TABLES

Table 1.1-1 (1/2) SUMMARY OF MASTER PLAN

Stage	Category	Objective	Project	Outcome	Procedure	Timing	Responsible agency *1	Effectiveness *2 (US$1,000)	Economic priority	Financial cost (US$1,000)	Method of cost recovery	Report reference
Short Term Program	Technical measure	Water quality improvement	Installation of treatment plant to existing factories and piggeries	Reduction of BOD pollution of 0.49 kg/day Reduction of SS pollution Reduction of toxicant	Installation of treatment plant to factories with support of institutional measures	2000-2003	(1) Factory and piggery owners (2) ACRT	$3,864 /ton/day	4	$11,998	Factory and piggery owners pay the cost	6.1.1 (Vol. 2)
			Installation of treatment plant to factories (newly constructed)	Reduction of BOD pollution of 0.67 ton/day, SS and Toxicant	Installation with support of institutional measures	2000-2003	(1) Factory owners (2) ACRT	$2,473/ton/day	3	$10,791	-do-	6.1.1 (Vol. 2)
			Installation of sewage treatment plant and its operation	Reduction of BOD pollution of 2.70 ton/day	Installation of sewage treatment plant in the area of Ocumare del Tuy	1997-2003	(1) ACRT (2) State Gov.	$1,333/ton/day	2	$28,020	Charge to households and factories	6.1.1 (Vol. 2)
				Reduction of BOD pollution of 4.07 ton/day*5	Installation in the area of Las Tejerias	2000-2003	(1) ACRT (2) State Gov.	$422 /ton/day	1	$12,700	- do -	
			Reforestation	Reduction of Turbidity of 35 mg/l	Reforestation in Maitana basin	1997-2003	(1) ACRT (2) State Gov.	$9.1/mg/l	1	$2,520	Government pay the cost	6.1.1 (Vol. 2)
		Securement of water quantity	O-Tuy III pumping and construction of Guare dar	Securement of water quantity by newly developed water of 2.0 m^3	Construction of pump and da	1997-2003	(1) Hidrocapital	$6,290/$m^3$/s	1	$85,980	Charge to households in CMA	6.1.2 (Vol. 2)
			Installation of sand settling pond and operatio	Securement of water quantity of 0.023m^3/s	Installation of sand settling pond at Tome de Agua	1997-2003	(1) Hidrocapital	$15,130/$m^3$/s	3	$2,610	-do-	6.1.1 (Vol. 2)
			Installation of treatment plant to factories	Securement of water quantity of 0.024 m^3/s	Installation of treatment plant to factories related to odor and color	1997-2003	(1) Factory and piggery owners (2) ACRT	$13,167/$m^3$/s	2	$2,057	-do-	6.1.1 (Vol. 2)
	Institutional measure	Assurance of water quantity and water quality improvement	Provision of law and regulation and operation	Strengthening of control of factory effluent	Approval from higher authority	1997-2003	(1) MARNR (2) CORDIPLAN	N.A.	N.A.	N.A.	N.A.	6.1.3 (Vol. 2)
			Strengthening of the function of organiznton and operation	Strengthening of enforcement for necessity action taken by agency concerned	Approval from higher authority	1997-2003	(1) ACRT (2) MARNR	N.A.	N.A.	N.A.	N.A.	6.1.3 (Vol. 2)
			Establishment/operation monitoring system	Collection of basic information	Confirmation of budgetary allocation	1997-2003	(1) ACRT (2) MARNR	N.A.	N.A.	1,652	Government pay the cost	6.1.3 (Vol. 2)
			Establishment of environmental fund and operation	Assistance for necessary works for environment improvement	Establishment of new law	1997-2003	(1) ACRT (2)FONCREI/CORP-INDUSTRIA	N.A.	N.A.	24,846	Repayment by borrowers	6.1.3 (Vol. 2)
			Establishment/operation pollution charge	Promotion of installation of trea ment plant for factories/piggeries	Establishment of new law	1997-2003	(1) ACRT	N.A.	N.A.	N.A.	N.A.	6.1.3 (Vol. 2)
			Establishment/operation public education system	Awareness by public on significance of environment problem	Approval from higher authority	1997-2003	(1) ACRT (2) State. Gov., private sector	N.A.	N.A.	50	Government pay the cost	6.1.3 (Vol. 2)

*1 (1): Implementing Agency/Body (2): Related Agency/Body
*2 Cost Effectiveness = Annual Cost /Outcome (Annual Cost = Initial Cost x annuity factor(0.11 to 0.13) + O&M Cost)
*3 Priority is confirmed through the pre-feasibility study
*4 The cost shows that esablish the Environmental Fund including loan amortizations for factories and piggeries
*5 Outcome at the Boca de Cagua
N.A.: not applicable

Table 1.1-1 (2/2) SUMMARY OF MASTER PLAN

Stage	Category	Objective	Project	Outcome	Procedure	Timing	Related agency *1	Effectiveness *2 (US$1,000)	Economic priority	Financial cost (US$1,000)	Method of cost recovery	Report reference
Mid Term Program	Technical measure	Water quality improvement and Securement of water Quantity	Installation of treatment plant to factories (newly constructed)	Reduction of BOD pollution of 1.17 ton/day Reduction of SS pollution Reduction of toxicant	Installation of treatment plant to factories with support of institutional measure	2004-2010	(1) Factory (2) ACRT	$2,441/ton/day	2	$18,606	Factory owners pay the cost	6.1.1 (Vol.2)
			Installation of sewage treatment plant and its operation	Reduction of BOD pollution of 0.55 ton/day	Installation of sewage system in the area of S.F. de Yare	2004-2010	(1) ACRT (2) State Gov.	$3,440/ton/day	4	$14,100	Charge to households and factories	6.1.1 (Vol.2)
			Installation of sewage treatment plant and its operation	Reduction of BOD pollution of 0.27 ton/day	Extention of sewage System in the area of Ocumare del Tuy	2004-2010	(1) ACRT (2) State Gov.	$2,640/ton/day	3	$4,914	Charge to households and factories	6.1.1 (Vol.2)
			Installation of sewage treatment plant and its operation	Reduction of BOD pollution of 2.30 ton/day	Installation of sewage system in the EL Consejo	2007-2010	(1) ACRT (2) State Gov.	$757 /ton/day	1	$13,100	Charge to households and factories	6.1.1 (Vol.2)
			Reforestation	Reduction of turbidity of 70 mg/l	Reforestation in two tributaries (Oda,Guayas and Cagua)	2004-2010	(1) ACRT (2) State Gov.	$8.5/mg/l	1	$5,130	Government pay the cost	6.1.1 (Vol.2)
			Sand settling pond in tributaries	Reduction of turbidity of 225 mg/l	Construction in 4 tributaries	2004-2010	(1) ACRT	$8.4/mg/l	2	$11,391	Government pay the cost	6.1.1 (Vol.2)
	Institutional measure	Water quality improvement and Securement of water Quantity	Sustainable enforcement of monitoring	Sustainable collection of basic information	Continuous operation	2004-2010	(1) ACRT	N.A.	N.A.	Continuation of Short Term	Government pay the cost	6.1.4 (Vol.2)
			Sustainable enforcement of strengthening of control	Strengthening of enforcement for necessity action taken by agency concerned	Continuous operation	2004-2010	(1) ACRT	N.A.	N.A.	Continuation of Short Term	Government pay the cost	6.1.3 (Vol.2)
			Sustainable enforcement of public education	Education for school, manufacturers and inhabitants	Continuous operation	2004-2010	(1) ACRT	N.A.	N.A.	Continuation of Short Term	Government pay the cost	6.1.3 (Vol.2)
			Sustainable enforcement of application of environmental fund	Assistance for necessary works for environment improvement	Continuous operation	2004-2010	(1) ACRT	N.A.	N.A.	US$18,606	Repayment by borrowers	6.1.3 (Vol.2)
			Sustainable enforcement of application of pollution charge	Promotion of installation of treatment plant for factories and piggeries	Continuous operation	2004-2010	(1) ACRT	N.A.	N.A.	N.A.	N.A.	6.1.3 (Vol.2)

*1 (1): Responsible Agency/Body (2): Related Agency/Body *2 Cost Effectiveness = Annual Cost /Outcome (Annual Cost = Initial Cost x 0.11 + O&M Cost) N.A.: not applicable

Table 2.1-1 Factory and Employee Numbers in Cities

CIIU	City / Category	Colonia Tovar	El Consejo	Las Tejerías	[illegible]	Cúa	Paracotos	San Diego de los Altos	San José de los Altos	Charallave	[illegible]	Ocumare del Tuy	San Francisco de Yare	Total
		Tovar	José Félix Ribas	Santos Michelena	Santos Michelena	Urdaneta	Guaicaipuro	Guaicaipuro	Guaicaipuro	Cristóbal Rojas	Cristóbal Rojas	Lander	Simón Bolívar	
31100	Food product factory excl. soft drinks						1(203)			1(691)			1(26)	3(920)
31111	Abattoirs for cattle, pigs, sheep, horses and rabbits			1(45)	1(90)					1(33)				3(168)
31112	Farms of chicken and other animals		1(80)		1(328)									2(408)
31113	Preparation and manufacture of meat conserves	1(54)		2(261)						1(56)				4(371)
31121	Milk pasteurization and bottling					1(14)								1(14)
31173	Biscuits,shortcake and noodles									1(390)			1(286)	2(676)
31221	Production of animal food			1(39)	1(39)									2(78)
31311	Distillery		1(573)									1(440)		2(1013)
31341	Production of soft drinks												1(18)	1(18)
31342	Bottling and gasification of natural mineral waters								1(49)					1(49)
Subtotal of food related factories		1(54)	2(653)	4(345)	3(457)	1(14)	1(203)	0	1(49)	4(1170)	0	1(440)	3(330)	21(3715)
32111	Manufacture of textiles fibers			1(253)		1(23)								2(276)
32112	Spinning, weaving and finishing of wool and mixed fibers					1(11)						1(37)		2(48)
32113	Spinning, weaving and finishing of cotton, artificial, synthetic and mixed fibers			2(859)		2(120)				5(376)	1(160)	1(61)		12(1576)
32311	Tannery, finishing of leather						1(41)							1(41)
32321	Tannery						2(65)							2(65)
35131	Synthetic resins, plastic materials and artificial fibers					1(28)								1(28)
35135	Synthetic resins, plastic materials and artificial fibers			1(117)		1(29)					1(700)	1(37)		4(882)
35211	Manufacture of paint and varnishes			1(11)		1(66)				3(821)			1(16)	6(914)
35231	Manufacture of soaps and cleaning products			1(48)	1(236)		1(39)			1(210)			3(288)	7(821)
35234	Manufacture of perfumes and cosmetics													0
35291	Manufacture of polishing products, waxes and polish			2(92)										2(92)
35292	Manufacture of adhesive, glue and priming for textile factory									1(45)				1(45)
35295	Manufacture of adhesive materials, glues, gelatin, and gums									1(18)				1(18)
36200	Pottery and porcelain maker												1(80)	1(80)
36201	Production of fiberglass					1(15)	1(72)							2(87)
36991	Manufacture of floor tiles					1(300)							1(1039)	2(1339)
3699	Manufacture of other non-metallic products										1(42)			1(42)
37102	Manufacture of iron and steel, excl. pig iron and without rolling					1(12)	1(24)			1(350)				3(386)
37201	Production of non-ferrous metals and alloys			1(180)		3(218)					1(41)		1(85)	6(524)
38191	Manufacture of metallic products, excl. machinery			1(22)			2(130)						1(53)	4(205)
38193	Metal plating		1(25)	2(346)		1(25)	1(53)			2(321)		2(141)		9(911)
38431	Car parts factory			1(296)										1(296)
38433	Automobile spare parts factory					2(414)		1(212)		1(170)		1(26)		5(822)
	Sand mining			1(7)		2(19)	2(19)					2(16)	1(7)	8(68)
Subtotal of non-food related factories		0	1(25)	14(1978)	1(236)	18(1279)	11(443)	1(212)	0	15(2311)	4(943)	8(318)	9(1568)	82(9566)
Total		1(54)	3(678)	18(2323)	4(693)	19(1293)	11(646)	1(212)	1(49)	19(3481)	4(943)	9(758)	12(1898)	103(13028)

