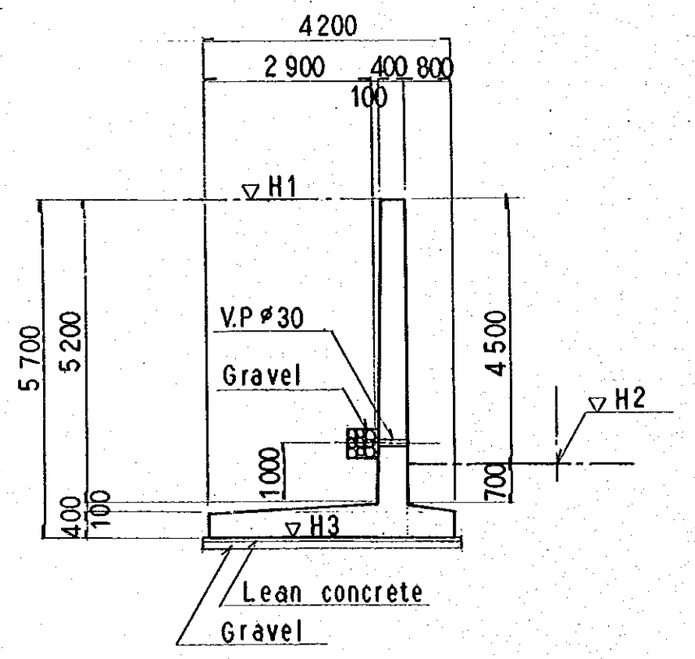
SCALE	1 : 100

JAPAN INTERNATIONAL COOPERATION AGENCY

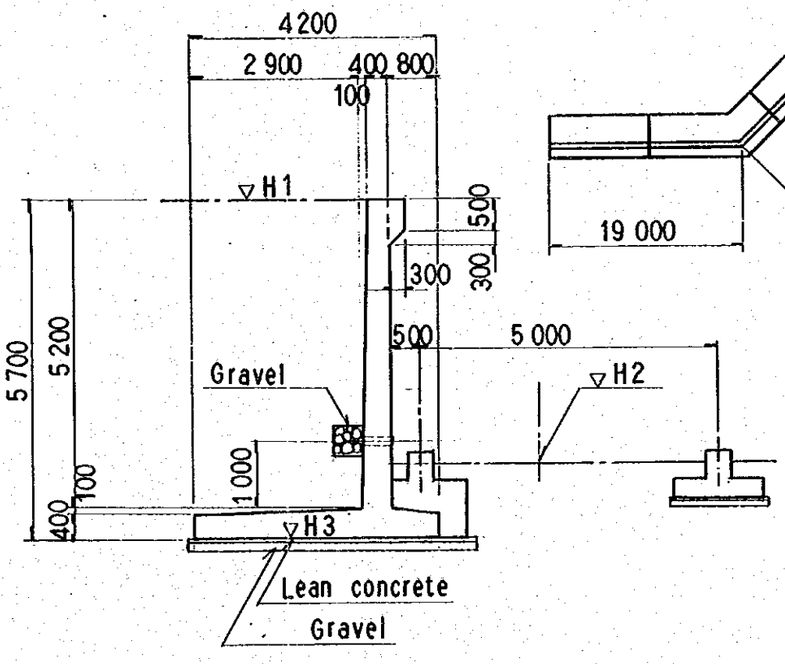




PLAN 1/600



1 - 1 1/100



2 - 2 1/100

Level: (GL+H1~H3)

	H1	H2	H3
WEST T/S	795.00	790.50	789.30
SPASSKAYA T/S	663.50	659.00	657.80

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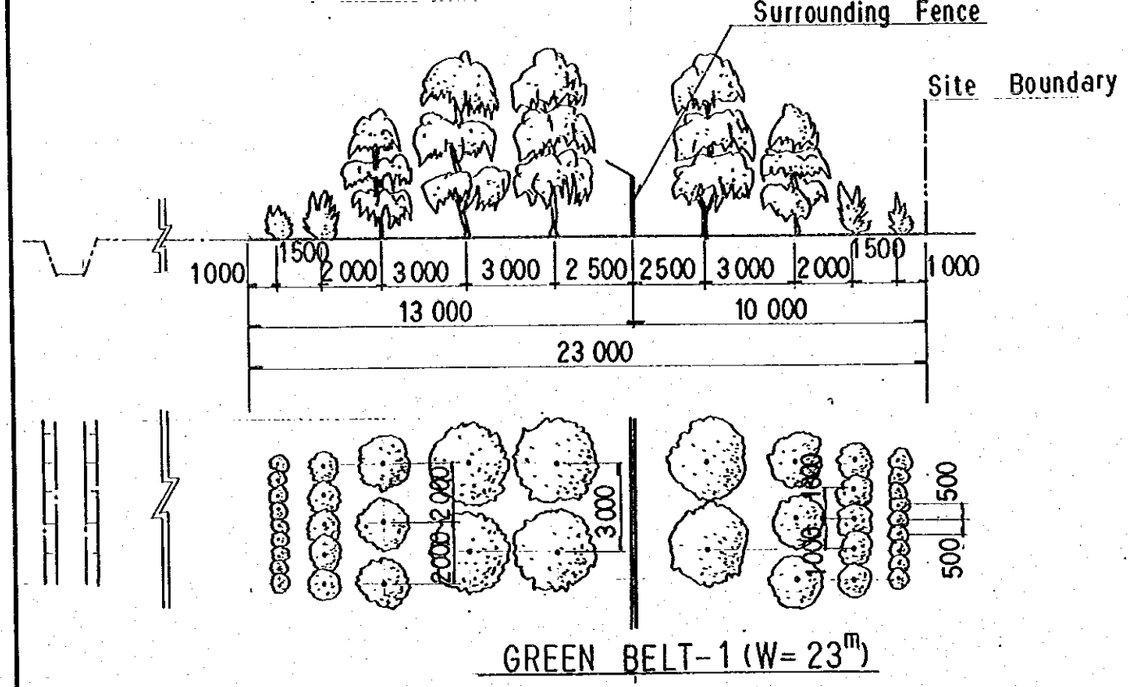
Figure 2.8
Details of Retaining Wall for West & Spasskaya T/S

SCALE 1 : 100

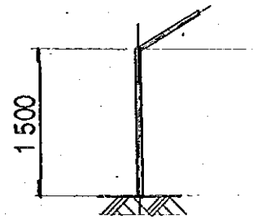
JAPAN INTERNATIONAL COOPERATION AGENCY

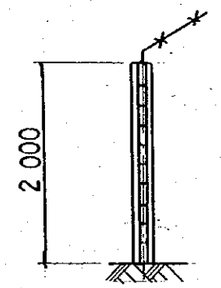
GREEN BELT/BUFFER ZONE

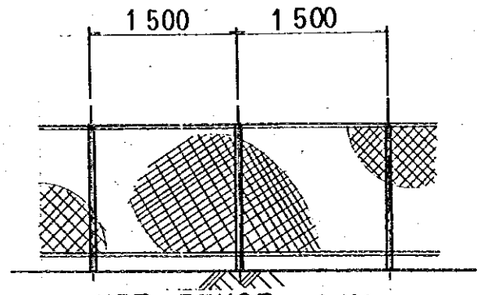
(Russian Standard of "Instruction for Sanitary Protection in Industrial Area Moscow 1984")



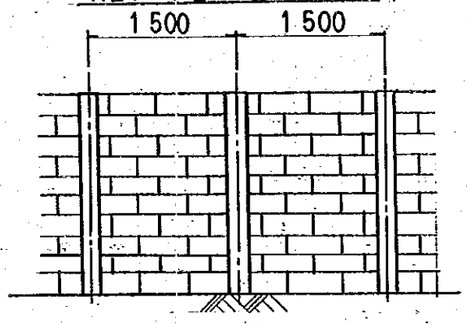
GREEN BELT-1 (W= 23^{m})



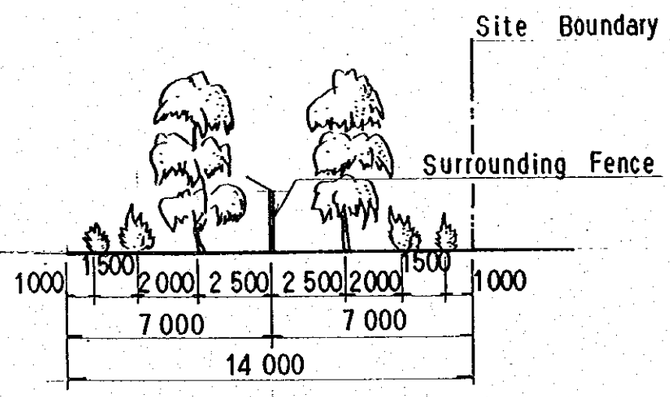




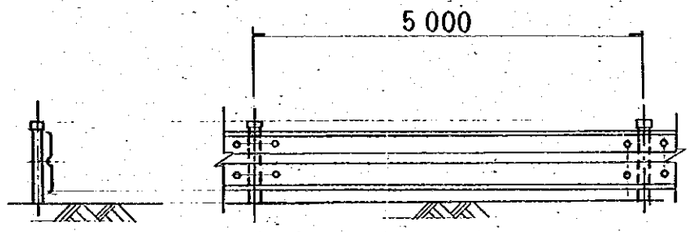
NET FENCE 1/60



CONCRETE BLOCK FENCE 1/60



GREEN BELT-2 (W=14^{m})



GUARD RAIL 1/60

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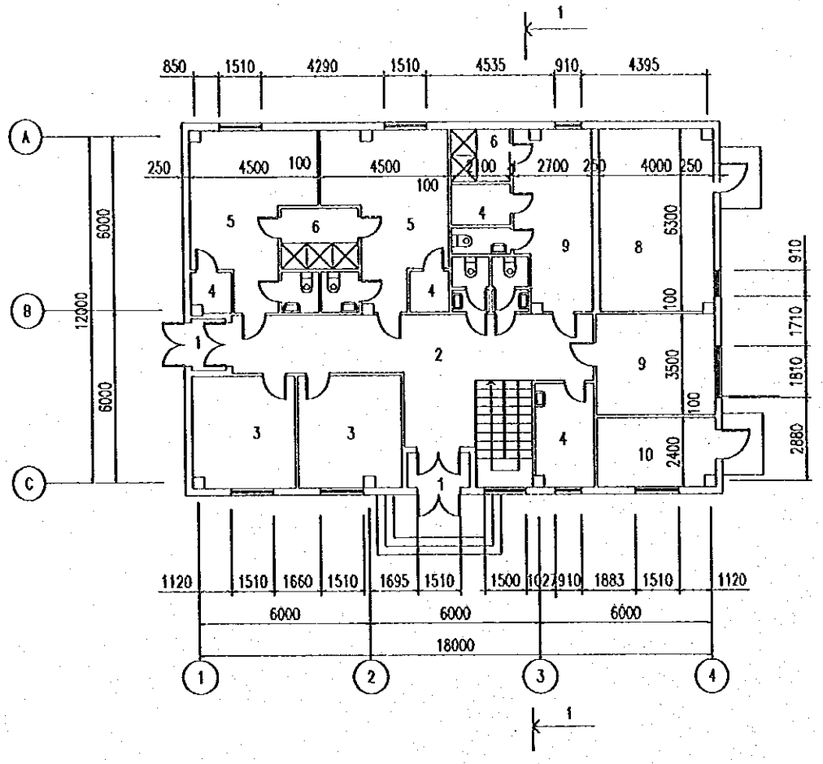
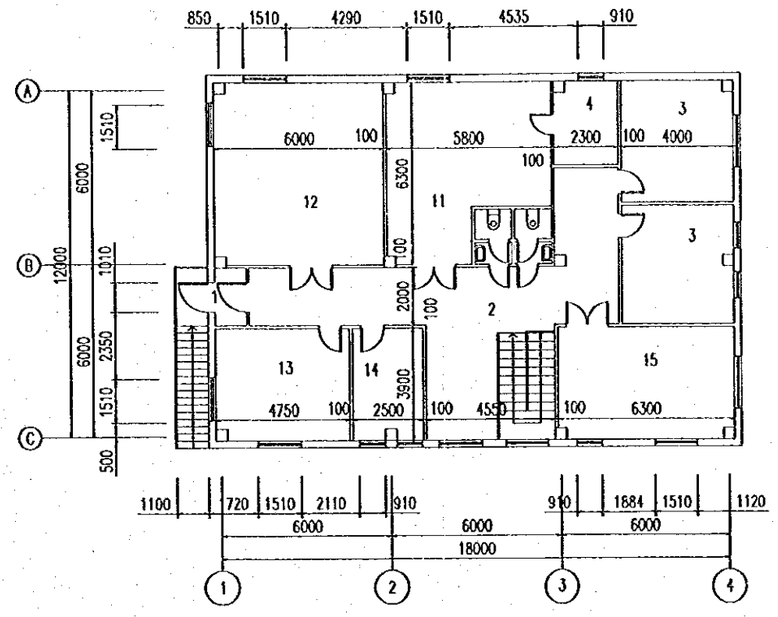
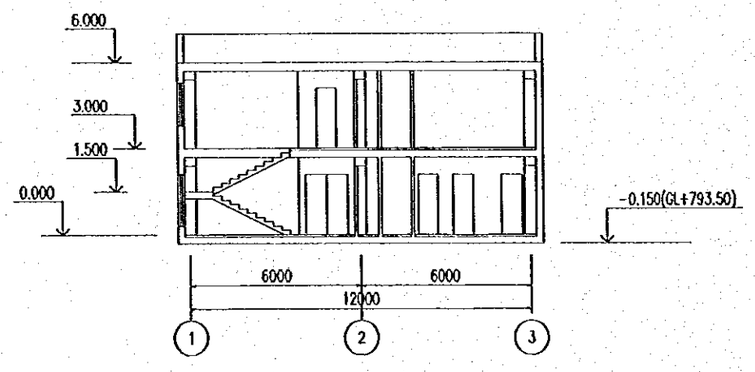
Figure 2.9 **Green Belt and Fences for West & Spasskaya T/S**
SCALE
JAPAN INTERNATIONAL COOPERATION AGENCY



1 ST FLOOR PLAN



2 ND FLOOR PLAN



SECTION 1-1

1	ENTRANCE	9	SECURITY ROOM
2	CORRIDOR	10	FIRE EQUIPMENT STORE
3	OFFICE	11	DINING ROOM
4	STORE	12	MEETING ROOM
5	LOCKER ROOM FOR MEN	13	DIRECTOR OFFICE
6	SHOWER	14	SECRETARY
7	LOCKER ROOM FOR WOMEN	15	STAFF ROOM
8	BOILER ROOM		