Note: Employee numbers in parentheses

Table.2.2-1 Wastewater Treatment Condition of Factories and Piggeries

Classification of Factories		Total Factories Number	Factories Number Sampled			
			Total	Fulfiling Standard	Not-fulfiling Std.	
Industry	Scale				T.P.exist	no-T.P.
Food Production	large	5	5	3	1	1
	middle	9	9	2	1	6
	small	7	7	5	0	2
Manufacturing of Textile	large	4	2	1	0	1
	middle	5	4	1	1	2
	small	6	3	1	0	2
Chemical & others	large	4	2	1	1	0
	middle	9	3	2	0	1
	small	15	3	2	0	1
Metal Manufacturing	large	5	4	1	1	2
	middle	11	6	5	0	1
	small	12	6	1	0	5
Tannery	large	0				
	middle	0				
	small	3	3	0	0	3
Sand Quarries	large	0				
	middle	0				
	small	8	8	0	0	8
Piggery	large	11	5		4	1
	middle	10	4	2	1	1
	small	12	4		3	1
Sub-Total	large	29	18	6	7	5
	middle	44	26	12	3	11
	small	63	34	9	3	22
Total		136	78	27	13	38

note : T.P. is Wastwater Treatment Plant

Table.2.2-2 Installation Cost of Existing Treatment Plant

Food Product Industry

Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
F2	25	119	104,000
F3	1,008	328	1,001,168
F4	200	390	344,800
F8	32	14	63,850
F9	320	440	510,800
F66	43	90	117,100
other area	500		276,000

Metal Manufacturing

Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
N16	42	211	175,042
N18	15	296	40,634
N21	29	41	30,946
N26	100	350	156,000
N31	11	63	50,000
N40	40	160	74,136
N77	7	25	122,200

Manufacturing of Textile

Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
N13	552	227	420,100
N15	749	379	389,800
N28	30	37	132,000
N41	80	45	160,000

Sand Quarries

Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
S1	2,000	11	14,924
S2	1,000	8	
S3	1,200	7	

Chemical Industry

Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
N14	1	11	30,000
N17	9	236	200,000
N25	50	700	465,000
N32	300	1,039	267,492
N33	20	50	76,000
N38	90	300	81,600

Piggery

Reference Number	Discharge (m3/day)	Piggs	Surveyed Cost ($)
No.13	10	1,500	12,000
N0.25	13	1,800	28,000

Tannery

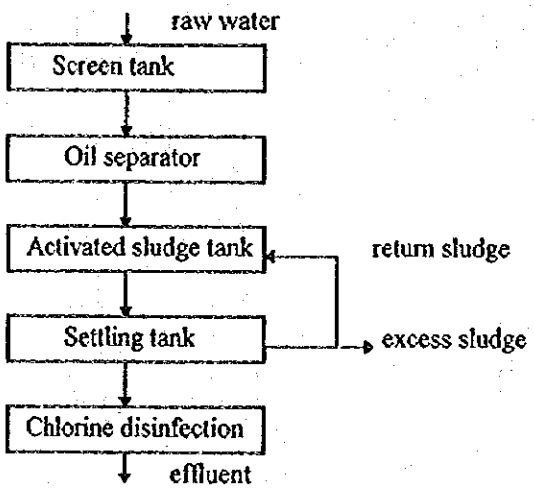
Reference Number	Discharge (m3/day)	Employee	Surveyed Cost ($)
N10	11	6	
N11	60	59	46,780
N93	59	41	

Table.2.3-1 (1/7) Outline of Specification and Composition of Standard Treatment Plant (Biological Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Food Production	BOD: 2000mg/l SS: 500mg/l	BOD: 60mg/l SS: 80mg/l	middle	200 m3/day
			large	500 m3/day
			small	40 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

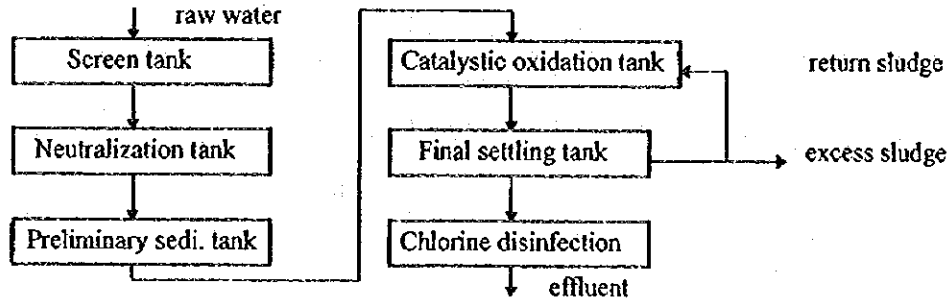
Category	Item	Residence time	Abstract	Tank capacity (m3)			Cost ratio*	
				middle	large	small	large	small
Treatment tank	Screen tank	10 min.	extended aeration & oil separation	1.4	3.5	no	1.6	0
	Oil separator	6 hours		50	125	10	1.6	0.3
	Activated sludge tank	24 hours		200	500	40	1.6	0.3
	Settling tank	2 hours		18	40	3	1.6	0.3
	Chlorination unit	-		-	-	-	-	-
Incidental facilities	Pump & Aerator etc.						2.0	0.3
Instrumentation & Control	Measuring device Control system						1.2	0.7

Table.2.3-1 (2/7) Outline of Specification and Composition of Standard Treatment Plant
(Combination of Biological and Physio-Chemical Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Manufacturing of textile	BOD: 400mg/l SS: 200mg/l	BOD: 60mg/l SS: 80mg/l	middle	100 m3/day
			large	300 m3/day
			small	30 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

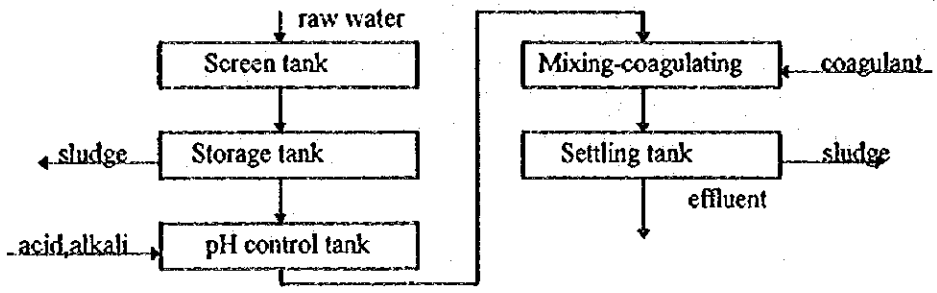
Category	Item	Residence time	Abstract	Tank capacity (m3) middle	large	small	Cost ratio* large	small
Treatment tank	Screen tank	10 min.	catalystic oxidation & solid-liquid separation	1	2	no	1.6	0
	Neutralization	30 min.		2	5	0.5	1.6	0.4
	Pre. settling tank	30 min.		2	5	0.5	1.6	0.4
	Catalystic oxidation tank	4 hours		17	50	5	1.6	0.4
	Settling tank	60 min.		5	13	1.5	1.6	0.4
	Chlorination unit	-		-	-	-	-	-
Incidental facilities	Pump Aerator Mixing unit etc.						1.5	0.5
Instrumentation & Control	Measuring device Control system						1.3	0.7

Table.2.3-1 (3/7) Outline of Specification and Composition of Standard Treatment Plant
(Physio-Chemical Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Chemical and others	BOD: 250mg/l SS: 100mg/l COD: 1000mg/l	BOD: 60mg/l SS: 80mg/l	middle large small	40 m3/day 100 m3/day 20 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

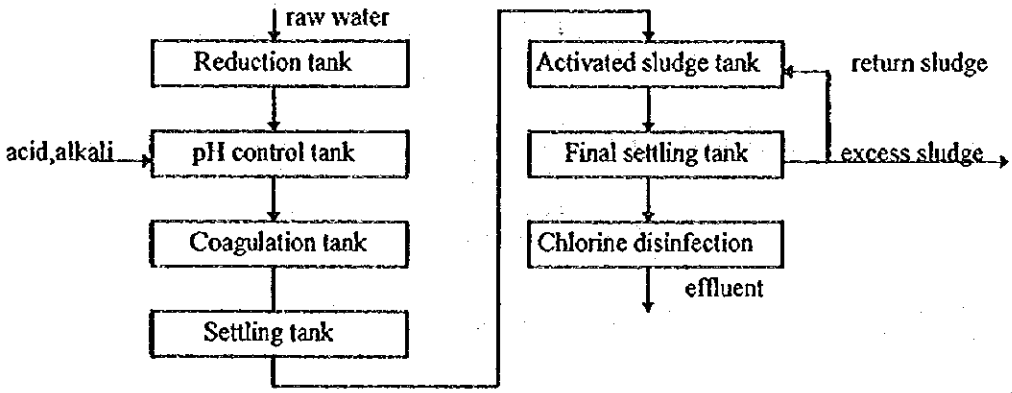
Category	Item	Residence time	Abstract	Tank capacity (m3) middle	large	small	Cost ratio* large	small
Treatment tank	Screen tank	10 min.	Coagulation & solid-liquid separation	0.3	0.7	0.1	1.6	0.6
	Storage tank	6 hours		10	25	5	1.6	0.6
	pH control tank	30 min.		0.8	2.0	0.4	1.6	0.6
	Mixing-coagulating tank	30 min.		0.8	2.0	0.4	1.6	0.6
	Settling tank	6 hours		10	25	5	1.6	0.6
Incidental facilities	Pump Aerator Mixing unit etc.						1.5	0.5
Instrumentation & Control	Measuringdevice Control system						1.2	0.8

Table.2.3-1 (4/7) Outline of Specification and Composition of Standard Treatment Plant
(Combination of Biological and Physio-Chemical Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Tannery	BOD: 700mg/l	BOD: 60mg/l	middle	-
	SS: 500mg/l	SS: 80mg/l	large	-
	Cr: 100mg/l	Cr: 2mg/l	small	50 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

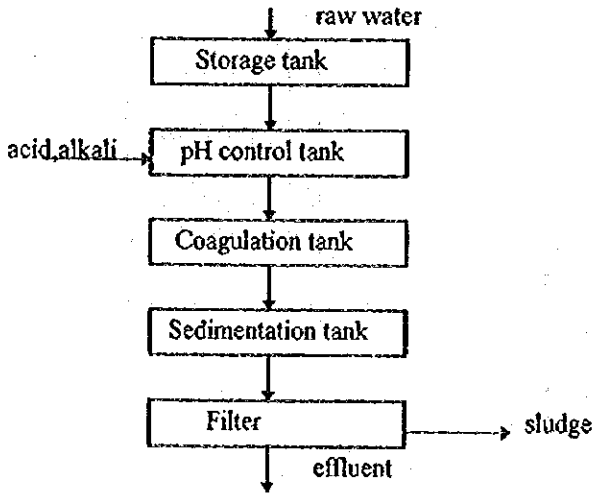
Category	Item	Residence time	Abstract	Tank capacity (m3)			Cost ratio*	
				middle	large	small	large	
Treatment tank	Reduction tank	1 hour	Reduction, Coagulation & solid-liquid separation	-	-	2.0	-	-
	pH control tank	30 min.		-	-	1.0	-	-
	Coagulation tank	30 min.		-	-	1.0	-	-
	Settling tank	2 hours		-	-	4.0	-	-
	Aeration tank	4 hours		-	-	8.0	-	-
	Final settling tank	1 hour		-	-	2.0	-	-
	Chlorination unit	-		-	-	-	-	-
Incidental facilities	Pump Aerator Mixing unit etc.						-	-
Instrumentation & Control	Measuring device Control system						-	-

Table.2.3-1 (5/7) Outline of Specification and Composition of Standard Treatment Plant
(Physio-Chemical Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Metal manufacturing	Cr:100mg/l Cu: 30mg/l	Cr: 2mg/l Cu: 1mg/l	middle	30 m3/day
			large	100 m3/day
			small	10 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

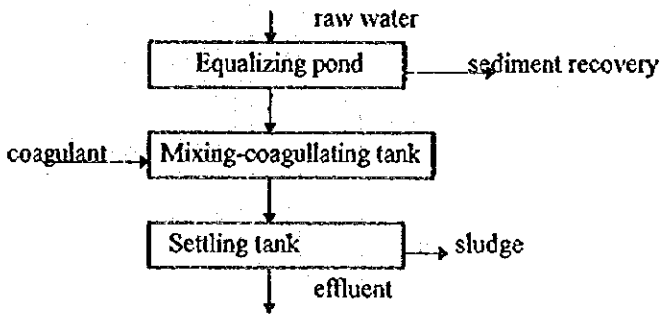
Category	Item	Residence time	Abstract	Tank capacity (m3)			Cost ratio*	
				middle	large	small	large	small
Treatment tank	Storage tank	12 hours	Coagulation solid-liquid separation	15	50	5	1.5	0.6
	pH control tank	30 min.		0.6	2	0.2	1.5	0.6
	Coagulation tank	30 min.		0.6	2	0.2	1.5	0.6
	Sedim. tank	6 hours		7.5	25	2.5	1.5	0.6
Incidental facilities	Pump Mixing unit Filter etc.						1.3	0.8
Instrumentation & Control	Measuringdevice Filling system						1.2	0.8

Table.2.3-1 (6/7) Outline of Specification and Composition of Standard Treatment Plant
(Physio-Chemical Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Sand quarries	SS: 2000 mg/l	SS: 80mg/l	middle	-
			large	-
			small	2000 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

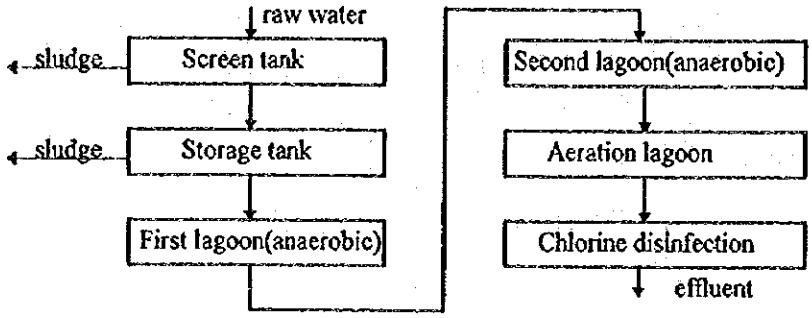
Category	Item	Residence time	Abstract	Tank capacity (m3)			Cost ratio*	
				middle	large	small	large	small
Treatment tank	Equalizing pond	24 hours	Coagulation and solid-liquid separation	-	-	2000		
	Mixing-coagulating tank	10 min.		-	-	15		
	Settling pond	120 min.		-	-	180		
Incidental facilities	Pump . Mixing unit							
Instrumentation & Control	Filling system							

Table.2.3-1 (7/7) Outline of Specification and Composition of Standard Treatment Plant (Biological Treatment Process)

1. Condition of Wastewater

Industry	Quality of raw water	Quality of treated water	Scale of Quantity	Quantity to be treated
Piggery	BOD: 7000mg/l SS: 10000mg/l	BOD: 60mg/l SS: 80mg/l	middle	15 m3/day
			large	5 m3/day
			small	40 m3/day

2. Flowchart of treatment (standard case)



3. Composition of treatment system

Category	Item	Residence time	Abstract	Tank capacity (m3) middle	large	small	Cost ratio* large	
Treatment tank	Screen tank	1 hour	solid-liquid	1	2	1	1.8	0.6
	Storage tank	24 hour	separation	15	40	5	1.8	0.6
	First lagoon	10 days	&	150	400	50	1.8	0.6
	Second lagoon	10 days	aeration	150	400	50	1.8	0.6
	Aeration lagoon	30 days	lagoon	450	1200	150	1.8	0.6
	Chlorination unit	-		-	-	-	1.8	0.6
Incidental facilities	Floating aerator Pump etc.						1.8	0.4
Instrumentation & Control	Measuring device Control system						1.3	0.6

Table 2.3-2 Installation Cost of Standard Treatment Plant

Treatment Plant Process	Industry	Scale	Quantity (m3/day	Installation Cost (Thousand US$)			
				Treatment Tank	Incidental Facilities	Instrument	Total
Biological	Food	Small	60	125	75	50	250
		Middle	200	290	130	80	500
		Large	500	355	200	96	651
Biological plus Physio-chemical	Textile	Small	30	40	40	70	150
		Middle	100	100	80	100	280
		Large	300	170	122	130	422
Physio-chemical	Chemical	Small	20	20	30	40	90
		Middle	40	30	50	90	170
		Large	100	50	70	105	225
Physio-chemical	Metal	Small	20	15	25	35	75
		Middle	50	40	50	98	188
		Large	100	100	110	129	339
Physio-chemical	Tannery	Small	20	70	75	85	230
		Middle					
		Large					
Sedimentation	Sand Quarrie	Small	2,000	15	25	28	68
		Middle	-	-	-	-	-
		Large	-	-	-	-	-
Biological	Piggery	Small	5	10	10	10	30
		Middle	15	15	13	20	48
		Large	40	30	26	34	90

Table 2.4-1 Cost for Installation of Treatment Plant for Existing Factories

Classification of Factories		(1)Unit Cost of Treatment Plant	Factory Number			Cost*
			GACETA Not-satisfaction		Total	
Industry	Scale	(US$)	(2)No Treatment Plant	(3)Partly Equipped		(US$)
Food Production	large	651,000	1	1	2	976,500
	middle	500,000	6	1	7	3,250,000
	small	250,000	2	0	2	500,000
Manufacturing of Textile	large	422,600	2	0	2	845,200
	middle	280,000	2	1	3	700,000
	small	149,700	4	0	4	598,800
Chemical & others	large	225,400	1	1	2	338,100
	middle	170,000	3	0	3	510,000
	small	90,000	11	0	11	990,000
Metal Manufacturing	large	339,000	3	1	4	1,186,500
	middle	188,000	3	0	3	564,000
	small	75,500	10	0	10	755,000
Tannery	large					0
	middle					0
	small	230,000	3	0	3	690,000
Sand Quarries	large					0
	middle					0
	small	68,000	8	0	8	544,000
Piggery	large	90,000	9	2	11	900,000
	middle	48,000	3	2	5	192,000
	small	29,800	9	3	12	312,900
Sub-Total	large	-	16	5	21	4,246,300
	middle	-	17	4	21	5,216,000
	small	-	47	3	50	4,390,700
Total	-	-	80	12	92	13,853,000

Note : *Cost =(1)x(2)+(1)x(3)x0.5

Table 2.4-2 Operation & Maintenance Cost of Existing Factories

Industry	Construction Cost(US$)	Rate of O/M Cost in Construction Cost(%)	Annual O/M Cost ($/year)
Food Production	4,726,500	8.00	378,120
Manufacturing of Textile	2,144,000	7.50	160,800
Chemical & others	1,838,100	8.60	158,077
Metal Manufacturing	2,505,500	8.50	212,968
Tannery	690,000	7.40	51,060
Sand Quarries	544,000	7.50	40,800
Piggery	1,404,900	7.50	105,368
Total	-	-	1,107,192

Table 2.5-1 Cost for Installation of Treatment Plant for Newly Built by 2003

Classification of Factories		Unit Cost of Treatment Plant (US$)	Factory Number Constructed until 2003	Cost (US$)
Industry	Scale			
Food Production	large	651,000	2	1,302,000
	middle	500,000	4	2,000,000
	small	250,000	3	750,000
Manufacturing of Textile	large	422,600	1	422,600
	middle	280,000	2	560,000
	small	149,700	2	299,400
Chemical & others	large	225,400	2	450,800
	middle	170,000	5	850,000
	small	90,000	9	810,000
Metal Manufacturing	large	339,000	2	678,000
	middle	188,000	5	940,000
	small	75,500	5	377,500
Tannery	large			
	middle			
	small	230,000	2	460,000
Sand Quarries	large			
	middle			
	small	68,000	1	68,000
Piggery	large	-	-	-
	middle	-	-	-
	small	-	-	-
Sub-Total	large	-	7	2,853,400
	middle	-	16	4,350,000
	small	-	22	2,764,900
Total	-	-	45	9,965,300

Table 2.5-2 Operation & Maintenance Cost of Newly Built Factories by 2003

Industry	Construction Cos(US$)	Rate of O/M Cost in Construction Cost(%)	Annual O/M Cost ($/year)
Food Production	4,052,000	8.00	324,160
Manufacturing of Textile	1,282,000	7.50	96,150
Chemical & others	2,110,800	8.60	181,529
Metal Manufacturing	1,995,500	8.50	169,618
Tannery	460,000	7.40	34,040
Sand Quarries	68,000	7.50	5,100
Piggery	-	-	-
Total	-	-	796,228

Table3.2-1 Sediment Volume in Pre-treatment Pond for 1 Year

Pond No.	Date of Cleaning Pond		Sediment		Total V (m^3)
	Start	End	Depth (m)	Volum (m^3)	
1	1995/11/20	1995/11/23	1.15	2263	
1	1995/12/28	1995/12/29	1.00	1968	
1	1996/6/17	1996/6/19	1.00	1968	
1	1996/7/15	1996/7/16	1.80	3542	
1	1996/8/8	1996/8/12	1.50	2952	
1	1996/9/18	1996/9/19	1.50	2952	
1	1996/10/7	1996/10/10	1.30	2558	
1	1996/10/28	1995/10/29	1.10	2165	
1	1996/11/18	1996/11/21	1.20	2362	22730
2	1995/11/22	1995/11/22	1.00	1968	
2	1996/1/2	1996/1/3	1.10	2165	
2	1996/6/20	1996/6/21	1.00	1968	
2	1996/7/17	1996/7/18	2.00	3936	
2	1996/8/23	1996/8/28	2.50	4920	
2	1996/9/20	1996/9/23	1.00	1968	
2	1996/10/9	1996/10/11	1.20	2362	
2	1996/10/30	1996/10/31	1.20	2362	
2	1996/11/22	1996/11/23	1.20	2362	24009.6
3	1995/11/24	1995/11/27	1.10	2165	
3	1996/7/8	1996/7/11	1.50	2952	
3	1996/7/19	1996/7/23	1.60	3149	
3	1996/8/29	1996/9/4	2.50	4920	
3	1996/9/25	1996/9/27	1.00	1968	
3	1996/11/1	1996/11/1	1.10	2165	17318.4
4	1995/11/10	1995/11/125	1.00	1968	
4	1996/1/4	1996/1/5	1.00	1968	
4	1996/7/1	1996/7/3	1.20	2362	
4	1996/7/30	1996/7/31	2.00	3936	
4	1996/9/5	1996/9/11	2.00	3936	
4	1996/9/24	1996/9/25	1.00	1968	
4	1996/11/5	1996/11/7	1.30	2558	18696
5	1995/11/16	1995/11/17	1.50	2952	
5	1996/6/27	1996/6/28	1.00	1968	
5	1996/8/6	1996/8/7	1.80	3542	
5	1996/9/30	1996/10/1	1.00	1968	
5	1996/10/22	1996/10/24	1.20	2362	
5	1996/11/8	1996/11/8	1.00	1968	14760
6	1995/11/20	1995/11/20	1.20	2362	
6	1996/6/11	1996/6/13	1.00	1968	
6	1996/8/1	1996/8/6	2.40	4723	
6	1996/9/12	1996/9/18	2.00	3936	
6	1996/10/2	1996/10/4	1.10	2165	
6	1996/10/24	1996/10/25	1.10	2165	
6	1996/11/11	1996/11/11	1.10	2165	19483
Total (Average intake volume = 3.27m^3/s					116998