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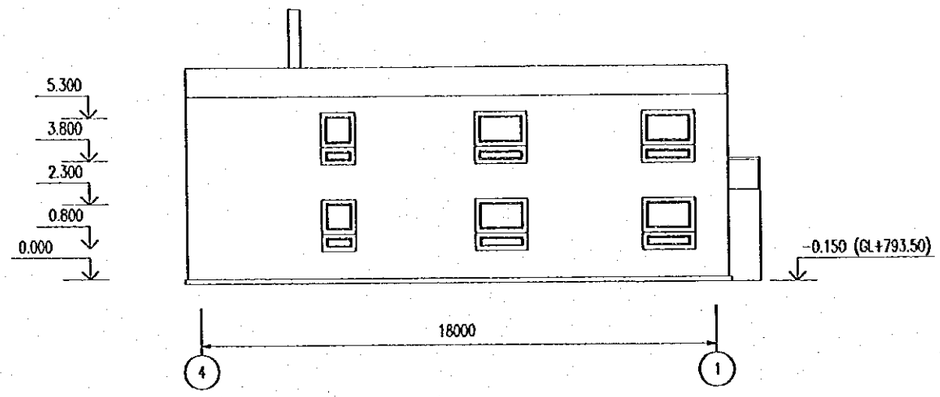
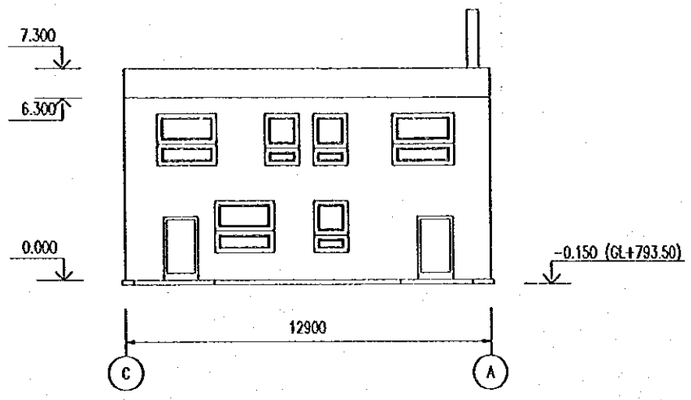
Figure 2.10
Main Control Building of West T/S (1/2) : Elevation

SCALE 1:200

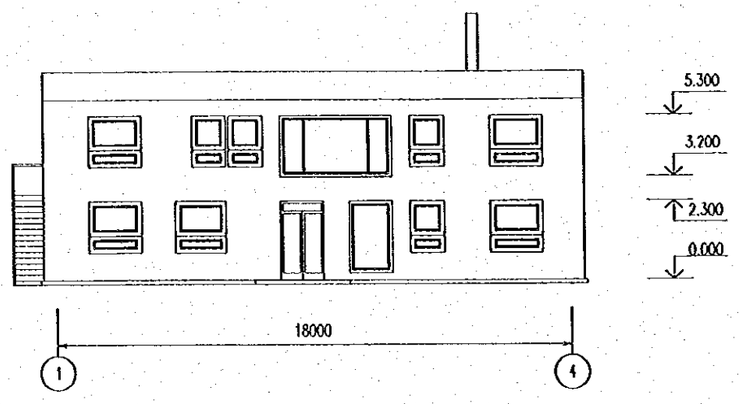
JAPAN INTERNATIONAL COOPERATION AGENCY



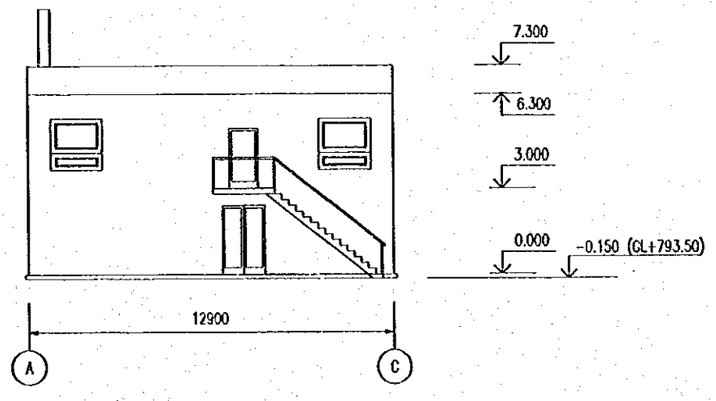
ELEVATION 4－1



ELEVATION C－A



ELEVATION 1－4



ELEVATION A－C

THE REPUBLIC OF KAZAKHSTAN
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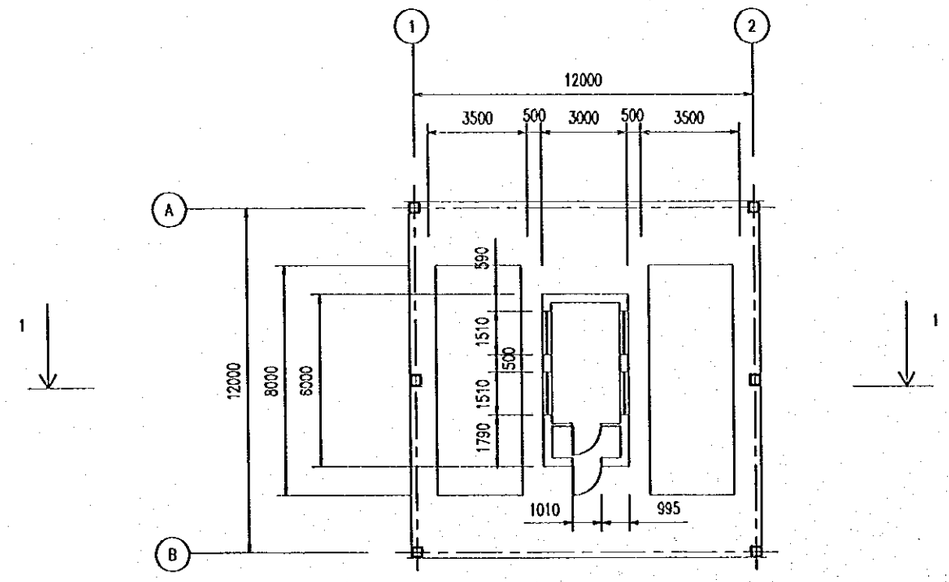
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSAN

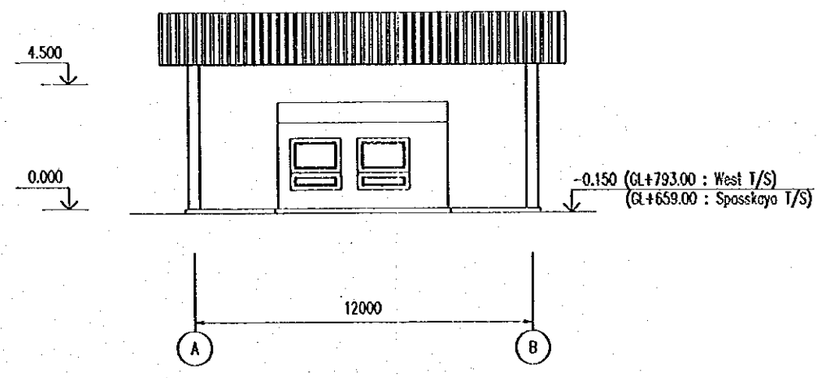
Figure 2.11
Main control building of
Weat T/S (2/2) : Elevation

SCALE	1 : 200

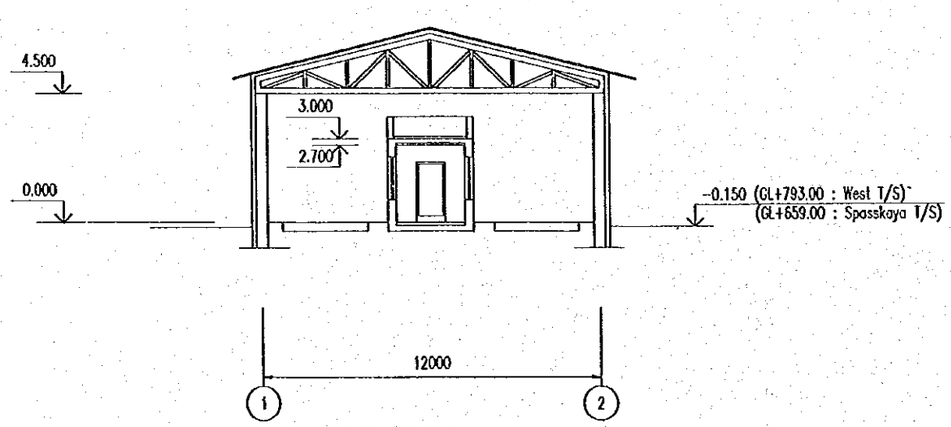
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN

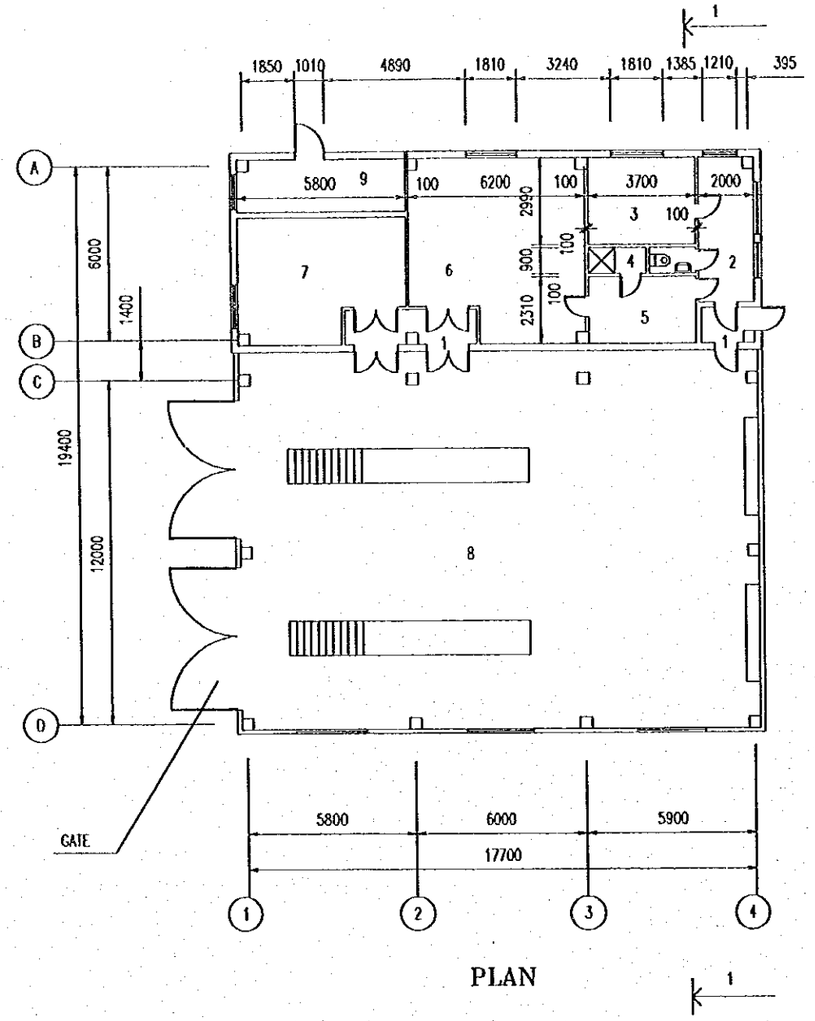


ELEVATION A–B



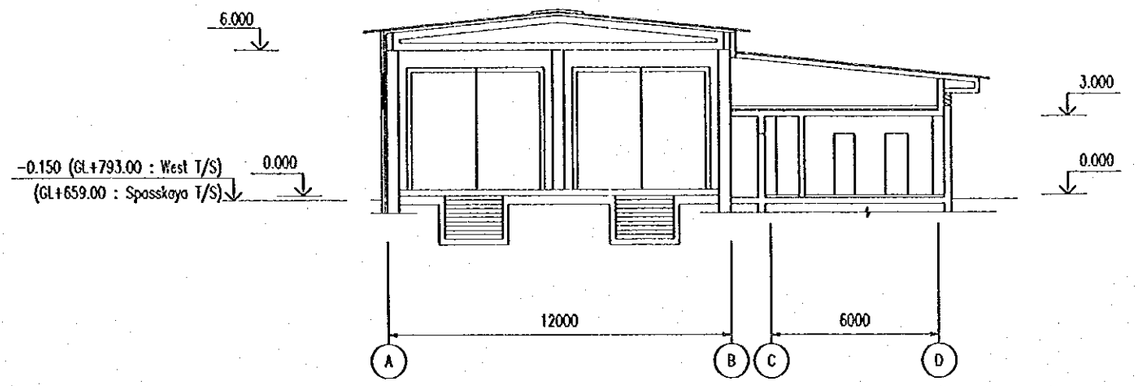
SECTION 1–1

THE REPUBLIC OF KAZAKHSTAN MINISTRY OF NATURL RESOURCES AND ENVIRONMENTAL PROTECTION ALMATY CITY GOVERNMENT	
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSAN	
Figure 2.12 Truck-scale Building of West & Spasskaya T/S	
SCALE	1 : 200
JAPAN INTERNATIONAL COOPERATION AGENCY	

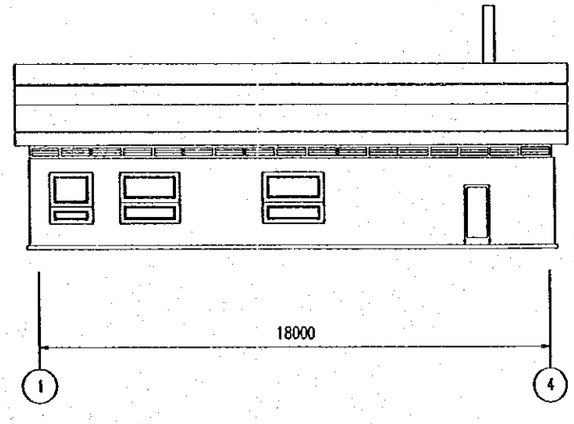


PLAN

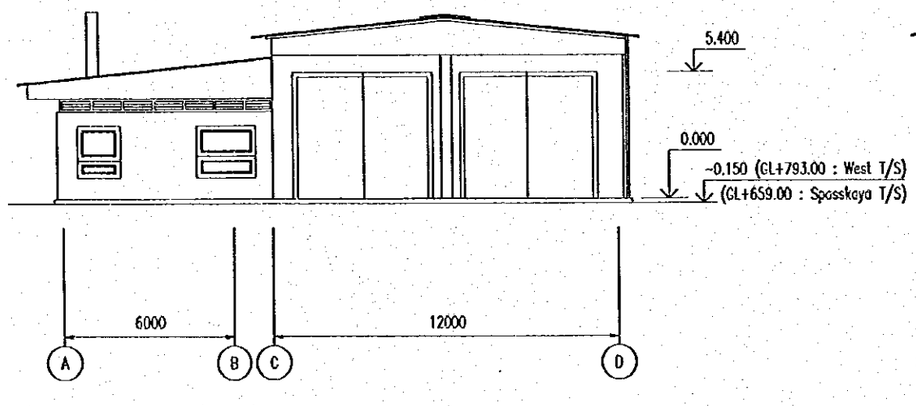
1	ENTRANCE	
2	CORRIDOR	
3	OFFICE	
4	SHOWER	
5	LOCKER ROOM	
6	MAINTENANCE ROOM	
7	STORE	
8	WORKSHOP	
9	BOILER	



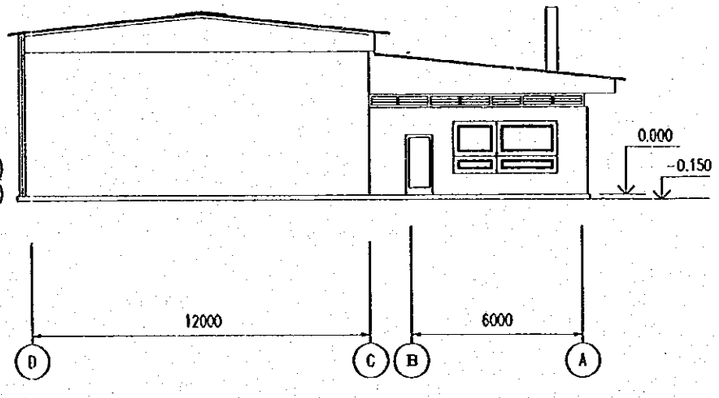
SECTION 1-1



ELEVATION 4-1



ELEVATION A-D



ELEVATION D-A

THE REPUBLIC OF KAZAKHSTAN
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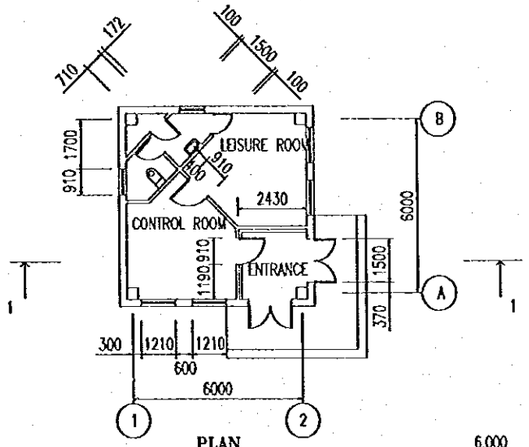
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSAN

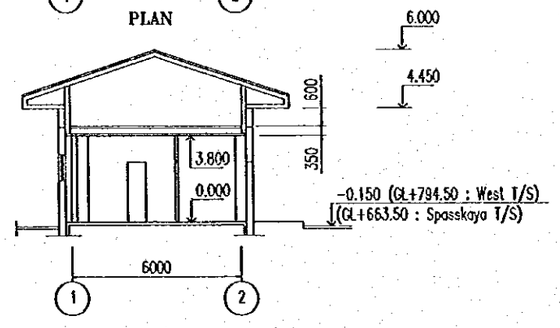
Figure 2.13
Workshop Building of West & Spasskaya T/S

SCALE 1 : 200

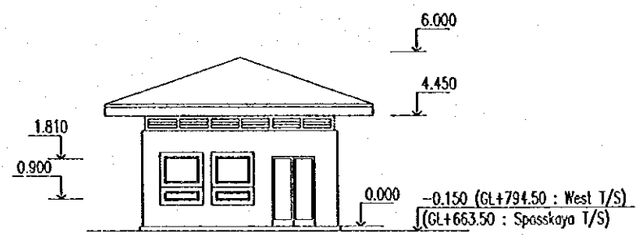
JAPAN INTERNATIONAL COOPERATION AGENCY



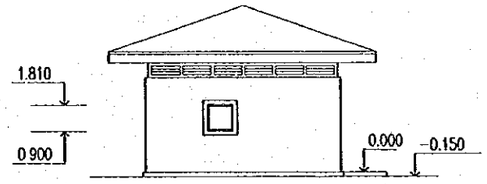
PLAN



SECTION 1–1

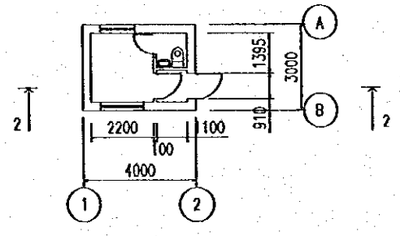


ELEVATION 1–2

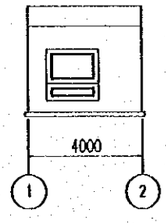


ELEVATION B–A

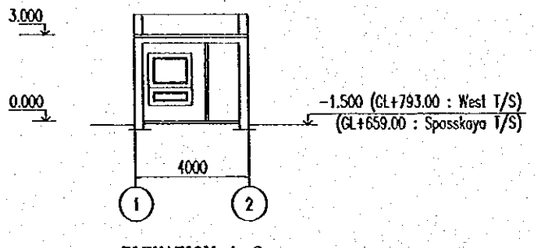
CONTROL HOUSE



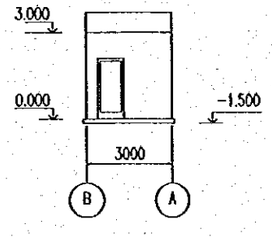
PLAN



SECTION 2–2



ELEVATION 1–2



ELEVATION B–A

GUARD HOUSE

THE REPUBLIC OF KAZAKHSTAN
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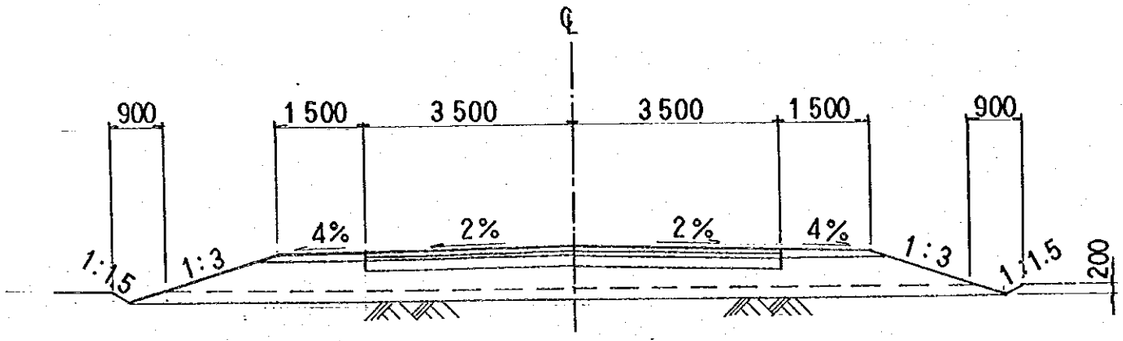
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSAN

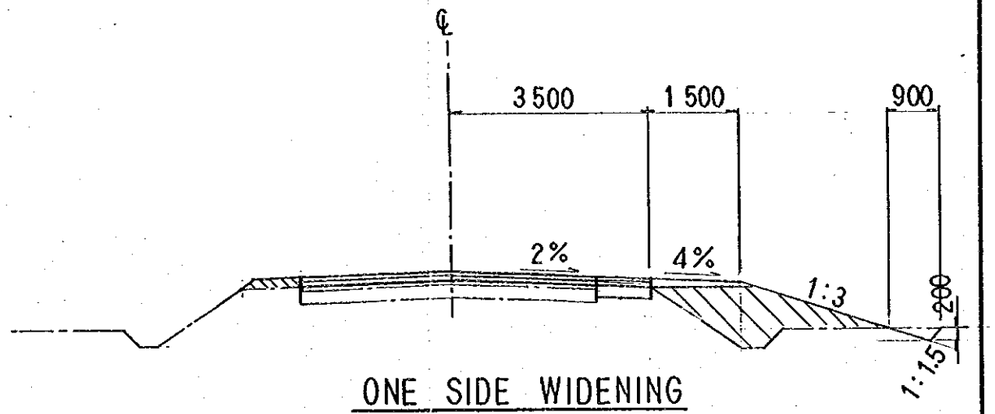
Figure 2.14
Control house & Guard House of West & Spasskaya T/S

SCALE	1 : 200

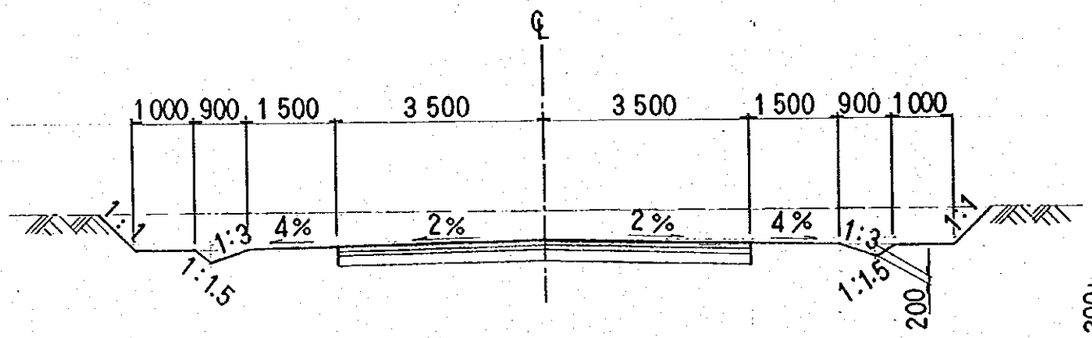
JAPAN INTERNATIONAL COOPERATION AGENCY



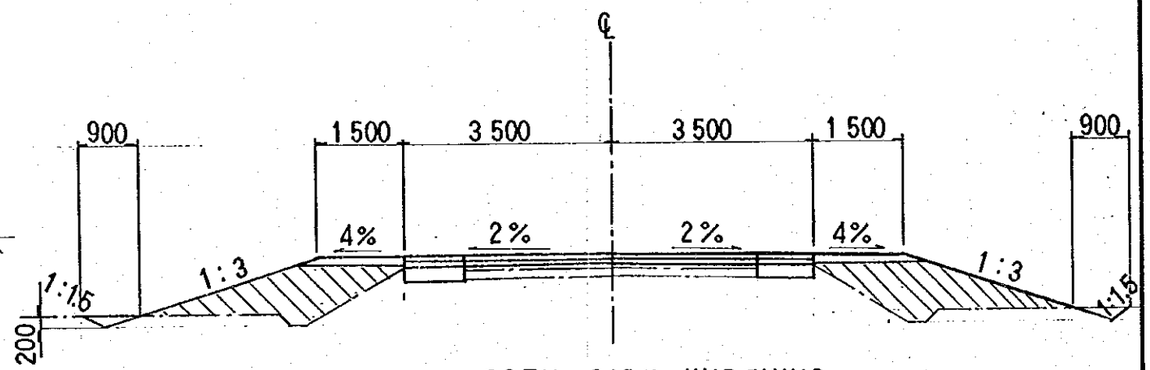
BANK



ONE SIDE WIDENING



CUT



BOTH SIDE WIDENING

TYPICAL SECTION OF ACCESS ROAD 1/100

(Russian Standard: SNIP 2.07.01-89)

IMPROVEMENT METHOD OF ACCESS ROAD 1/100

(Russian Standard: VSN 46-72)

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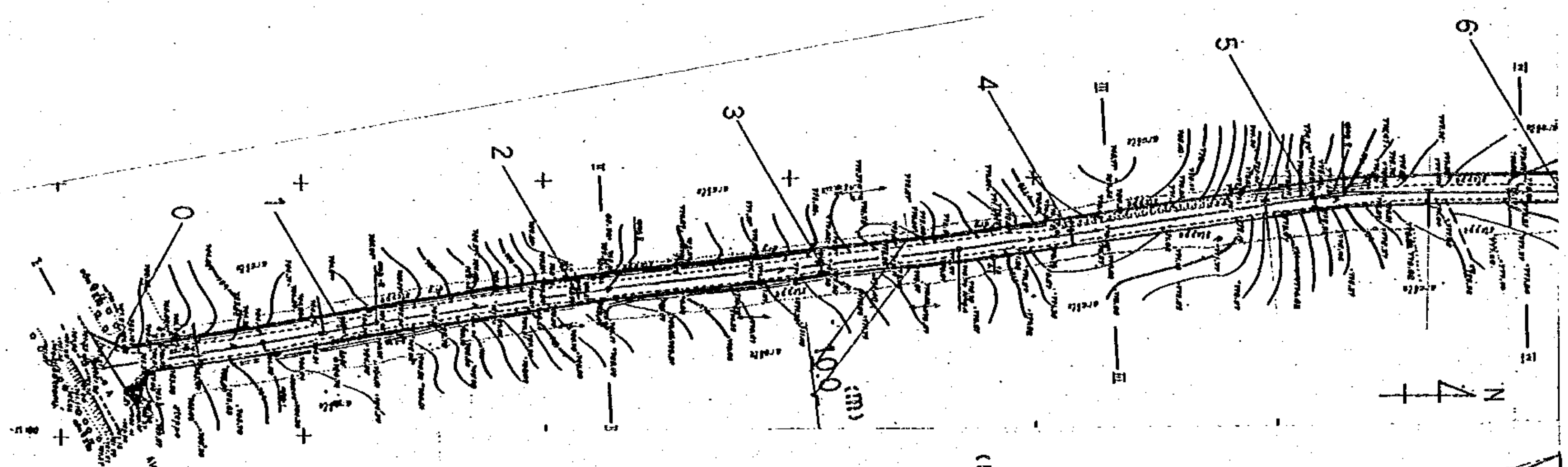
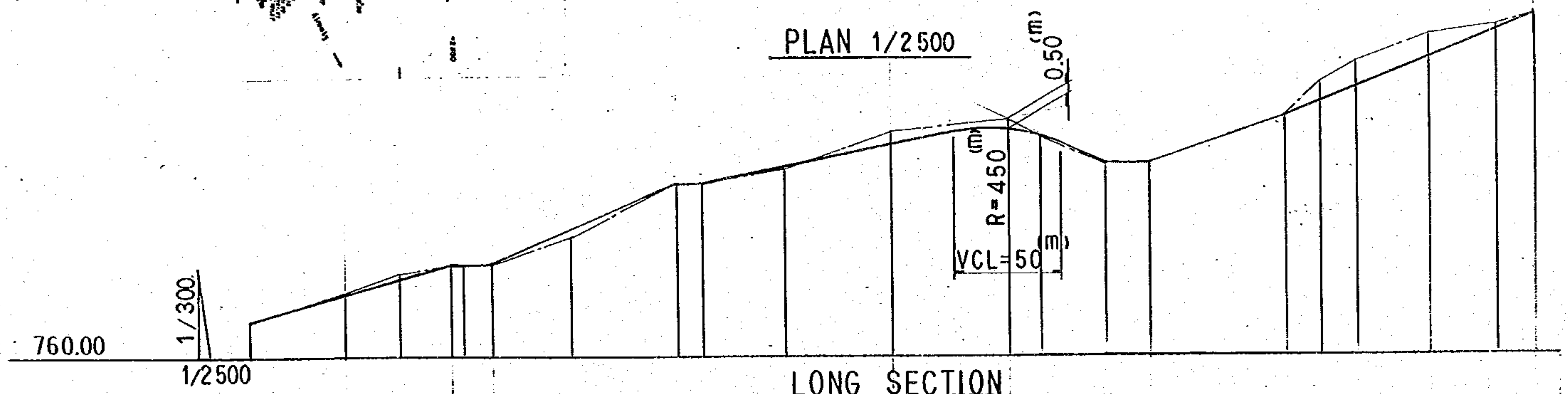
Figure 2.15 **Typical Section of Access Road for West & Spasskaya T/S**
SCALE 1 : 100
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2500