Table 4.2-1 Area of Land Use in Ocumare del Tuy

		Commercial District	Residential District	New Residential District	Industrial District	Forest, Aguri culture...	Others	Tatal
Present	Area(ha)	51	696	-	191	2,638	60	3,636
	Ratio(%)	1.4	19.2	-	5.2	72.5	1.7	100.0
Future	Area(ha)	63	696	1,650	576	516	134	3,636
	Ratio(%)	1.7	19.2	45.4	15.8	14.2	3.7	100.0

*Commercial district : including high-densly populated residential district

*Forest,Aguriculture... :including protection area

Table 4.2-2 Population in each town of Ocumare Urban Area

	1990	2003	2010
Ocumare del Tuy	61,043	111,715	151,985
Piloncito	4,075	7,458	10,146
Santa Barbara	1,691	3,095	4,210
Total	66,809	122,268	166,341
Remark	OCEI	JICA(M/P)	JICA(M/P)

Table 4.2-3 Distance of Existing Pipes

Diameter(mm)	Distance(m)	Remarks
457	2,000	ƒÓ18 inch
508	43,900	ƒÓ20 inch
635	6,750	ƒÓ25 inch
762	2,525	ƒÓ30 inch
965	4,275	ƒÓ38 inch
1168	750	ƒÓ46 inch
1346	1,950	ƒÓ53 inch
1753	600	ƒÓ69 inch

Table 4.3-1 Population Density According to Land Use in Ocumare Treatme

	Area (ha)	1990		2003		2010	
		Population	density	Population	density	Population	density
Commercial District	63	17,997	284	19,020	300	22,190	350
Residential District	696	44,368	64	54,189	78	70,794	102
New Residential Distric	1,650			40,927	25	62,293	38
Industrial District	576						
Forest, Agriculuture...	516						
Etc.	134						
Total	3,636	62,365	17	114,135	31	155,277	43

Table 4.3-2 Employee Numbers and Proposed Industrial Discharge in Future (Ocumare del Tuy)

CIIU	Category	Discharge flowrate	Employee Numbers					Discharge(m^3/day)				
			1995	2000	2003	2005	2010	1995	2000	2003	2005	2010
31100	Nourishing product factory expect soft drinks	2.01	0	0	0	0	0	0	0	0	0	0
31111	Slaughtering cattle, pigs, sheep, horses and rabbits	2.01	0	0	0	0	0	0	0	0	0	0
31112	Farms of chicken and other animals expect domestic animals	2.01	0	0	0	0	0	0	0	0	0	0
31113	Preparation and manufacture of meat	2.01	0	0	0	0	0	0	0	0	0	0
31121	Milk pasteurization and bottling	2.01	0	0	0	0	0	0	0	0	0	0
31173	Biscuits, shortcake and noodles	2.01	0	0	0	0	0	0	0	0	0	0
31221	Production of animal food	2.01	0	0	0	0	0	0	0	0	0	0
31311	Distillation, rectify and blend of alcohol	0.97	440	590	724	814	1,153	427	572	702	789	1,119
31341	Production of soft drinks	0.97	0	0	0	0	0	0	0	0	0	0
31342	Bottling and gasification of natural mineral water	0.97	0	0	0	0	0	0	0	0	0	0
32111	Preparation of taxtile	2.43	0	0	0	0	0	0	0	0	0	0
32112	Spinning, weaving and finishing of wool and mixed fibers	2.43	0	0	0	0	0	0	0	0	0	0
32113	Spinning, weaving and finishing of cotton,artifical and mixed fibers	2.43	54	64	73	78	101	131	155	176	191	244
32311	Tannery and repair of leather	1.43	0	0	0	0	0	0	0	0	0	0
32321	Industry to prepare tanning leather	1.43	0	0	0	0	0	0	0	0	0	0
35131	Synthetic resins, plastic materials and artificial fibers	2.50	0	0	0	0	0	0	0	0	0	0
35135	Synthetic resins, plastic materials and artificial fibers, expect glass	2.50	103	124	144	156	205	257	311	359	391	512
35211	Manufacturing of paint, vanishes and shellac	0.09	0	0	0	0	0	0	0	0	0	0
35231	Manufacture of soaps and cleaning products	0.09	0	0	0	0	0	0	0	0	0	0
35234	Manufacture of perfumes and cosmetics	0.09	0	0	0	0	0	0	0	0	0	0
35291	Manufacture of several chemical products	0.92	67	85	101	111	152	62	78	93	102	140
35292	Adhesives, alus, priming for clothes	0.92	0	0	0	0	0	0	0	0	0	0
35295	Manufacture of adhesive materials, glues gelatin and gumes	0.92	0	0	0	0	0	0	0	0	0	0
36200	Mud, porcelain stuff factory	0.45	0	0	0	0	0	0	0	0	0	0
36201	Production of glass and glass fiber	0.67	0	0	0	0	0	0	0	0	0	0
3699	Manufacture of other non-metalic products	0.99	178	204	228	244	304	176	202	225	241	300
37102	Manufacture of iron and steel without pig metal and without rolling	0.26	0	0	0	0	0	0	0	0	0	0
37201	Basic industry of alminium	1.44	0	0	0	0	0	0	0	0	0	0
38191	Manufacture of metallic products, not expecified,expect machinery a	0.26	0	0	0	0	0	0	0	0	0	0
38193	Factory of nickel plate	0.26	78	93	106	114	147	20	24	27	30	38
38431	Car(automobiles) factory	0.24	0	0	0	0	0	0	0	0	0	0
38433	Automobile spare parts factory	0.24	0	0	0	0	0	0	0	0	0	0
0	TOTAL	-	920	1,160	1,375	1,518	2,061	1,073	1,342	1,583	1,743	2,352

Table 4.3-3 Flow per Resident in Past Studies and Plans

No.	Objective Year	Reference	Average Flow per Resident
A	2010	*Plan Rector para la Cuenca Alta y Media del Rio Tuy (1995, Michael Schlegel)*	250 (l/per/day)
B	2010	*Analisis de Sensibilidad para el Modelaje de Calidad de Agua(RIOS) del Rio Tuy*	272 (l/per/day)
C	1995	*Actualizacion de Proyectos de Inversion Ambiental en la Cuenca del Rio Tuy y su Area de Influencia(1994, Efren Guedez)*	By a coefficient of return of 0.8 • Ocumare del Tuy 298×0.8=238.4 (l/per/day) • Las Tejerias 258×0.8=206.4 (l/per/day)
D	2010	*Actualizacion de Proyectos de Inversion Ambiental en la Cuenca del Rio Tuy y su Area de Influencia(1994, Efren Guedez)*	By a coefficient of return of 0.8 • Ocumare del Tuy 528.9×0.8=476.0 (l/per/day) • Las Tejerias 461.6×0.8=369.3 (l/per/day)

Daily mean : Daily maximum : Hourly maximum = 0.7 : 1.0 : 1.5

Table 4.3-4 Design Flowrate of Domestic Wastewater (Ocumare del Tuy)

	Population	Daily Mean		Daily Maximum		Hourly Maximum	
	(person)	Flowrate (m^3/person/day)	Discharge (m^3/day)	Flowrate (m^3/person/day)	Discharge (m^3/day)	Flowrate (m^3/person/day)	Discharge (m^3/day)
1990	62,365	0.207	12,930	0.296	18,472	0.444	27,708
2000	99,186	0.269	26,648	0.384	38,068	0.576	57,103
2003	114,134	0.287	32,764	0.410	46,806	0.615	70,209
2005	124,100	0.299	37,147	0.428	53,068	0.641	79,602
2010	155,277	0.330	51,241	0.471	73,202	0.707	109,803

Table 4.3-5 Design Flowrate of Industrial Wastewater (Ocumare del Tuy)

Year	Daily Mean (m^3/day)	Daily Maximum (m^3/day)	Hourly Maximum (m^3/day)
1995	1,073	1,073	2,146
2000	1,342	1,342	2,684
2003	1,583	1,583	3,165
2005	1,743	1,743	3,487
2010	2,352	2,352	4,705

Note ; Daily Mean : Daily Maximum : Hourly Maximum = 1 : 1 : 2

Table 4.3-6 Design Flowrate in Ocumare Sewer Treatment Area

Target year	2010 (m^3/day)			2003 (m^3/day)		
Category	Daily Mean	Daily Max	Hourly Max	Daily Mean	Daily Max	Hourly Max
Domestic Wastewater	51,241	73,202	109,803	32,764	46,806	70,209
Industrial Wastewater	2,352	2,352	4,705	1,583	1,583	3,165
Infiltration	10,980	10,980	10,980	7,021	7,021	7,021
Total	64,574	86,535	125,488	41,368	55,410	80,395

Note: Infiltration=15% of Daily Maximum of Domestic Waste Water

Table 4.3-7 Water Quarity of Inflow of Treatment Plant (Ocumare del Tuy)

Target year	2010					2003				
	Daily Mean	LOAD(kg/day)		CONC(mg/l)		Daily Mean	LOAD(kg/day)		CONC(mg/l)	
Category	(m^3/day)	BOD	SS	BOD	SS	(m^3/day)	BOD	SS	BOD	SS
Domestic Wastewater	51,241	8,385	8,540	164	167	32,764	6,163	6,277	188	192
Industrial Wastewater	2,352	823	941	350	400	1,583	554	633	350	400
Infiltration	10,980	-	-	-	-	7,021	-	-	-	-
Total	64,574	9,208	9,481	143	147	41,368	6,717	6,910	162	167

*Concentration of industrial wastewater;Standard value of discharging to sewer
**Standard : BOD≤350(mg/l), SS≤400(mg/l)

Table 5.2-1 Area of Land Use in Las Tejerias

		Commercial District	Residential District	New Residential District	Industrial District	Forest, Aguri culture...	Others	Tatal
Present	Area(ha)	35	189	-	103	129	40	495
	Ratio(%)	7.1	38.1	-	20.7	26.0	8.1	100.0
Future	Area(ha)	35	189	89	103	40	40	495
	Ratio(%)	7.1	38.1	17.9	20.7	8.1	8.1	100.0

*Commercial district : including high-densly populated residential district

*Forest,Aguriculture : including protection area

Table 5.2-2 Population in each town of Las Tejerias Urban Area

	1990	2003	2010
Las Tejerias	20,246	26,898	30,825
Remark	OCEI	JICA(M/P)	JICA(M/P)

Table 5.2-3 Distance of Existing Pipes

Diameter(mm)	Distance(m)	Remarks
200	10,980	
300	1700	

Table 5.3-1 Population Density According to Land Use in Las Tejerias Treatment Area

Land Use	Area	1990		2003		2010	
	(ha)	Population	density*	Population	density*	Population	density*
Commercial District	35	5,232	148	5,745	163	6,278	178
Residential District	189	14,002	74	15,377	81	16,802	89
New Residential District	89	-	-	4,431	50	6,203	70
Industrial District	103	-	-	-	-	-	-
Forest, Agriculuture...	40	-	-	-	-	-	-
Etc.	40	-	-	-	-	-	-
Total	495	19,234	39	25,553	52	29,284	59

* Unit : Persons/ha

Table 5.3-2 Employee Numbers and Proposed Industrial Discharge in Future (Las Tejerias)

CIIU	Category	Discharge flowrate	Employee Numbers					Discharge(m^3/day)				
			1995	2000	2003	2005	2010	1995	2000	2003	2005	2010
31100	Nourishing product factory expect soft drinks	2.01	0	0	0	0	0	0	0	0	0	0
31111	Slaughtering cattle, pigs, sheep, horses and rabbits	2.01	45	56	66	73	99	90	113	133	147	198
31112	Farms of chicken and other animals expect domestic animals	2.01	0	0	0	0	0	0	0	0	0	0
31113	Preparation and manufacture of meat	2.01	259	324	382	420	567	521	651	767	845	1,140
31121	Milk pasteurization and bottling	2.01	0	0	0	0	0	0	0	0	0	0
31173	Biscuits, shortcake and noodles	2.01	0	0	0	0	0	0	0	0	0	0
31221	Production of animal food	2.01	39	49	57	63	85	78	98	116	127	172
31311	Distillation, rectify and blend of alcohol	0.97	0	0	0	0	0	0	0	0	0	0
31341	Production of soft drinks	0.97	0	0	0	0	0	0	0	0	0	0
31342	Bottling and gasification of natural mineral water	0.97	0	0	0	0	0	0	0	0	0	0
32111	Preparation of taxtile	2.43	253	299	340	367	471	615	726	826	893	1,145
32112	Spinning, weaving and finishing of wool and mixed fibers	2.43	0	0	0	0	0	0	0	0	0	0
32113	Spinning, weaving and finishing of cotton,artifical and mixed fibers	2.43	606	716	814	880	1,129	1,473	1,740	1,979	2,138	2,744
32311	Tannery and repair of leather	1.43	0	0	0	0	0	0	0	0	0	0
32321	Industry to prepare tanning leather	1.43	0	0	0	0	0	0	0	0	0	0
35131	Synthetic resins, plastic materials and artificial fibers	2.50	0	0	0	0	0	0	0	0	0	0
35135	Synthetic resins, plastic materials and artificial fibers, expect glass	2.50	146	176	204	222	291	364	440	508	554	726
35211	Manufacturing of paint, vanishes and shellac	0.09	11	15	19	22	32	1	1	2	2	3
35231	Manufacture of soaps and cleaning products	0.09	0	0	0	0	0	0	0	0	0	0
35234	Manufacture of perfumes and cosmetics	0.09	9	13	16	18	26	1	1	1	2	2
35291	Manufacture of several chemical products	0.92	100	127	150	166	226	92	117	138	153	208
35292	Adhesives, alus, priming for clothes	0.92	0	0	0	0	0	0	0	0	0	0
35295	Manufacture of adhesive materials, glues gelatin and gumes	0.92	0	0	0	0	0	0	0	0	0	0
36200	Mud, porcelain stuff factory	0.45	0	0	0	0	0	0	0	0	0	0
36201	Production of glass and glass fiber	0.67	0	0	0	0	0	0	0	0	0	0
3699	Manufacture of other non-metalic products	0.99	0	0	0	0	0	0	0	0	0	0
37102	Manufacture of iron and steel without pig metal and without rolling	0.26	0	0	0	0	0	0	0	0	0	0
37201	Basic industry of alminium	1.44	0	0	0	0	0	0	0	0	0	0
38191	Manufacture of metallic products, not expecified,expect machinery and equipment	0.26	205	243	277	300	387	53	63	72	78	101
38193	Factory of nickel plate	0.26	356	422	482	521	671	93	110	125	136	175
38431	Car(automobiles) factory	0.24	412	541	656	733	1,025	99	130	158	176	246
38433	Automobile spare parts factory	0.24	0	0	0	0	0	0	0	0	0	0
	TOTAL	-	2,441	2,981	3,465	3,787	5,011	3,480	4,191	4,826	5,250	6,860

Table 5.3-3 Flow per Resident in Past Studies and Plans

No.	Objective Year	Reference	Average Flow per Resident
A	2010	*Plan Rector para la Cuenca Alta y Media del Rio Tuy (1995, Michael Schlegel)*	250 (l/per/day)
B	2010	*Analisis de Sensibilidad para el Modelaje de Calidad de Agua(RIOS) del Rio Tuy*	272 (l/per/day)
C	1995	*Actualizacion de Proyectos de Inversion Ambiental en la Cuenca del Rio Tuy y su Area de Influencia(1994, Efren Guedez)*	By a coefficient of return of 0.8 • Ocumare del Tuy 298×0.8=238.4 (l/per/day) • Las Tejerias 258×0.8=206.4 (l/per/day)
D	2010	*Actualizacion de Proyectos de Inversion Ambiental en la Cuenca del Rio Tuy y su Area de Influencia(1994, Efren Guedez)*	By a coefficient of return of 0.8 • Ocumare del Tuy 528.9×0.8=476.0 (l/per/day) • Las Tejerias 461.6×0.8=369.3 (l/per/day)

Daily mean : Daily maximum : Hourly maximum = 0.7 : 1.0 : 1.5

Table 5.3-4 Design Flowrate of Domestic Wastewater (Las Tejerias)

	Population	Daily Mean		Daily Maximum		Hourly Maximum	
	(person)	Flowrate (m^3/person/day)	Discharge (m^3/day)	Flowrate (m^3/person/day)	Discharge (m^3/day)	Flowrate (m^3/person/day)	Discharge (m^3/day)
1990	19,234	0.175	3,370	0.250	4,814	0.375	7,221
2000	23,977	0.238	5,697	0.339	8,138	0.509	12,208
2003	25,553	0.256	6,550	0.366	9,357	0.549	14,035
2005	26,604	0.269	7,151	0.384	10,216	0.576	15,324
2010	29,284	0.300	8,785	0.429	12,550	0.643	18,825

Note : Daily Average : Daily Maximum : Hour Maximum = 0.7 : 1.0 : 1.5

Table 5.3-5 Design Flowrate of Industrial Wastewater (Las Tejerias)

Year	Daily Mean (m^3/day)	Daily Maximum (m^3/day)	Hourly Maximum (m^3/day)
1995	3,480	3,480	6,960
2000	4,191	4,191	8,381
2003	4,826	4,826	9,653
2005	5,250	5,250	10,501
2010	6,860	6,860	13,719

Remark ; DailyMean : Daily Maximum : Hourly Maxmum = 1 : 1 : 2

Table 5.3-6 Design Flowrate in Las Tejerias Sewer Treatment Area

Target year	2010 (m^3/day)			2003 (m^3/day)		
Category	Daily Mean	Daily Max	Hourly Max	Daily Mean	Daily Max	Hourly Max
Domestic Wastewater	8,785	12,550	18,825	6,550	9,357	14,035
Industrial Wastewater	6,860	6,860	13,719	4,826	4,826	9,653
Infiltration	1,883	1,883	1,883	1,404	1,404	1,404
Total	17,527	21,292	34,427	12,780	15,587	25,092

Note: Infiltration=15% of Daily Maxmum of Domestic WasteWater

Table 5.3-7 Water Quarity of Inflow of Treatment Plant (Las Tejerias)

Target year	2010					2003				
	Daily Mean	LOAD(kg/day)		CONC(mg/l)		Daily Mean	LOAD(kg/day)		CONC(mg/l)	
Category	(m^3/day)	BOD	SS	BOD	SS	(m^3/day)	BOD	SS	BOD	SS
Domestic Wastewater	8,785	1,581	1,611	180	183	6,550	1,380	1,405	211	215
Industrial Wastewater	6,860	2,401	2,744	350	400	4,826	1,689	1,931	350	400
Infiltration	1,883	-	-	-	-	1,404	-	-	-	-
Total	17,527	3,982	4,354	227	248	12,780	3,069	3,336	240	261

*Concentration of industrial wastewater;Standard value of discharging to sewer

*Standard ; BOD≤350(mg/l), SS≤400(mg/l)

Table6.2-1 Compartmentalization of Reforestation Area

	Block Name	Co. No.	Area (ha)	Reforestation Area (ha)	Belts of Fire Resistant Trees (ha)	Distance of New Forest road (km)	Total of Existing Road (km)	Mixed Planting	Fire Resistant Trees	Cutting	Seedling
6	Qda. Santa Maria	1	59.1	57.9	1.2		0.3	77218	1333	38609	39942
7		2	1129.2	1077.2	52.0		13.0	1436318	57778	718159	775937
8		3	361.0	355.0	6.0	0.8	0.7	473394	6667	236697	243364
9		4	182.9	156.9	26.0		6.5	209141	28889	104571	133460
10		5	189.5	175.1	14.4		3.6	233470	16000	116735	132735
11		6	362.6	349.4	13.2		3.3	465868	14667	232934	247601
12		7	244.7	224.7	20.0		5.0	299542	22222	149771	171993
13		8	146.2	139.0	7.2		1.8	185371	8000	92686	100686
Sub-total			2675.2	2535.2	140.0	0.8	34.2	3380323	155556	1690161	1845717
14	Palo Negro	1	177.9	173.9	4.0	0.4	0.6	231875	4444	115938	120382
15		2	349.9	333.5	16.4	1.4	2.7	444631	18222	222315	240538
16		3	139.2	130.0	9.2	1.2	1.1	173276	10222	86638	96860
Sub-total			666.9	637.3	29.6	3	4.4	849782	32889	424891	457780
total			3342.2	3172.6	169.6	3.8	38.6	4230105	188444	2115053	2303497
Quantity for 1 year			668.4					846021	37689	423011	460699

Table6.2-2 Landowner in the Reforestation Area

No.	Area Name	No.	Owner	Observation	ha (aprox.)	Address
1	Qda. Santa Maria	1	No data available	No data available		Unknown
2		2	Sucesion Hermanos Bravos		920	Moscatel Piso 4, Apto. 4 - 2. Los Teques
3		3	No data available	No data available		Unknown
4		4	Sucesion Hermanos Bravos		920	Moscatel Piso 4, Apto. 4 - 2. Los Teques
5		5	Ditto		920	Ditto
6		6	Ditto		920	Ditto
7		7	Ditto		920	Ditto
8		8	No data available	No data available		
9	Palo Negro	1	Instituto Agrario Nacional	Estates belong to Agriculture National	450	Unknown
10		2	Instituto Agrario Nacional	Ditto	450	Ditto
			& Abrahan Malave	Ocampo Farm (Finca Ocampo)	290	Ditto
11		3	Abrahan Malave	Ditto	290	Ditto