LONG SECTION

(‰) GRADIENT: 32.0(‰)/95(m); 0/18; 51.7/87; 0/12; 24.5/143; 55.6/45; 0/20; 42.2/64; 47.4/116

(m) ESTIMATED ELEVATION	761.96	763.37	764.20	765.00	765.00	765.00	766.91	769.50	769.50	770.43	771.65	773.00	772.00	770.50	770.50	773.20	773.96	774.76	776.33	777.85	778.70
(m) ELEVATION	761.96	763.51	764.53	764.95	764.95	765.00	766.49	769.49	769.52	770.23	772.30	772.97	772.00	770.55	770.50	773.20	775.00	776.10	777.50	778.10	778.70
(m) DISTANCE	0	44.0	26.0	25.0	5.0	13.0	37.0	50.0	12.0	38.0	50.0	55.0	15.0	30.0	20.0	64.0	16.0	17.0	33.0	32.0	18.0
NO.	0				1			2			3			4			5				6

DIRECTS AND CURVES IN PLAN: ANG. 1 I=2° 56′; ANG.2 I=3° 23′; ANG.3 I=1° 12′; ANG.4 I=1° 43′; ANG.5 I=7° 38′; ANG.6 I=11° 00′

Circular Curves

ANG. 1	0+69.81	I(deg.) 2°56'	B.C = 0 + 44.21 E.C = 0 + 95.41 R(m) = 1000 TL(m) = 25.60 CL(m) = 51.20 SL(m) = 0.33
ANG. 5	5+16.98	I(deg.) 7°38'	B.C = 4 + 83.62 E.C = 5 + 50.34 R(m) = 500 TL(m) = 33.36 CL(m) = 66.61 SL(m) = 1.11
ANG. 6	6+29.88	I(deg.) 11°00'	B.C = 5 + 81.74 E.C = 6 + 78.02 R(m) = 500 TL(m) = 48.14 CL(m) = 95.99 SL(m) = 2.31

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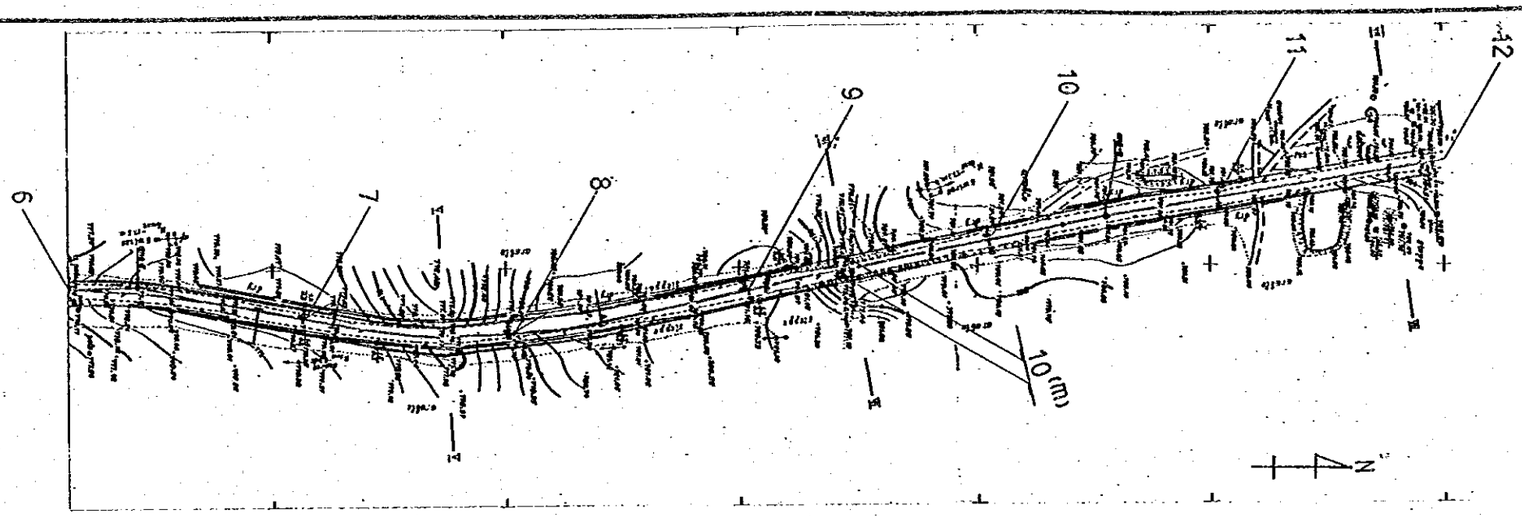
THE STUDY ON SOLID WASTE MANAGEMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

Figure 2.16
Access Road Improvement Plan for West T/S (1/4)

SCALE

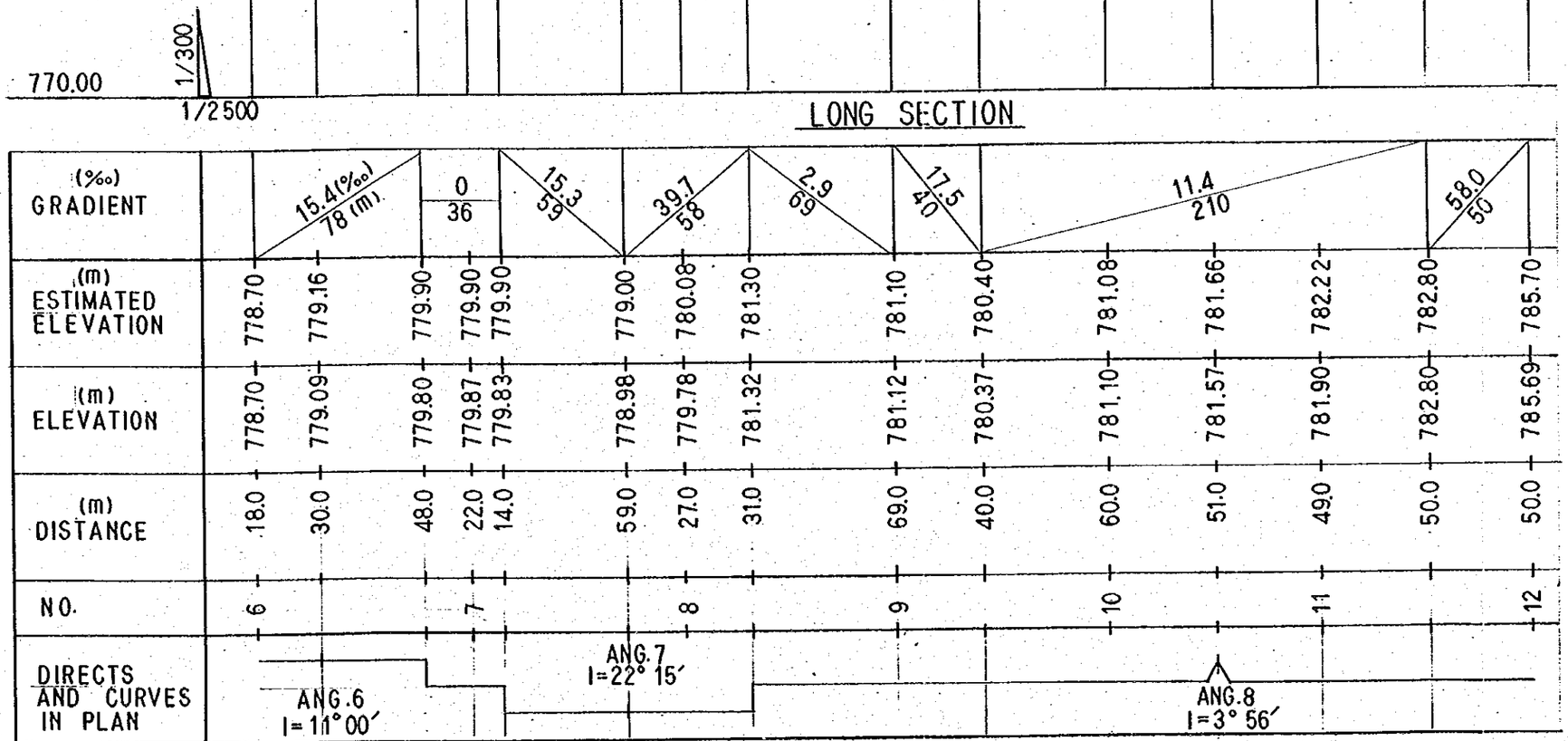
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2 500

Circular Curves

		I(deg.)	B.C = 5 +	81.74
ANG.6	6+29.88	11°00'	E.C = 6 +	78.02
			R(m) =	500
			TL(m)=	48.14
			CL(m)=	95.99
			SL(m)=	2.31
		I(deg.)	B.C = 7 +	14.23
ANG.7	7+73.22	22°15'	E.C = 8 +	32.21
			R(m) =	300
			TL(m)=	58.99
			CL(m)=	116.50
			SL(m)=	5.75



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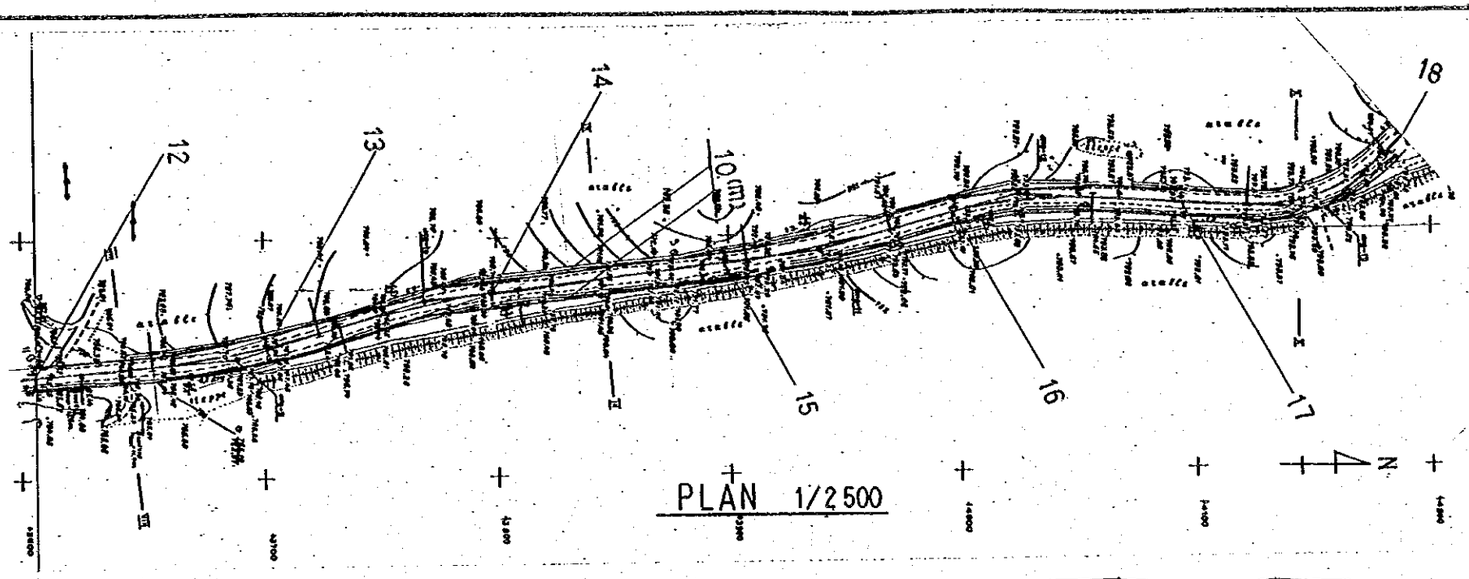
THE STUDY ON SOLID WASTE MANAGEMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

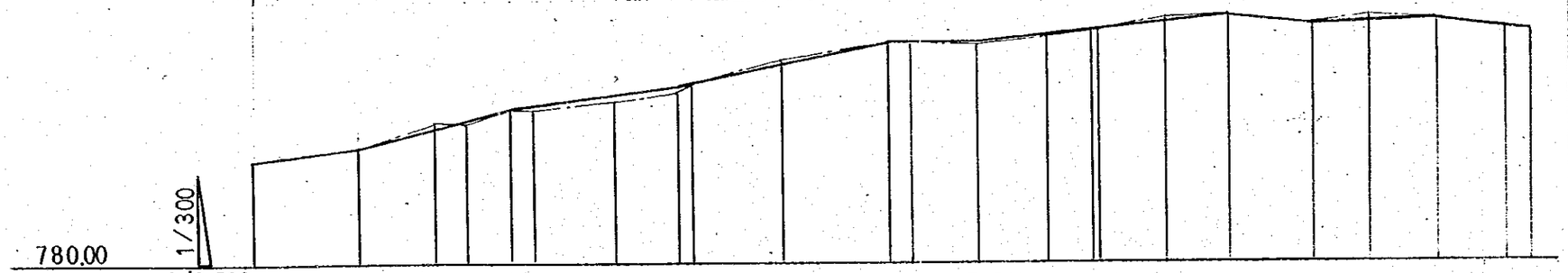
Figure 2.17
Access Road Improvement Plan for West T/S (2/4)

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2500



LONG SECTION

(‰) GRADIENT		(‰) 12.2 / 49(m)		33.3 / 72		14.0 / 86		25.8 / 93		0 / 42		12.4 / 117		13.4 / 41		6.1 / 57		15.1 / 43	
(m) ESTIMATED ELEVATION	785.70		786.30		787.50	788.00	788.70	788.85	789.39	789.81	789.90	791.01	792.30	792.30	792.30	792.70	793.01	793.02	793.38	793.75	793.20	793.35	793.55	793.07	792.90
(m) ELEVATION	785.69		786.30		787.78	787.90	788.71	788.57	789.12	789.60	789.90	791.20	792.30	792.27	792.18	792.72	793.05	793.05	793.45	793.75	793.18	793.78	793.55	792.95	792.87
(m) DISTANCE	50.0		49.0		36.0	15.0	21.0	11.0	38.0	30.0	7.0	43.0	50.0	10.0	32.0	32.0	25.0	1.0	29.0	30.0	41.0	25.0	32.0	32.0	11.0
NO.	12				13					14			15			16					17			18	
DIRECTS AND CURVES IN PLAN			ANG.9 I=8° 16′				ANG.10 I=8° 30′							ANG.11 I=7° 19′			ANG.12 I=17° 25′						ANG.13 I=45° 38′		

Circular Curves

		I(deg.)	
ANG. 9	12+84.70	8°16′	B.C =12 + 48.57 E.C =13 + 20.83 R(m) = 500 TL(m)= 36.13 CL(m)= 72.14 SL(m)= 1.30
ANG. 10	13+69.49	8°39′	B.C =13 + 31.68 E.C =14 + 7.30 R(m) = 500 TL(m)= 37.81 CL(m)= 75.49 SL(m)= 1.43
ANG. 11	15+41.61	7°19′	B.C =15 + 9.64 E.C =15 + 73.58 R(m) = 500 TL(m)= 31.97 CL(m)= 63.85 SL(m)= 1.02
ANG. 12	16+29.22	17°25′	B.C =15 + 98.59 E.C =16 + 59.85 R(m) = 200 TL(m)= 30.63 CL(m)= 60.80 SL(m)= 2.33
ANG. 13	17+58.95	45°38′	B.C =17 + 25.29 E.C =17 + 92.61 R(m) = 80 TL(m)= 33.66 CL(m)= 63.72 SL(m)= 6.79