Table 6.3-1 Tree Species Chosen for Reforestation

Types (Local Name)		Sowing & Distance (m×m)	Resistance to Fire	Maintenance Required	Annual Growth, Diameter & Height	Cost (Bs)	Selection
Fire Resistant Tree Belt	Alnus Jorulensis (Aliso)	Seed 4×4~ 4×5	Weak Evergreen.	Laborious	0.5 m/year ϕ = 20 cm. Height = 15~20 m	86.14	
	Cuji (Prosopis Julifora)	Seed 3×3 ~ 3×4	Medium Evergreen	Only a little	1 m/year ϕ=8 ~ 15cm Height = ± 3 ~ 5 m	86.14	●
Mixed Planting Area	Bauhinia (Pata e'Vaca)	Seed 3×3 ~ 3×4	Weak Deciduous tree in dry season	Only a little Resist to dry season.	0,5 - 1 mt/year. ϕ = 8 ~15 cm. Height = 4 ~ 7 m	86.14	●
	Cassia Moschata (Caña Fistolo)	Seed 2×2	Weak Deciduous tree in dry season	Only a little.	0,5 mt/year ϕ = 30 cm Height = ± 4 m	86.14	
	Gliriscidia sp (Mataraton)	Cutting or Seed 2×2	Weak Deciduous tree in dry season	Only a little	1 m/year or more. ϕ= 8 ~ 15cm Height = ±3 ~ 4 m	20.54	●

Table 6.5-1 Nursery & Planting Activity Schedule for Reforestation

No.	Activity	Month												
		11	12	1	2	3	4	5	6	7	8	9	10	11
1	Preparation of Nursery													
	- Land cleaning													
	- Building of facilities													
	- Preparation of soil for pots													
	- Procurement of seed													
2	Procurement of cutting													
3	Seeding													
4	Planting													
5	Weeding													
6	Replanting													

Planting Activity Schedule of Blocks

	Block Name	Year				
		1999	2000	'01	'02	'03
1	Qda. Santa Maria No.1,2-4,4,5 (620ha)					
2	Qda. Santa Maria No.2-1,2-2 (658ha)					
2	Qda. Santa Maria No.2-3,6,8 (733ha)					
4	Qda. Santa Maria No.3,7 (605ha)					
5	Palo Negro (667ha)					

Table 7.1-1 Historical Review Concerning Fiscal Incentives

Law or Regulation	Date Published	Objective	Standing
Decree No. 1.846	26/10/1976	Exoneration of income tax in a period of 3 years of up to 10% to those investments assigned to avoid environment pollution	No (Derogated by Dec. 2.001)
Decree No. 2.995	12/12/1978	Regarding Valencia Lake Basin: - Exoneration of importation tax for equipment, materials and raw material for installation/operation of water treatment systems. - Exoneration of income tax in a period of 5 years for the equivalent amount of the operation costs. - Soft conditions of credit by the government financing institutions for acquisition and installation of equipment for water treatment. To be regulated by the Ministry of Development and the MARNR.	No (Derogated by Dec. 2.001)
Decree No. 2.001	13/5/1983	- Exoneration of importation tax for equipment, materials and raw material for installation/operation of water treatment systems. - Exoneration of income tax in the first year of operation of the decontaminating equipment. - Soft conditions of credit by the government financing institutions for acquisition and installation of equipment for environmental decontamination.	No (Derogated by Dec. 1.302)
Income Tax Law Art. 14, item 3	3/10/1986	Exoneration of tax to those industries which apply methods to avoid the pollution of environment	No
Decree No. 1,302 Art. 3	10/10/1986	Reduction of 10% income tax for investments in equipment, civil works or facilities for the conservation, safeguard and improvement of environment. For local equipment 15%.	No
Income Tax Law Art.62, 63	13/8/1991	Deduction of 10% tax to those industries which make investments to eliminate or avoid the pollution of environment.	No
Decree No. 1,793	7/10/1991	States the applicability of incentives of Decree 1,302.	No
Income Tax Law - Art. 27: - Art. 118:	25/5/1994	 - Tax deduction for the constructions to comply with sanitary regulations. - Applicability of tax deductions stated in Income Tax Law of 1991.	 Yes No

Sources: a) Collection of laws, b)Consultation to Legal Bureau of Tuy Agency and c) Consultation to Legal Bureau of Finance Ministry (SENIAT)

Table 9.5-1 Predictable Adverse Impacts and Mitigation Measures

Predictable Impact	Impact Stage	Assessment of Impact Significance	Mitigation Measure
Illegal land use	Pre-construction Post-construction	High	Proposed land should be under strict surveillance of Tuy Agency or local Government to protect against illegal land use or invasion of third persons. Fencing and employment of security guard are advisable in this regard.
Noise	Construction	Low	Work schedule should be informed in public through local Government, and care needs to be taken to the heavy equipment, of which operation should be limited to only daytime.
Dust	Construction	Low	Watering is desirable for earth moving work or access road. Soil materials should be covered with sheet.
Traffic congestion	Construction	Moderate	Number of mobilized equipment and vehicles should be controlled taking account of present traffic conditions and proposed work schedule.
Water quality of the river	Construction	Moderate	Protective net or fence should be placed on the river edge to keep the stream from entering spilt soil and construction of scrap or waste.
Sediment	Construction	Moderate	Sediment accumulated in the Tuy River channel should not be used for construction materials. It is required to be disposed at designated site.
Aquatic biology	Construction	Low	Same measure as mentioned in the item "water quality" is required not to worsen present stream-ecosystem in the course of construction.
Generation of stench and insects	Post-construction	High	Competent personel should be placed to deal with proper operation and maintenance of sewerage treatment plant
Sludge	Post-construction	High	Sludge produced in treatment plant should be disposed in landfill site at Bonanza on condition that its composition is not detrimental to the environment.

Table 9.6-1 Environmental Management Plan for the Installation of Sewerage Treatment Plant at Ocumare del Tuy and Las Tejerias

Managing Item	Source of Impact	Measuring Standard of Impact	Managing Approach	Management Location	Managing Agency Concerned
(Pre-Construction Stage)					
-Social unrest	-Project location -Land acquisition	-Compensation -Public protest/ demonstration & project disturb	-Negotiation -Public hearing -Presidential decree No.184 (Expropriation Law)	-Project site -All project-affected communities	-MARNR -Tuy Agency -Local Government -Regional Government
(Construction Stage)					
-Noise	Operation of heavy equipment	Noise level : 65 dB (Leq) (Decree No.2217)	-Control of number or speed of vehicles/ equipment -Working hour -Equipment operators	-Residential area -School, clinic	-Tuy Agency -Local Government
-Air pollution and traffic congestion	-Mobilization of equipment -Civil works	-Quality standard (Decree No.638) -Traffic congestion frequency/duration	-Covering materials with sheet -Watering road -Selection of spoil site	-Construction site -Public road & access road	-Tuy Agency -Local Government
-Water quality of the river	All civil works relating to the project	Water quality standard according to Decree No.883	-Effort to minimize spilt soil into the river -Protective net at downstream direction	-Construction site -Sewage pipe setting location	-Tuy Agency
-Sediment	Earth works (embankment / filling)	Contents of Cr, Ni, Pb Cu and Zn in sediment	-No use of such materials for embankment -Proper method of disposal in dumping site	Construction site	-Tuy Agency
-Aquatic biology	Embankment / filling for flood protection	Presence and density of benthos, plankton and necton	-Effort to minimize degradation of water quality -Preservation of natural ecology	Tuy river at Project site (sampling point as determined in EIA)	-Tuy Agency
-Employment and economic growth	Project implementation	-Willingness to participate in project -Increase in family income	Recruitment of local manpower	Municipalities of Santos Michelena and Tomas Lander	-Tuy Agency -Local Government
(Post-Construction Stage)					
-Illegal land use of project site	-Project location -Land acquisition	-No. of squatters -Illegal land use	-Effort to gain public comprehension -Control of illegal land use	Proposed site for sewerage treatment plant	-MARNR -Tuy Agency -Local Government -Regional Government
-Generation of stench and insects	Sewerage treatment plant	Public complaint, protest and reaction	-Treatment method and system -Proper operation and maintenance	Sewerage treatment plant	-Tuy Agency
-Disposal of sludge	Sewerage treatment plant	Sludge composition (contents of toxic substances)	-Sludge disposal system -Proper operation and maintenance	-Final disposal site -Sewerage treatment system	-Tuy Agency -Mancoser -Local Government
-Sewage canals/pipes	Domestic/industrial wastewater	Function of sewerage system	-Proper maintenance of sewerage network -Educating people	Each community concerned	-Tuy Agency -Local Government

Table 9.6-2 Environmental Management Plan for the Construction of Sand Settling Pond at Water Intake

Managing Item	Source of Impact	Measuring Standard of Impact	Managing Approach	Management Location	Managing Agency Concerned
(Pre-Construction Stage)					
-Social unrest	-Project location	-Compensation -Public protest/ demonstration & project disturb	-Negotiation -Public hearing	-Construction site -All project-affected land	-Hidrocapital -MARNR -Tuy Agency -Local Government
(Construction Stage)					
-Noise	Operation of heavy equipment	Noise level : 65 dB (Leq) (Decree No.2217)	-Control of number or speed of vehicles/ equipment -Working hour -Equipment operators	Village(s) close to project site	-Hidrocapital -Tuy Agency -Local Government
-Air pollution and traffic congestion	-Mobilization of equipment -Civil works	-Quality standard (Decree No.638) -Traffic congestion frequency/duration	-Covering materials with sheet -Watering road -Selection of spoil site	-Construction site -Public road & access road	-Hidrocapital -Tuy Agency -Local Government
-Water quality of the river	All civil works relating to the project	Water quality standard according to Decree No.883	-Effort to minimize spilt soil into the river -Protective net at downstream direction	-Construction site -Water intake facility	-Hidrocapital -Tuy Agency
-Sediment	Earth works (embankment / filling)	Contents of Cr, Ni, Pb Cu and Zn in sediment	-No use of such materials for embankment -Proper method of disposal in dumping site	Construction site	-Hidrocapital -Tuy Agency
-Aquatic biology	All civil works relating to the project	Presence and density of benthos, plankton and necton	-Effort to minimize degradation of water quality -Preservation of natural ecology	Tuy river at Project site (sampling point as determined in EIA)	-Tuy Agency
-Employment and economic growth	Project implementation	-Willingness to participate in project -Increase in family income	Employment of local manpower	San Francisco de Yare and other nearby villages	-Hidrocapital -Local Government
(Post-Construction Stage)					
-Illegal land use of project site	-Project location	-No. of squatters -Illegal land use	-Effort to gain public comprehension -Control of illegal land use	Proposed site for sand settling pond and its surrounding area	-Hidrocapital -MARNR -Tuy Agency -Local Government
-Water intake and pre-treatment facility	Sand settling pond	-Turbidity -Pumping operation	-Introduction of mechanical sand settling system -Proper operation and maintenance	-Sand settling pond -Intake facility	-Hidrocapital -Tuy Agency
-Flushed sediment	Sand settling pond	Volume of flushed sediment	-Flushing operation -Proper maintenance of facility	-Flushing gate -Downstream of intake weir	-Hidrocapital -Tuy Agency
-Sewage canals/pipes	Domestic/industrial wastewater	Function of sewerage system	-Proper maintenance of sewerage network -Educating people	Each community concerned	-Tuy Agency -Local Government

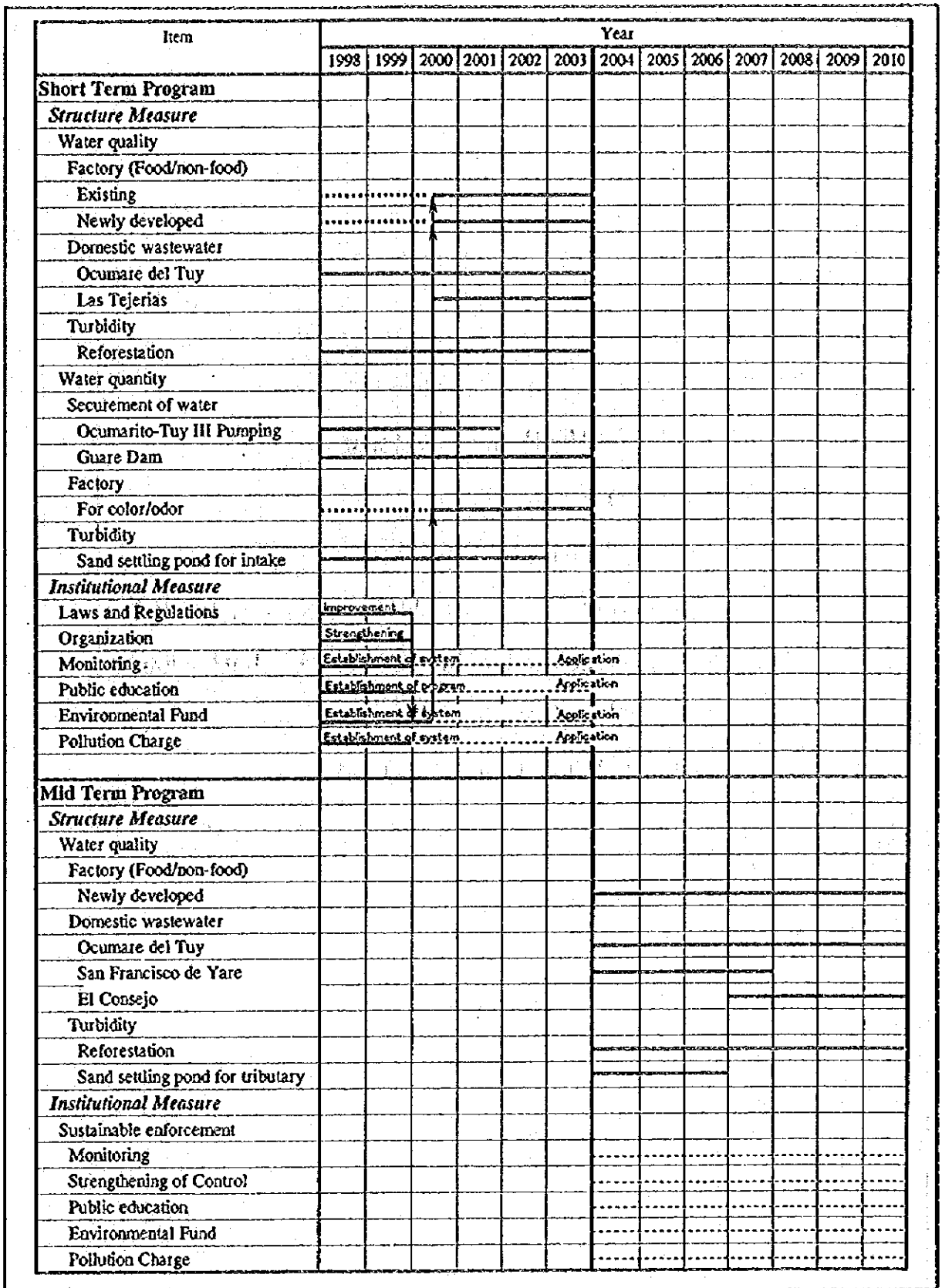
Table 9.7-1 Environmental Monitoring Plan for the Installation of Sewerage Treatment Plant at Ocumare del Tuy and Las Tejerias

Monitoring Item	Monitoring Method	Location	Monitoring Frequency	Duration	Monitoring Agency
Illegal land use of project site	Field visit and confirmation	Proposed site for sewerage treatment plant	Every 6 months	No limit defined	-MARNR -Tuy Agency -Local Government
Noise	Measured by noise level meter	Residential area close to project site	Once a month	Construction period	Tuy Agency
Dust and traffic congestion	Field inspection and measurement	-Construction site -Urban area	Once a month	Construction period	Tuy Agency
Sediment	Field inspection and measurement	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Aquatic biology	-Field inspection -Sample analysis	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Water quality of the Tuy River	Test and analysis of sample waters in laboratory	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Groundwater quality	Test and analysis of sample waters in laboratory	Sampling points (deep well) as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Inflow of wastewater	Sample analysis in laboratory	Inlet of sewerage treatment plant	Once a week	No limit defined	Tuy Agency
Outflow of wastewater	Sample analysis in laboratory	Outlet of sewerage treatment plant	Once a week	No limit defined	Tuy Agency
Disposal of sludge	-Field inspection -Sample analysis	-Sewerage treatment plant -Disposal site	Once a month	No limit defined	-Tuy Agency -MARNR
Water supply operation	-Pump operation hours -Volume of pre-treated water	Pre-treatment plant	Every 3 months	Till year 2010	Hidrocapital
Public health	Collection of inform. on waterborn diseases	Distrito Sanitario No 2	Every 3 months	Till year 2010	Tuy Agency
Generation of stench and insects	Public opinion and field inspection	-Sewerage treatment plant -Residential area	Every 3 months	Till year 2010	Tuy Agency
Operation and maintenance of facility	Field inspection	-Sewerage treatment plant -Project-related communities	Every 6 months	No limit defined	Tuy Agency

Table 9.7-2 Environmental Monitoring Plan for the Construction of Sand Settling Pond at Water Intake

Monitoring Item	Monitoring Method	Location	Monitoring Frequency	Duration	Monitoring Agency
Illegal land use of project site	Field visit and inspection	Construction site and its surrounding areas	Every 6 months	No limit defined	-MARNR -Hidrocapital -Local Government
Noise	Measured by noise level meter	Communities close to project site	Once a month	Construction period	Tuy Agency
Dust and traffic congestion	Field inspection and measurement	-Construction site -Artery road to urban center	Once a month	Construction period	Tuy Agency
Sediment	Field inspection and measurement	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Aquatic biology	-Field inspection -Sample analysis	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Water quality of the Tuy River	Test and analysis of sample waters in laboratory	Sampling points as selected in EIA	Every 6 months	Till year 2010	Tuy Agency
Flushed sediment	-Field inspection -Volume of flushed sediment	-Sand settling pond -Downstream of intake weir	Once a month	Till year 2010	-Hidrocapital -Tuy Agency
Turbidity	Sample analysis in laboratory	Pre-treatment plant	Once a week	No limit defined	Hidrocapital
Water supply operation	-Pump operation hours -Volume of flushed sediment	Pre-treatment plant	Every 3 months	Till year 2010	Hidrocapital
Operation and maintenance of facility	Field inspection	Sand settling pond	Every 3 months	No limit defined	Hidrocapital
	-Volume of pre-treated water				
Public health	Collection of inform on waterborn diseases	Distrito Sanitario No 2	Every 3 months	Till year 2010	Tuy Agency
Generation of stench and insects	Public opinion and field inspection	-Sewerage treatment plant -Residential area	Every 3 months	Till year 2010	Tuy Agency
Operation and maintenance of facility	Field inspection	-Sewerage treatment plant -Project-related communities	Every 6 months	No limit defined	Tuy Agency

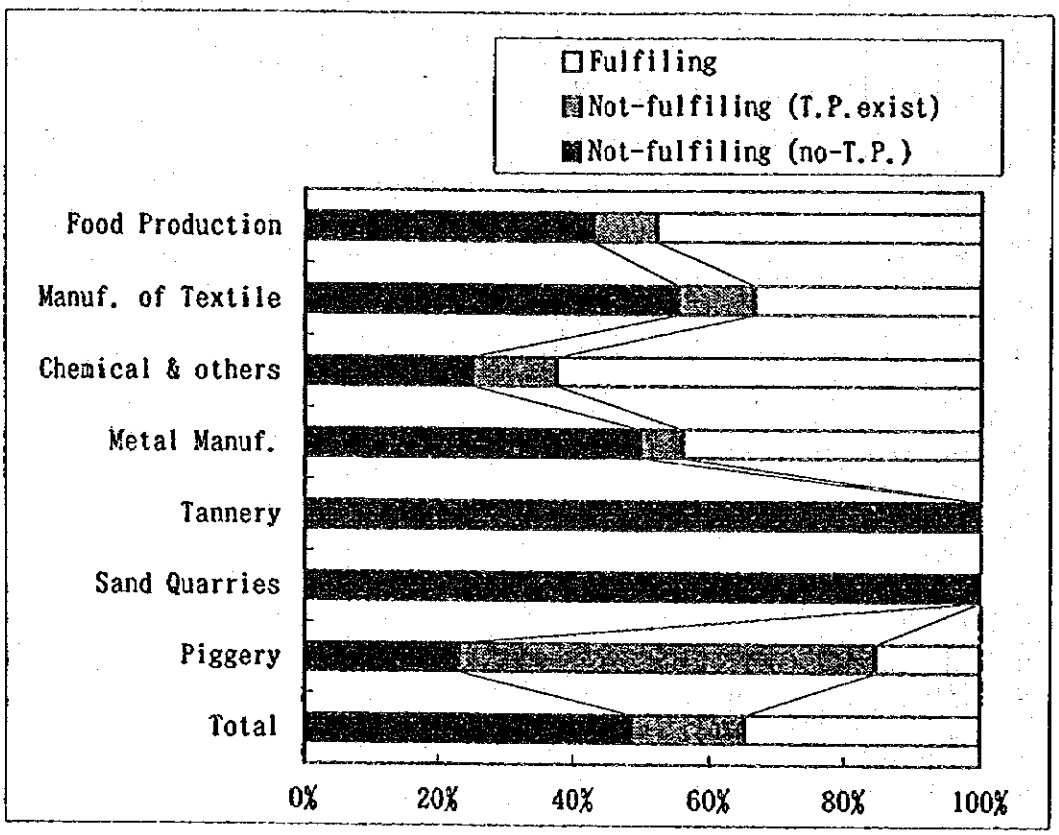
FIGURES



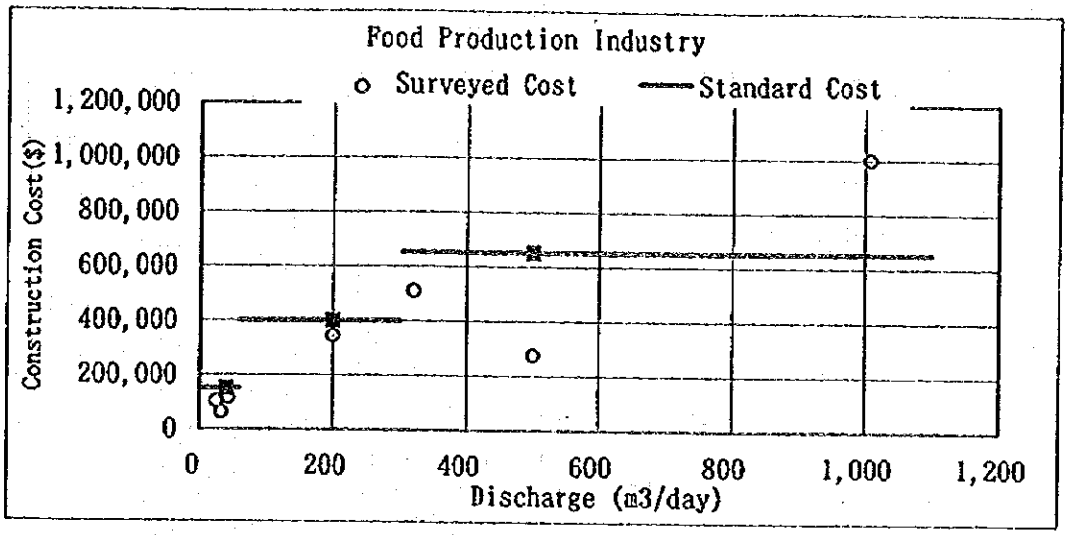
THE STUDY ON
THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN
IN THE REPUBLIC OF VENEZUELA