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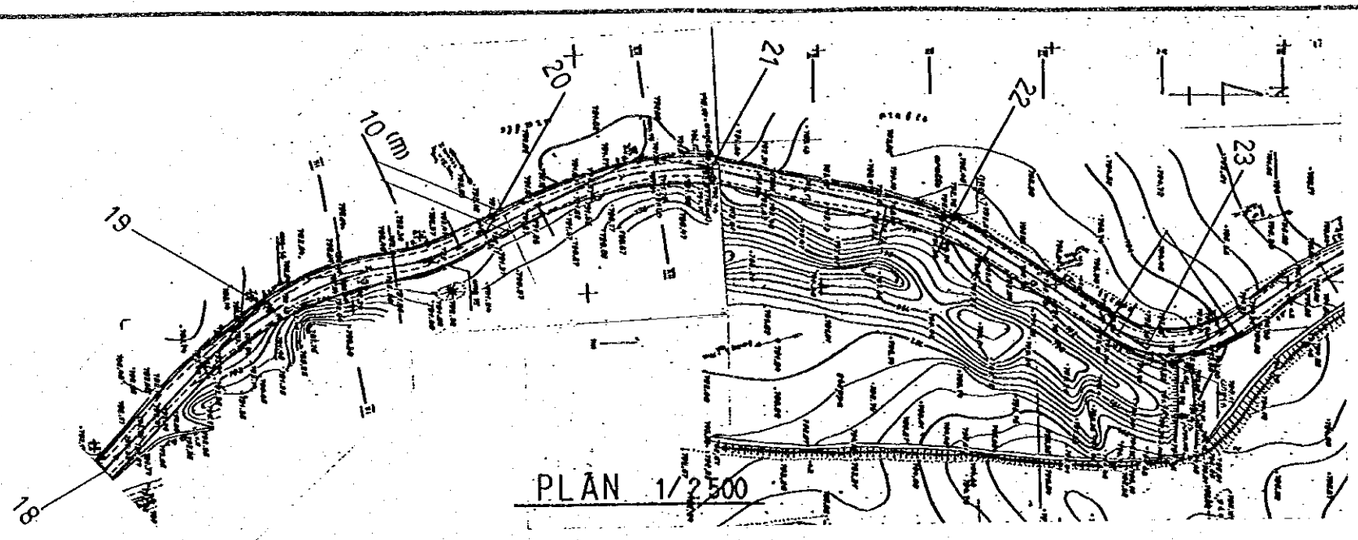
THE STUDY ON SOLID WASTE MANAGEMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

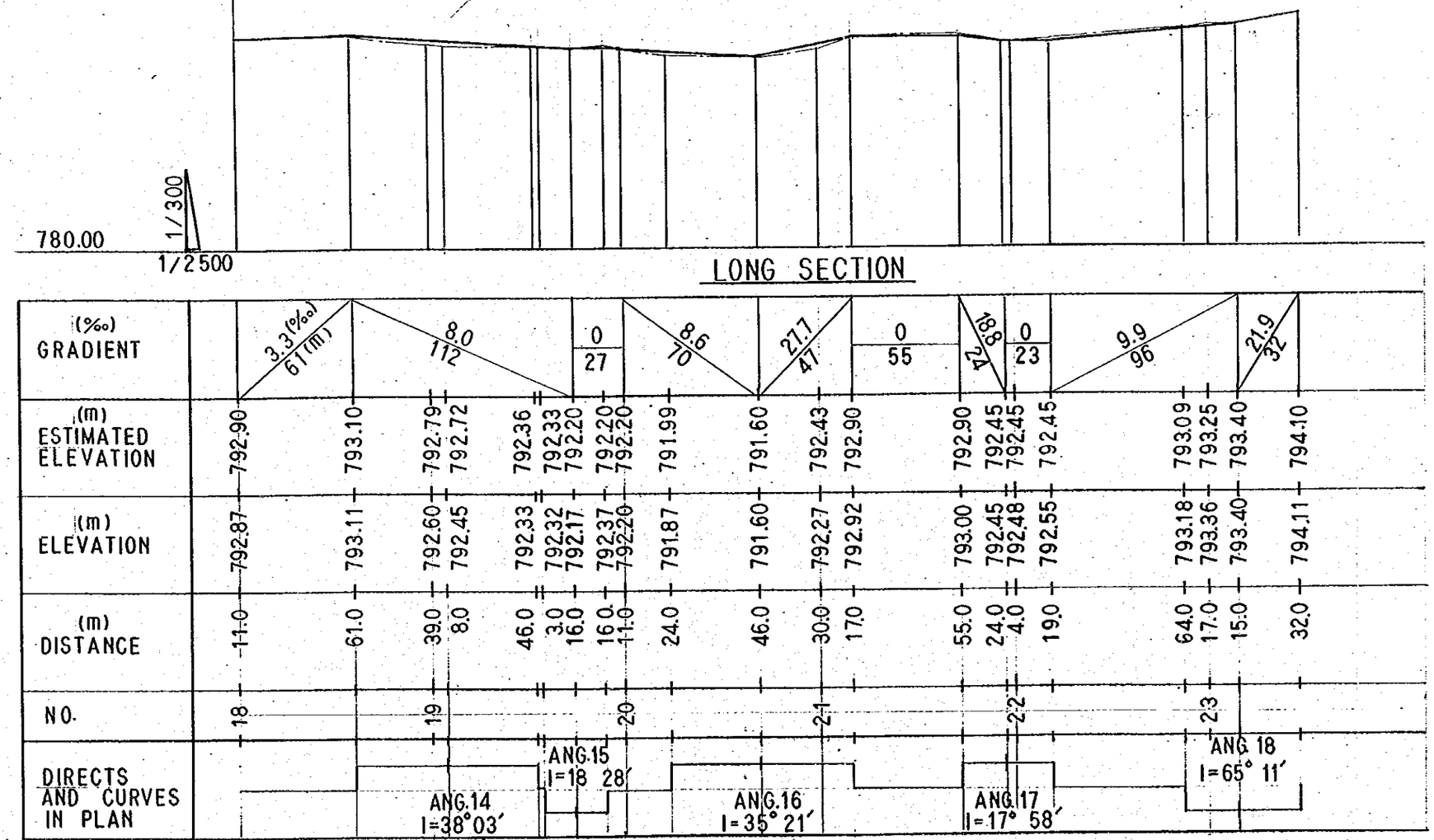
Figure 2.18
Access Road Improvement Plan for West T/S (3/4)

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2500



LONG SECTION

Circular Curves

ANG. 14	19+49.37	I(deg.) 38°03'	B.C =18 +	61.10
			E.C =19 +	57.64
			R(m) =	140
			TL(m)=	48.27
			CL(m)=	92.97
			SL(m)=	8.09
ANG. 15	19+73.40	I(deg.) 18°28'	B.C =19 +	57.14
			E.C =19 +	89.66
			R(m) =	100
			TL(m)=	16.26
			CL(m)=	32.23
			SL(m)=	1.31
ANG. 16	20+71.89	I(deg.) 35°21'	B.C =20 +	24.09
			E.C =21 +	19.69
			R(m) =	150
			TL(m)=	47.80
			CL(m)=	92.55
			SL(m)=	7.43
ANG. 17	19+95.82	I(deg.) 17°58'	B.C =21 +	72.11
			E.C =22 +	19.53
			R(m) =	150
			TL(m)=	23.71
			CL(m)=	47.04
			SL(m)=	1.86
ANG. 18	23+17.80	I(deg.) 65°11'	B.C =22 +	85.83
			E.C =23 +	49.77
			R(m) =	50
			TL(m)=	31.97
			CL(m)=	56.88
			SL(m)=	9.35

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THE STUDY ON SOLID WASTE MANAGEMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

Figure 2.19
Access Road Improvement Plan for West T/S (4/4)

SCALE

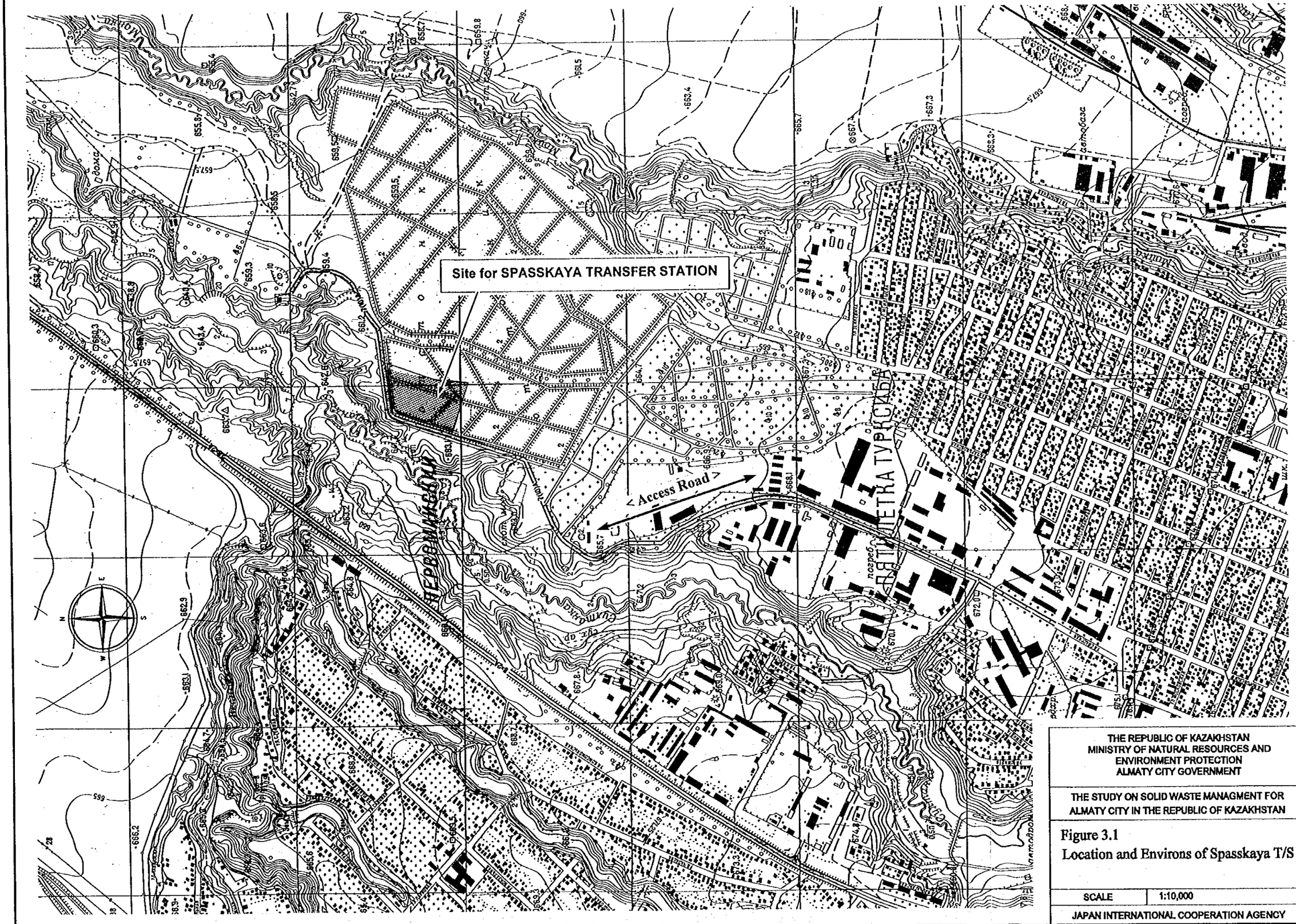
JAPAN INTERNATIONAL COOPERATION AGENCY

DATA BOOK 3

SPASSKAYA TRANSFER STATION

DATA BOOK 3

SPASSKAYA TRANSFER STATION



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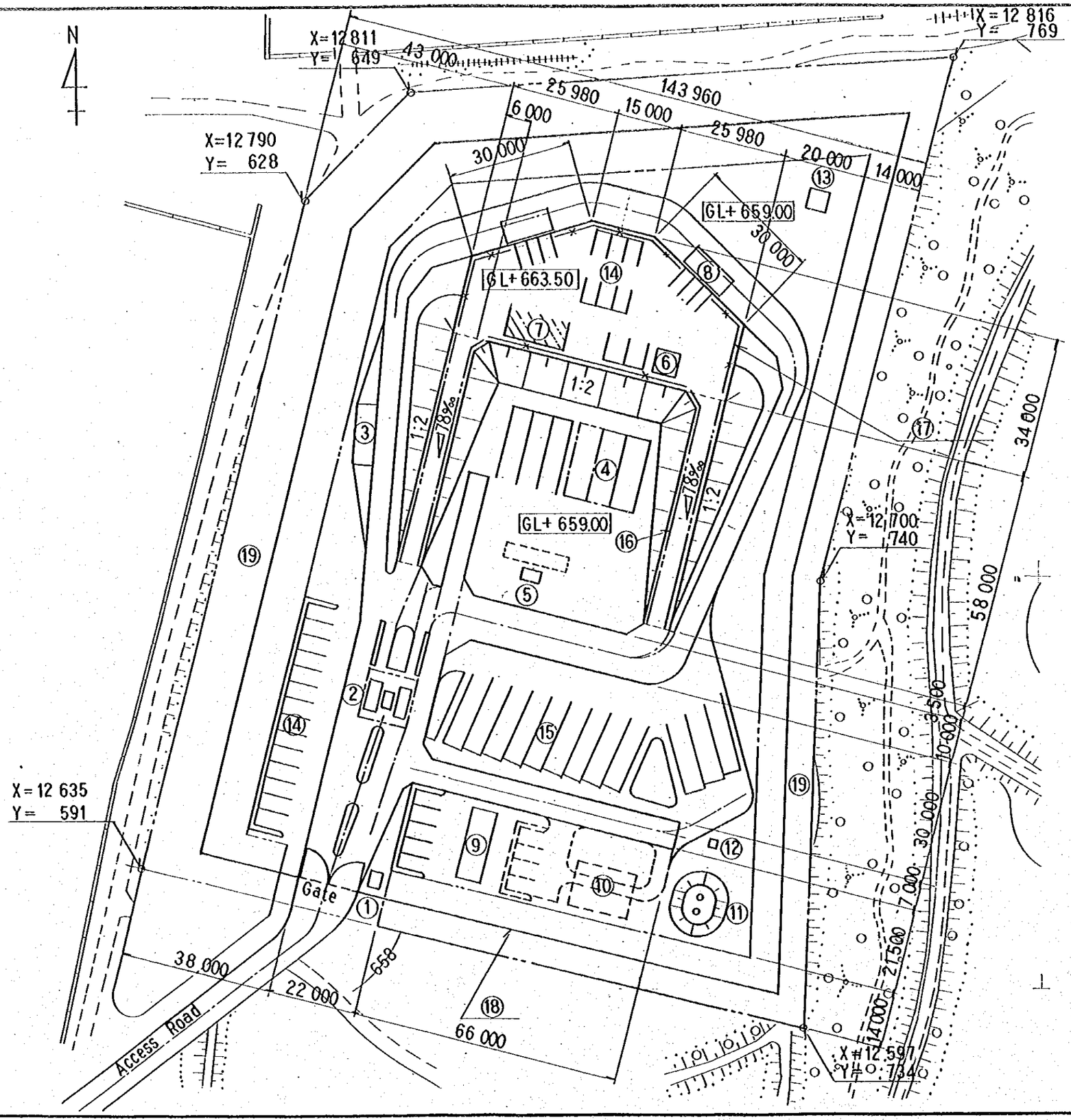
THE STUDY ON SOLID WASTE MANAGMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN

Figure 3.1
Location and Environs of Spasskaya T/S

SCALE	1:10,000

JAPAN INTERNATIONAL COOPERATION AGENCY



① Guard House
② Truck-scale Building
③ Car Washing
④ Workshop
⑤ Fuel Station
⑥ Control House
⑦ Temporary Storage Yard of Waste
⑧ Waste Re-loading Building
⑨ Main Control Building
⑩ Amenity Center
⑪ Well for Water Supply
⑫ Water Storage Tank
⑬ Pit for Wastewater Collection
⑭ Car Parking
⑮ Parking for Transfer Vehicles
⑯ Guard Rail
⑰ Net Fence
⑱ Concrete Block Fence
⑲ Green Belt

Scale :
0 10 20 30 40 50 m

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Figure 3.2
Layout Plan of Spasskaya T/S

SCALE	1 : 1000

JAPAN INTERNATIONAL COOPERATION AGENCY

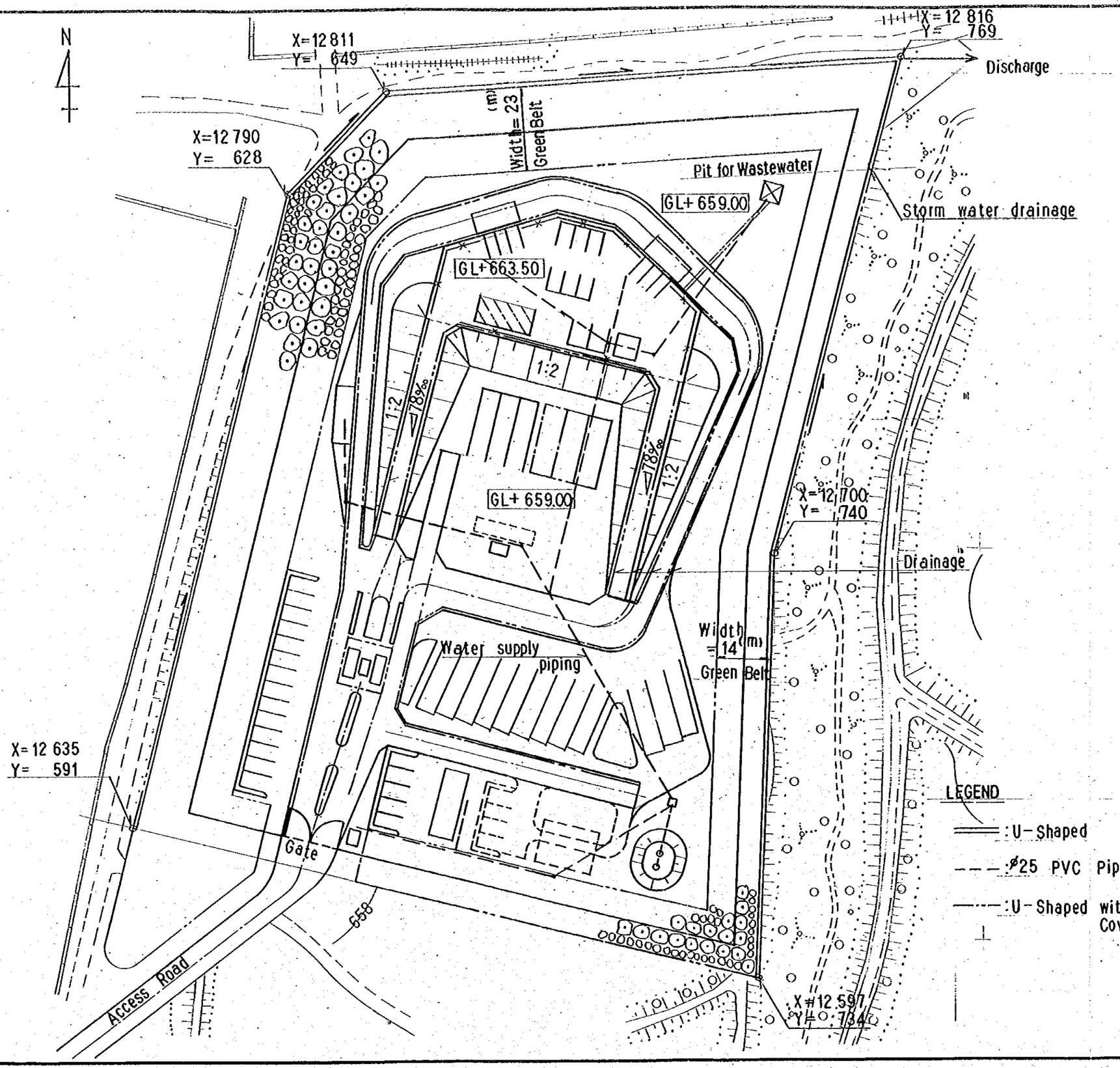

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Figure 3.3
Water Supply and Drainage Plan for Spasskaya T/S

SCALE	1 : 1000

JAPAN INTERNATIONAL COOPERATION AGENCY

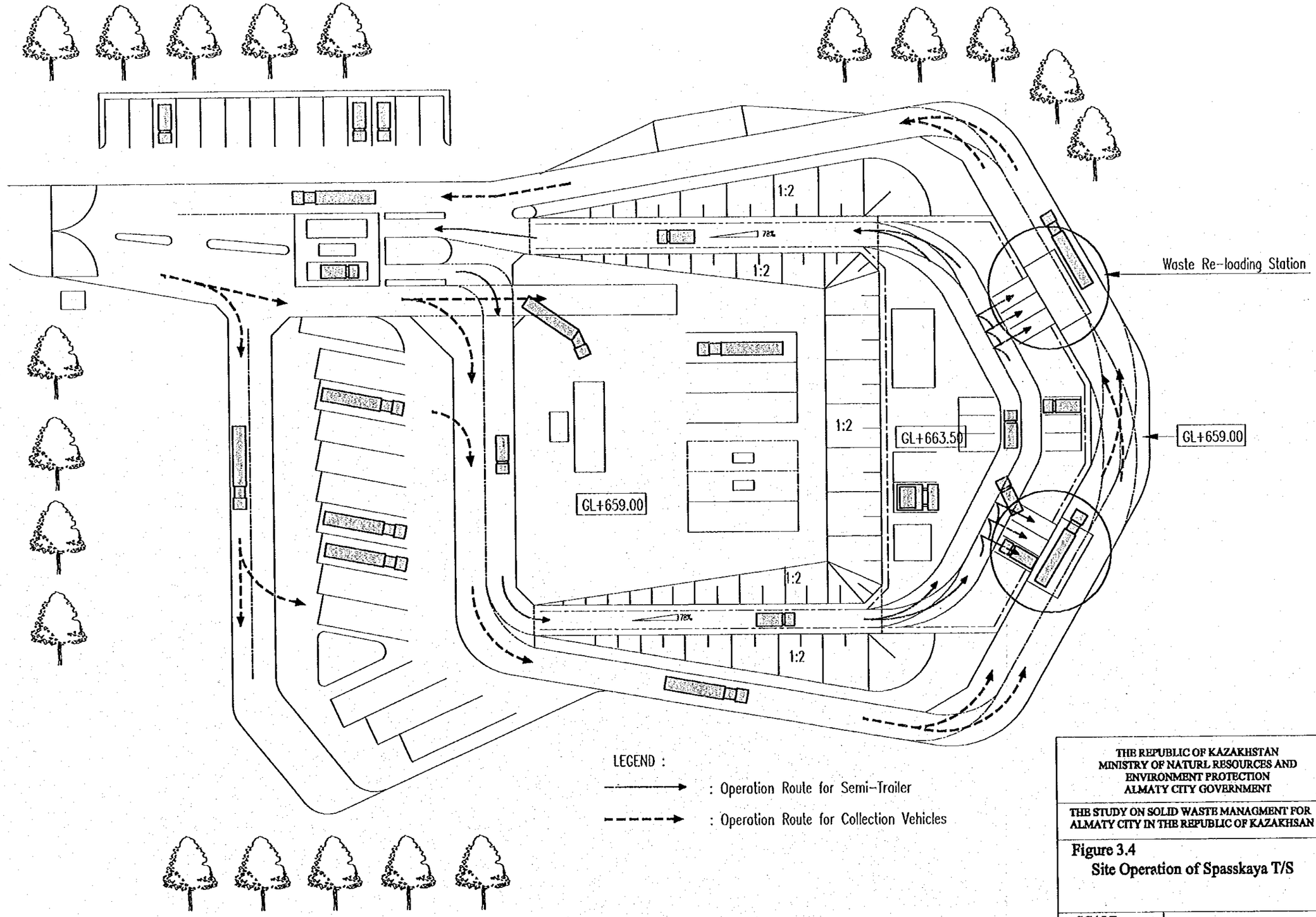

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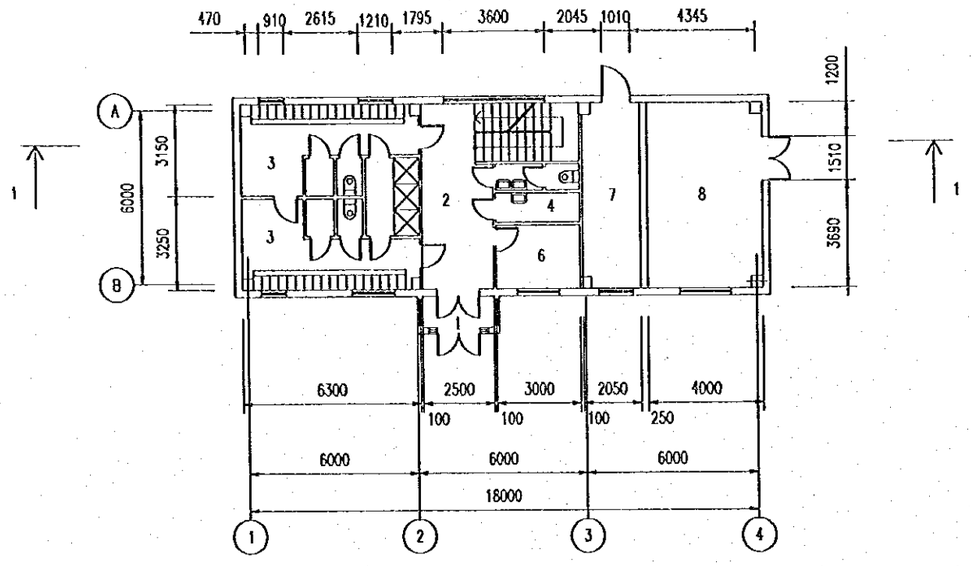
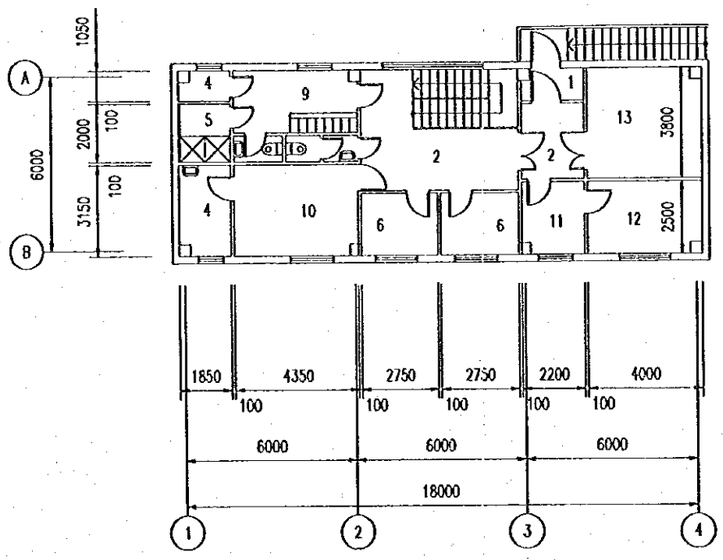
Figure 3.4
Site Operation of Spasskaya T/S

SCALE

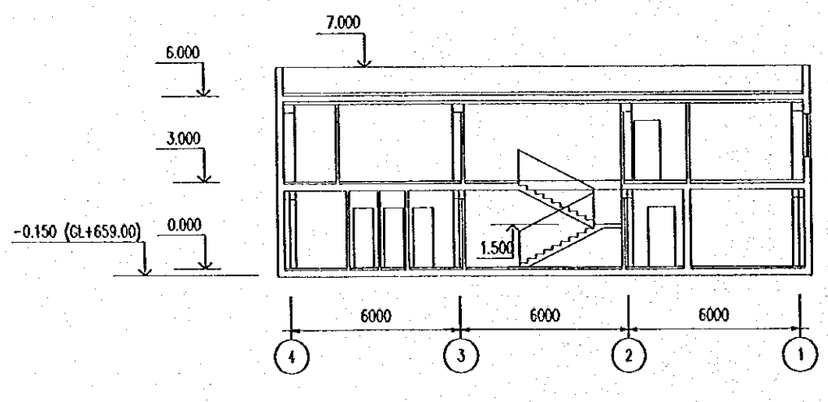
JAPAN INTERNATIONAL COOPERATION AGENCY



1 ST FLOOR LAYOUT



2 ND FLOOR LAYOUT



SECTION 1–1

1	ENTRANCE	8	BOILER ROOM
2	CORRIDOR	9	LOCKER ROOM FOR WOMEN
3	LOCKER ROOM FOR MEN	10	DINING ROOM
4	STORE	11	SECRETARY
5	SHOWER	12	DIRECTOR OFFICE
6	OFFICE	13	MEETING ROOM
7	FIRE EQUIPMENT STORE		

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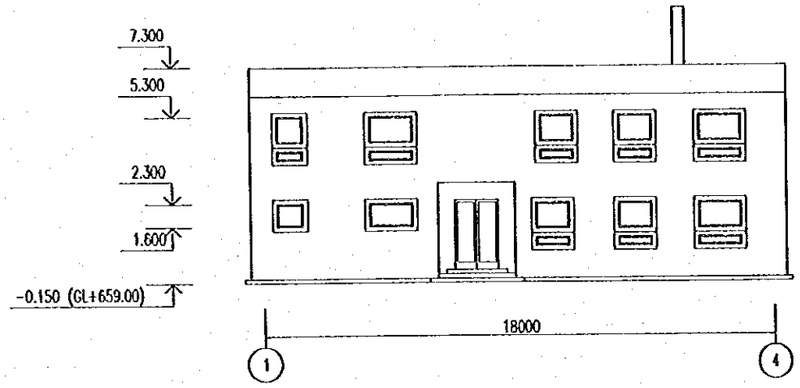
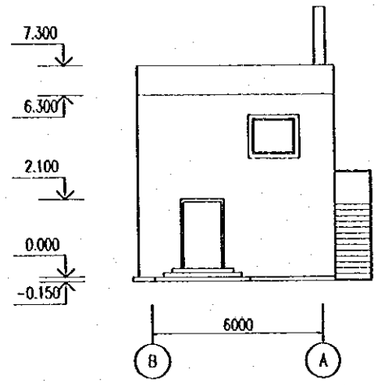
Figure 3.5
Main Control Building of Spasskaya T/S (1/2) : Plan

SCALE 1:200

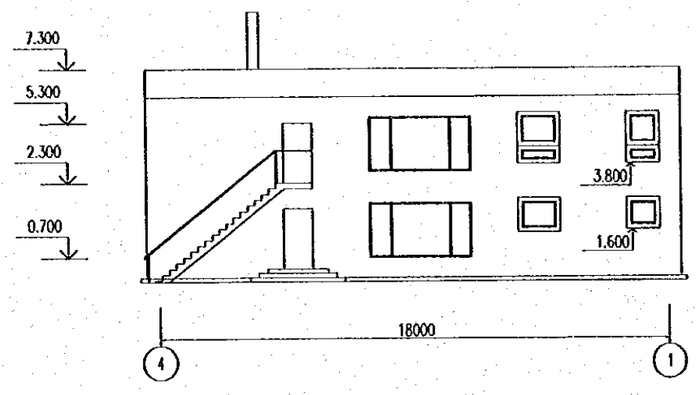
JAPAN INTERNATIONAL COOPERATION AGENCY



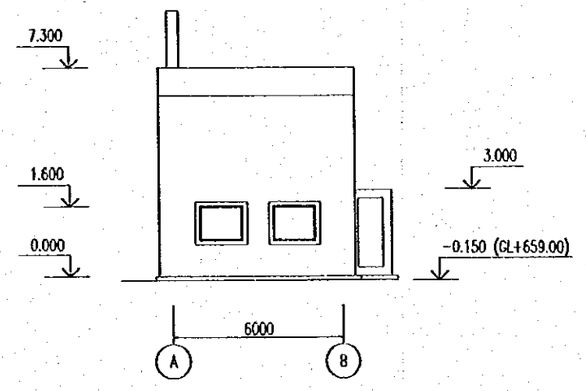
ELEVATION 1-4



ELEVATION B-A



ELEVATION 4-1



ELEVATION A-B

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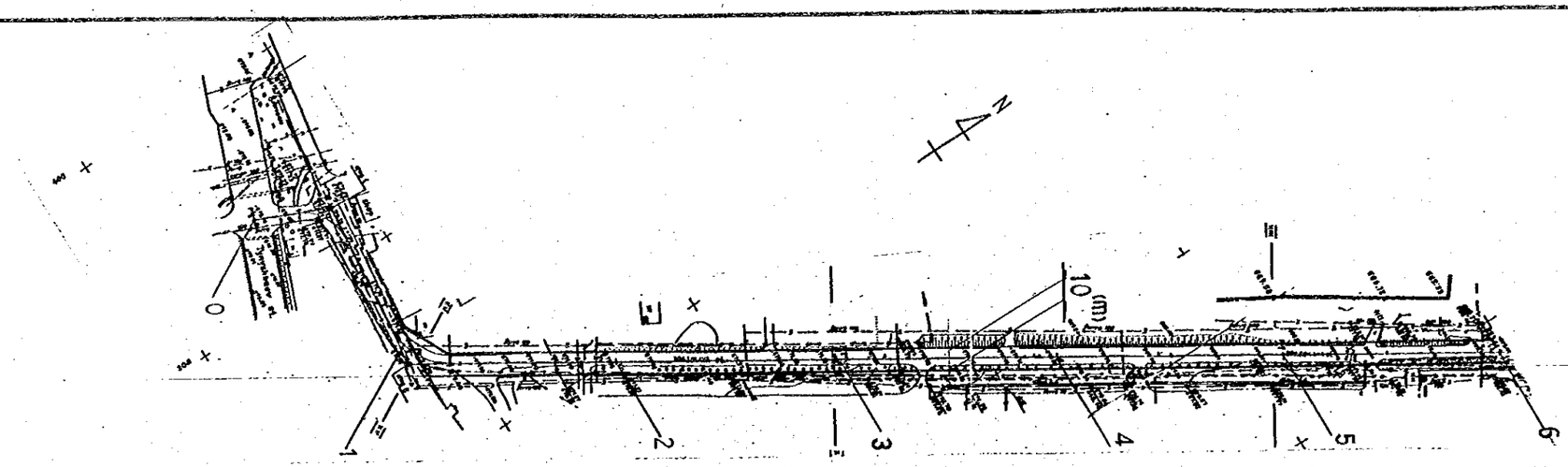
Figure 3.6
Main Control Building of Spasskaya T/S (2/2) : Elevation

SCALE 1 : 200

JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2500

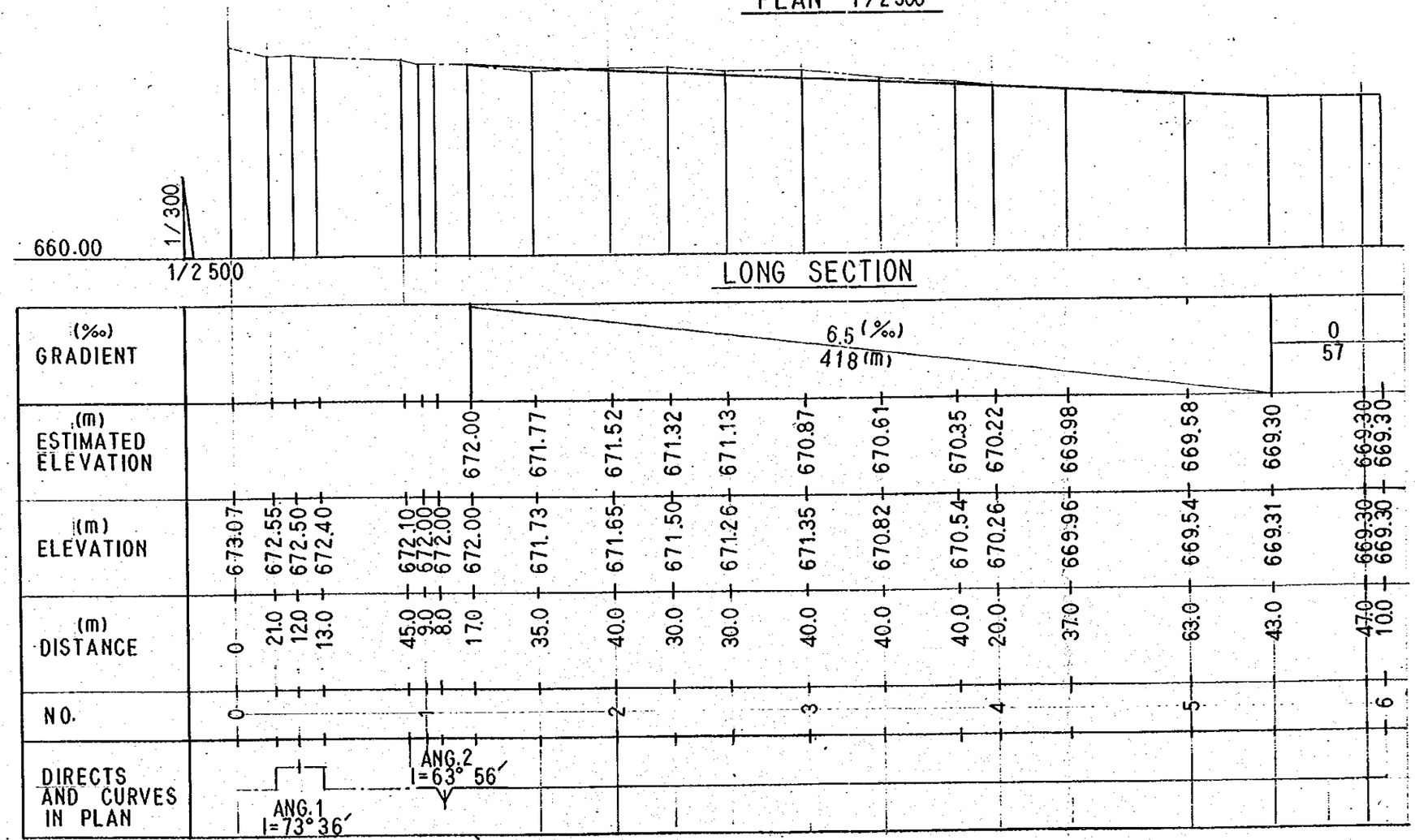


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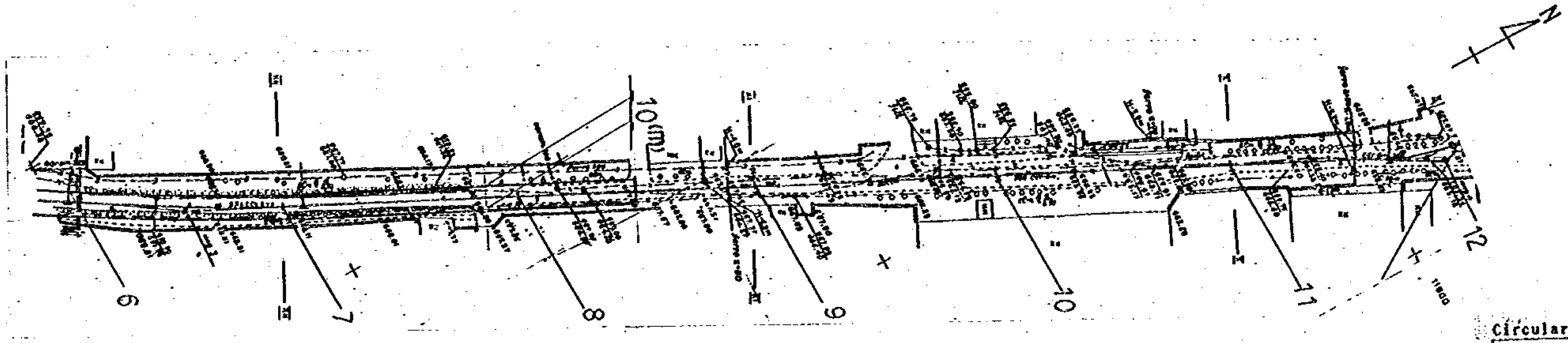
Figure 3.7
Access Road Improvement Plan for Spasskaya T/S (1/4)

SCALE

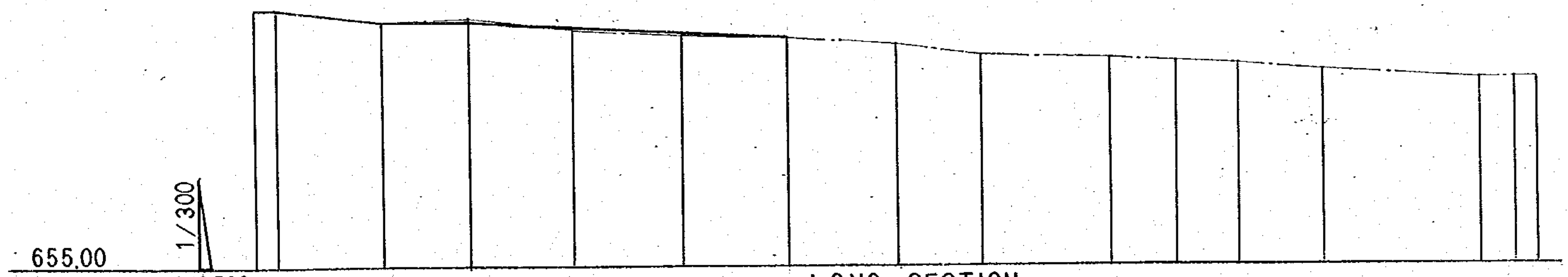
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2500

Circular Curves

		I(deg.)	
ANG.3	6+60.13	6'58'	B.C = 6 + 11.43 E.C = 7 + 8.83 R(m) = 800 TL(m)= 48.70 CL(m)= 97.27 SL(m)= 1.48



LONG SECTION

(‰) GRADIENT: 0 / 57 ; 14.3 (‰) / 49 (m) ; 0 / 40 ; 6.0 / 150

(m) ESTIMATED ELEVATION	669.30	669.30	668.60	668.60	668.55	668.30	668.00	667.70									
(m) ELEVATION	669.30	669.30	668.60	668.70	668.50	668.20	667.88	667.67	667.30	666.67	666.49	666.29	666.07	665.80	665.37	665.30	665.28
(m) DISTANCE	10.0	11.0	49.0	40.0	8.0	42.0	50.0	50.0	50.0	60.0	40.0	30.0	30.0	40.0	68.0	23.0	9.0
NO.	6			7			8		9		10			11			12
DIRECTS AND CURVES IN PLAN			ANG.3 I=6°58'												ANG.4 I=26° 13'		

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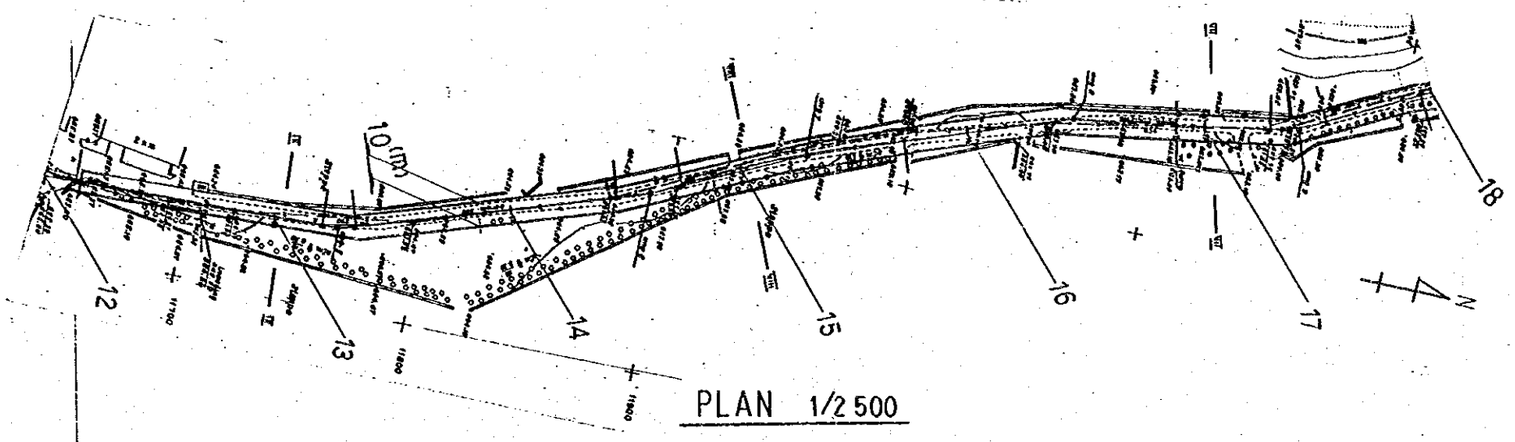
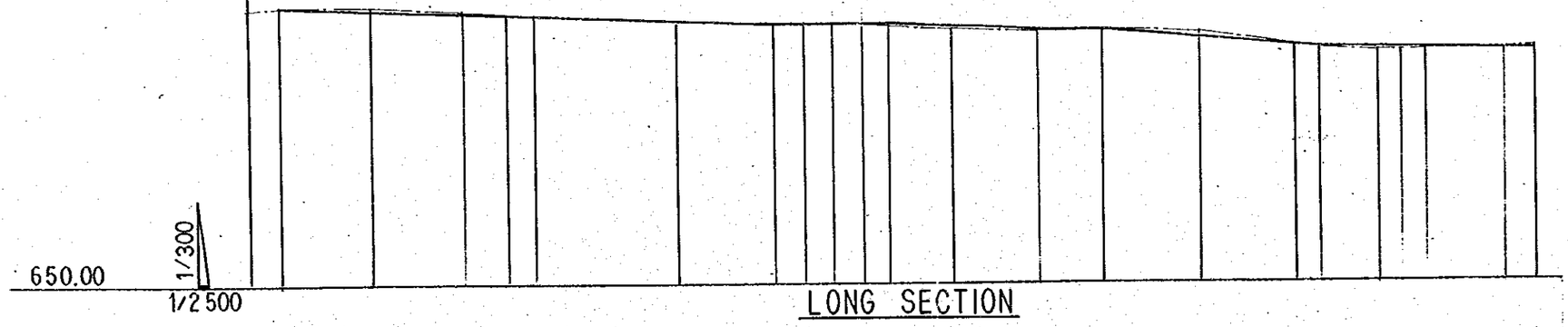
Figure 3.8
Access Road Improvement Plan for Spasskaya T/S (2/4)

SCALE

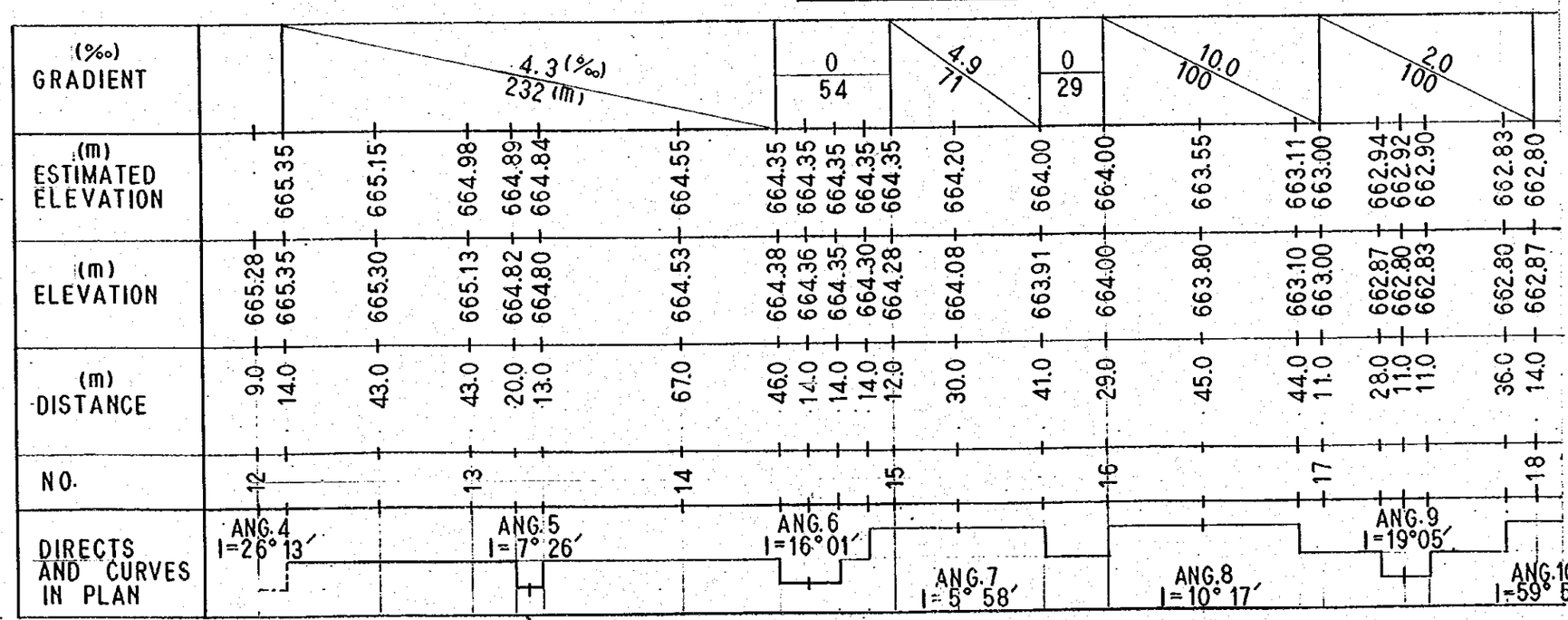
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2 500



LONG SECTION



Circular Curves

ANG. 5	13+26.27	I(deg.) 7°26′	B.C =13 + 19.77 E.C =13 + 32.77 R(m) = 100 TL(m)= 6.60 CL(m)= 12.97 SL(m)= 0.21	
ANG. 6	14+60.34	I(deg.) 16°01′	B.C =14 + 46.27 E.C =14 + 74.41 R(m) = 100 TL(m)= 14.07 CL(m)= 27.95 SL(m)= 0.98	
ANG. 7	15+29.50	I(deg.) 5°58′	B.C =14 + 87.81 E.C =15 + 71.19 R(m) = 800 TL(m)= 41.69 CL(m)= 83.31 SL(m)= 1.09	
ANG. 8	16+44.54	I(deg.) 10°17′	B.C =15 + 99.55 E.C =16 + 89.53 R(m) = 500 TL(m)= 44.99 CL(m)= 89.74 SL(m)= 2.02	
ANG. 9	17+39.34	I(deg.) 19°05′	B.C =17 + 27.57 E.C =17 + 51.11 R(m) = 70 TL(m)= 11.77 CL(m)= 23.31 SL(m)= 0.98	
ANG. 10	18+16.95	I(deg.) 59°52′	B.C =17 + 88.16 E.C =18 + 45.74 R(m) = 50 TL(m)= 28.79 CL(m)= 52.24 SL(m)= 7.70	

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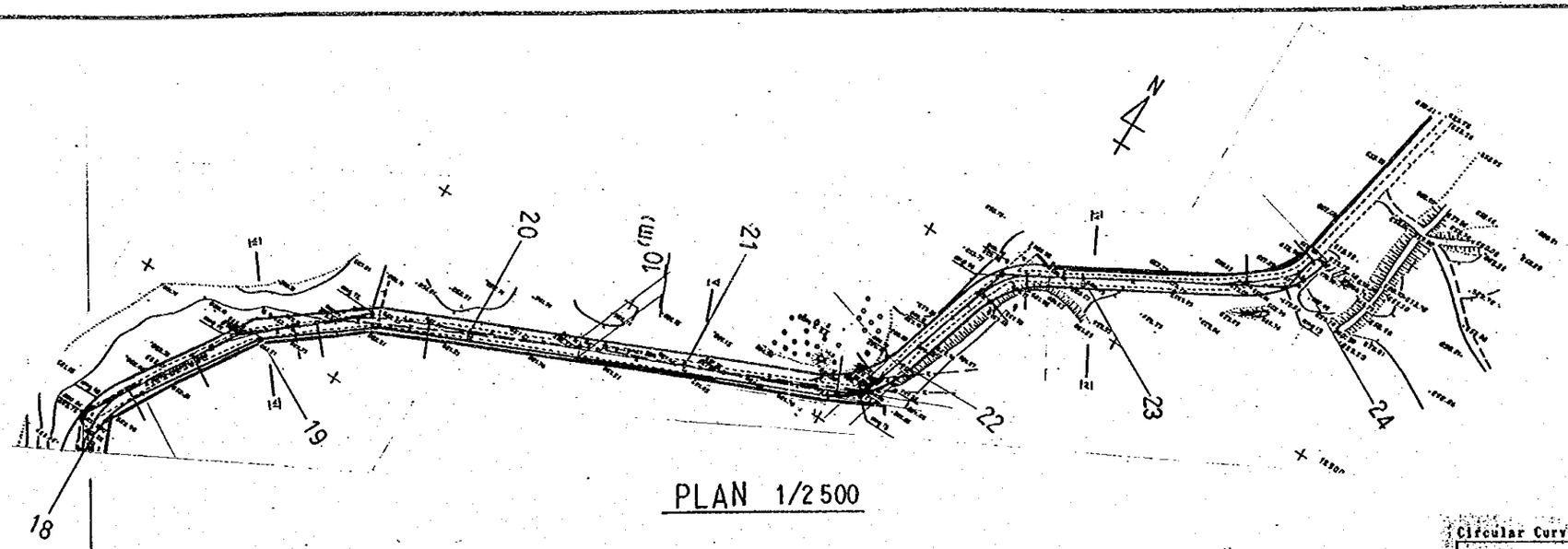
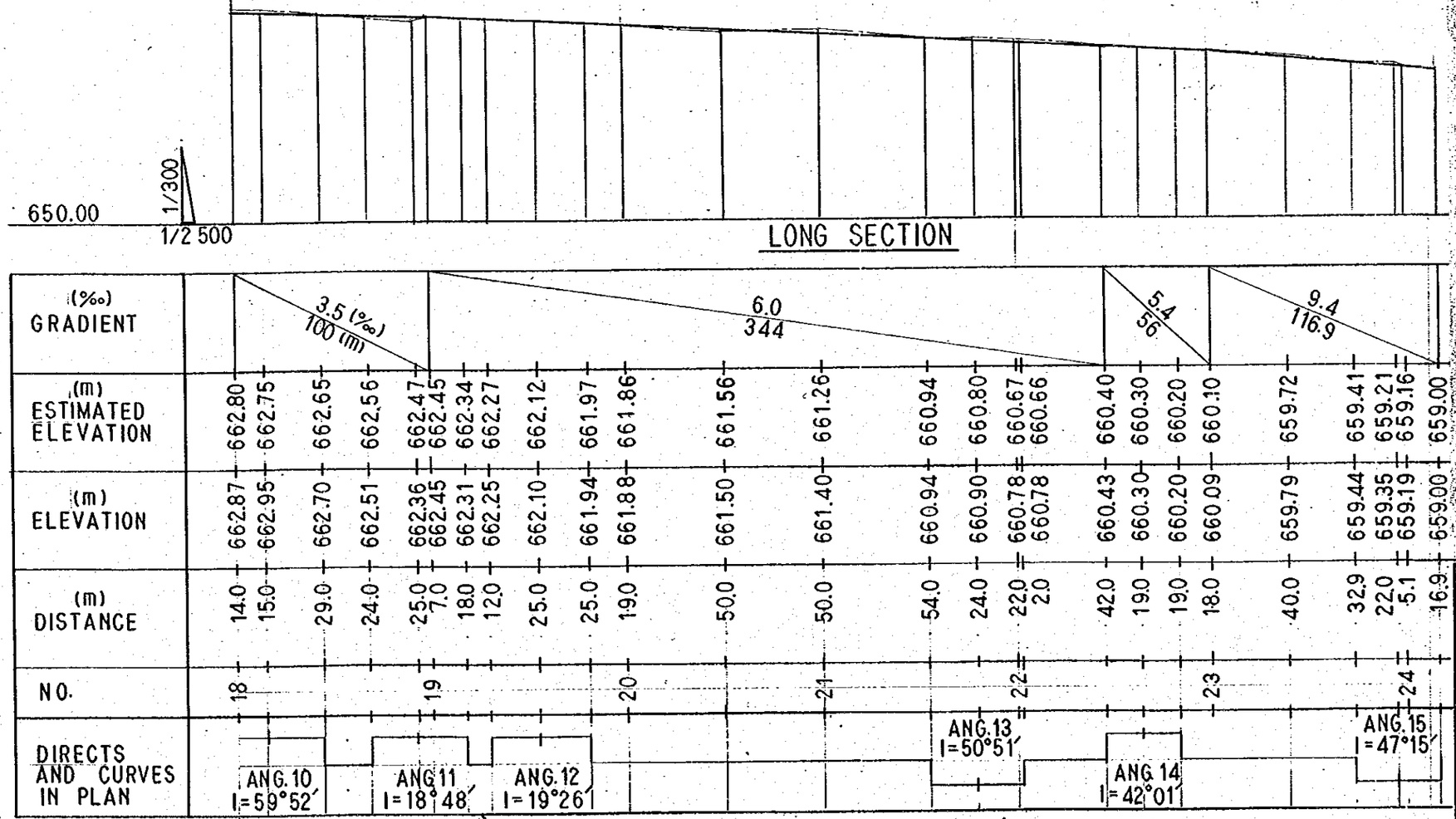
Figure 3.9
Access Road Improvement Plan for Spasskaya T/S (3/4)

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN 1/2 500



Circular Curves

		I(deg.)	B.C =17 + 88.16
ANG.10	18+16.95	59°52'	E.C =18 + 45.74
			R(m) = 50
			TL(m)= 28.79
			CL(m)= 52.24
			SL(m)= 7.70
		I(deg.)	B.C =18 + 68.30
ANG.11	18+93.13	18°48'	E.C =19 + 17.96
			R(m) = 150
			TL(m)= 24.83
			CL(m)= 49.22
			SL(m)= 2.04
		I(deg.)	B.C =19 + 29.94
ANG.12	19+55.62	19°26'	E.C =19 + 81.30
			R(m) = 150
			TL(m)= 25.68
			CL(m)= 50.88
			SL(m)= 2.18
		I(deg.)	B.C =21 + 55.13
ANG.13	21+78.90	50°51'	E.C =22 + 2.67
			R(m) = 50
			TL(m)= 23.77
			CL(m)= 44.38
			SL(m)= 5.36
		I(deg.)	B.C =22 + 44.46
ANG.14	22+63.66	42°01'	E.C =22 + 82.86
			R(m) = 50
			TL(m)= 19.20
			CL(m)= 36.67
			SL(m)= 3.56
		I(deg.)	B.C =23 + 72.99
ANG.15	23+94.86	47°15'	E.C =24 + 16.73
			R(m) = 50
			TL(m)= 21.87
			CL(m)= 41.23
			SL(m)= 4.57

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Figure 3.10
Access Road Improvement Plan for Spasskaya T/S (4/4)

SCALE

JAPAN INTERNATIONAL COOPERATION AGENCY