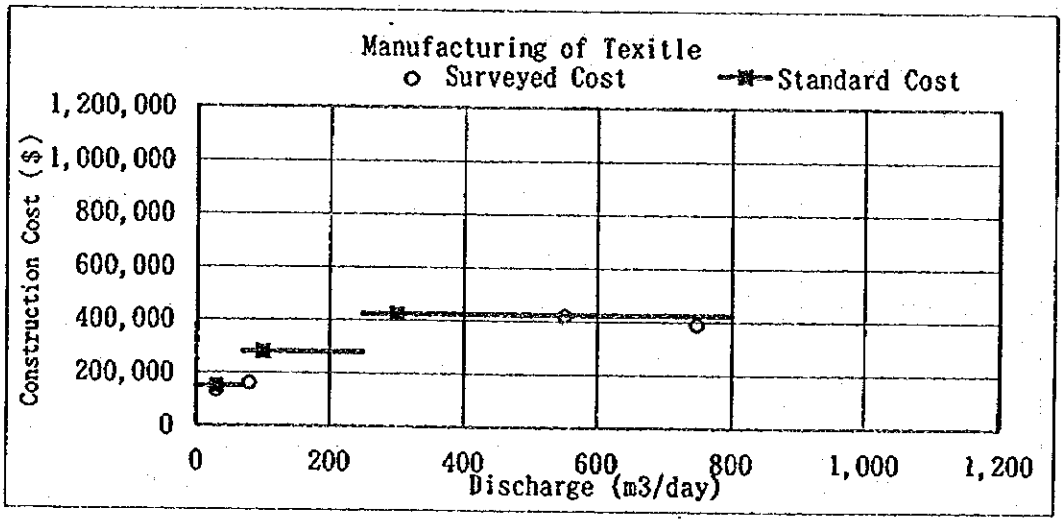
JAPAN INTERNATIONAL COOPERATION AGENCY

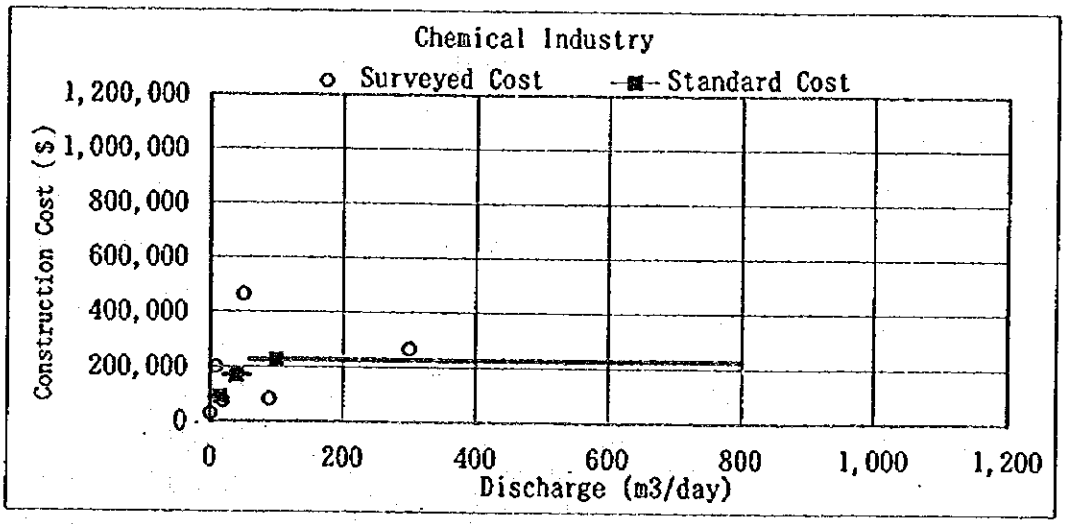
Fig. 1.1-1 Implementing Schedule



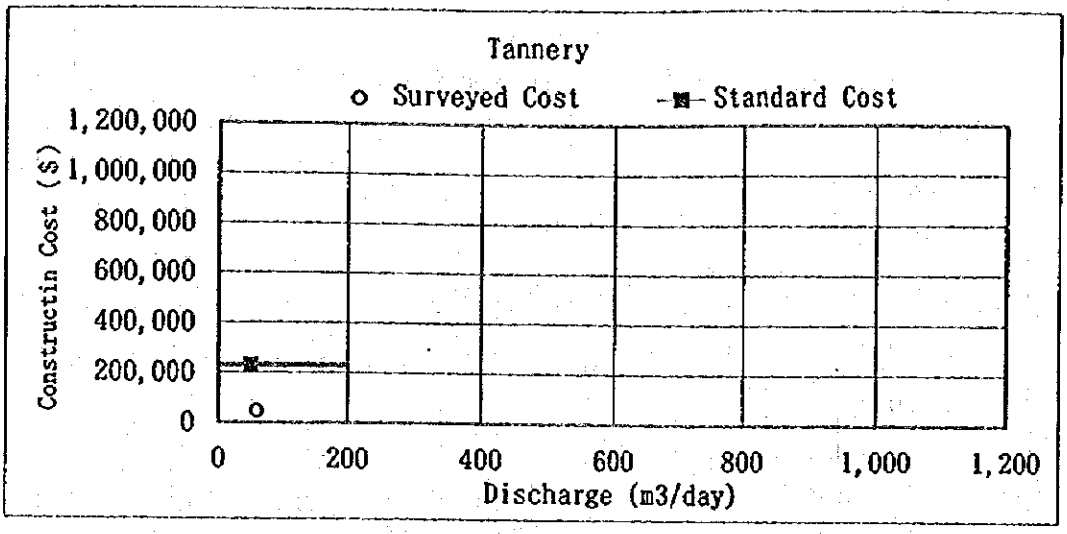
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.2-1 Treatment Condition of Existing Factories and Piggeries

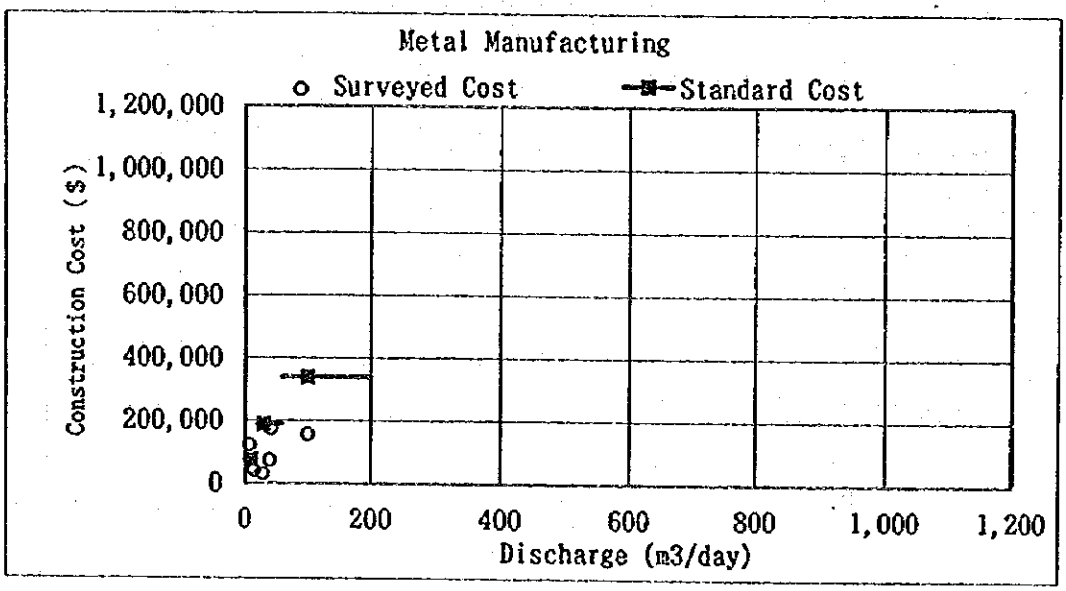


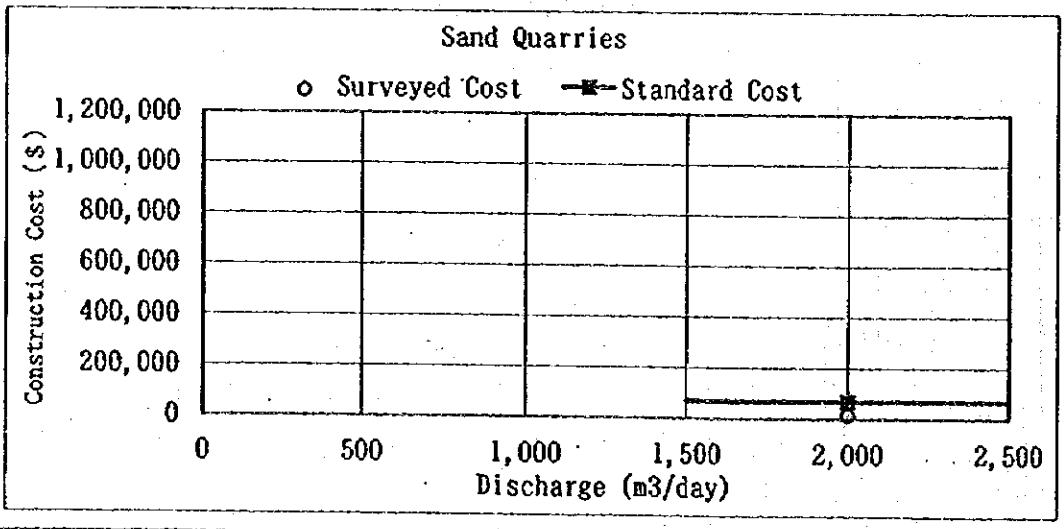




THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.3-1 (1/3) Relation Between Wastewater Discharge and Installation Cost of Treatment Plant



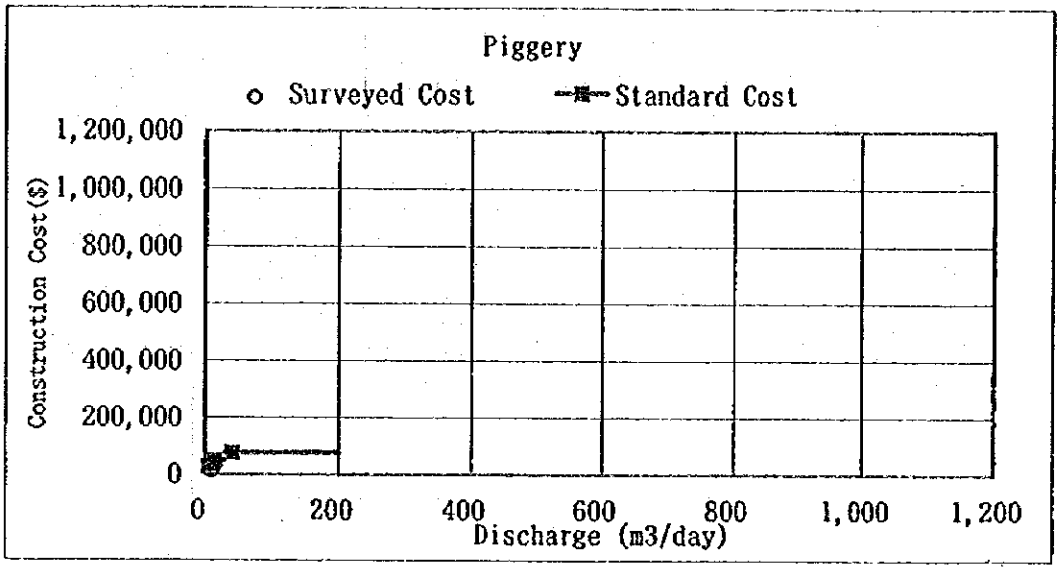




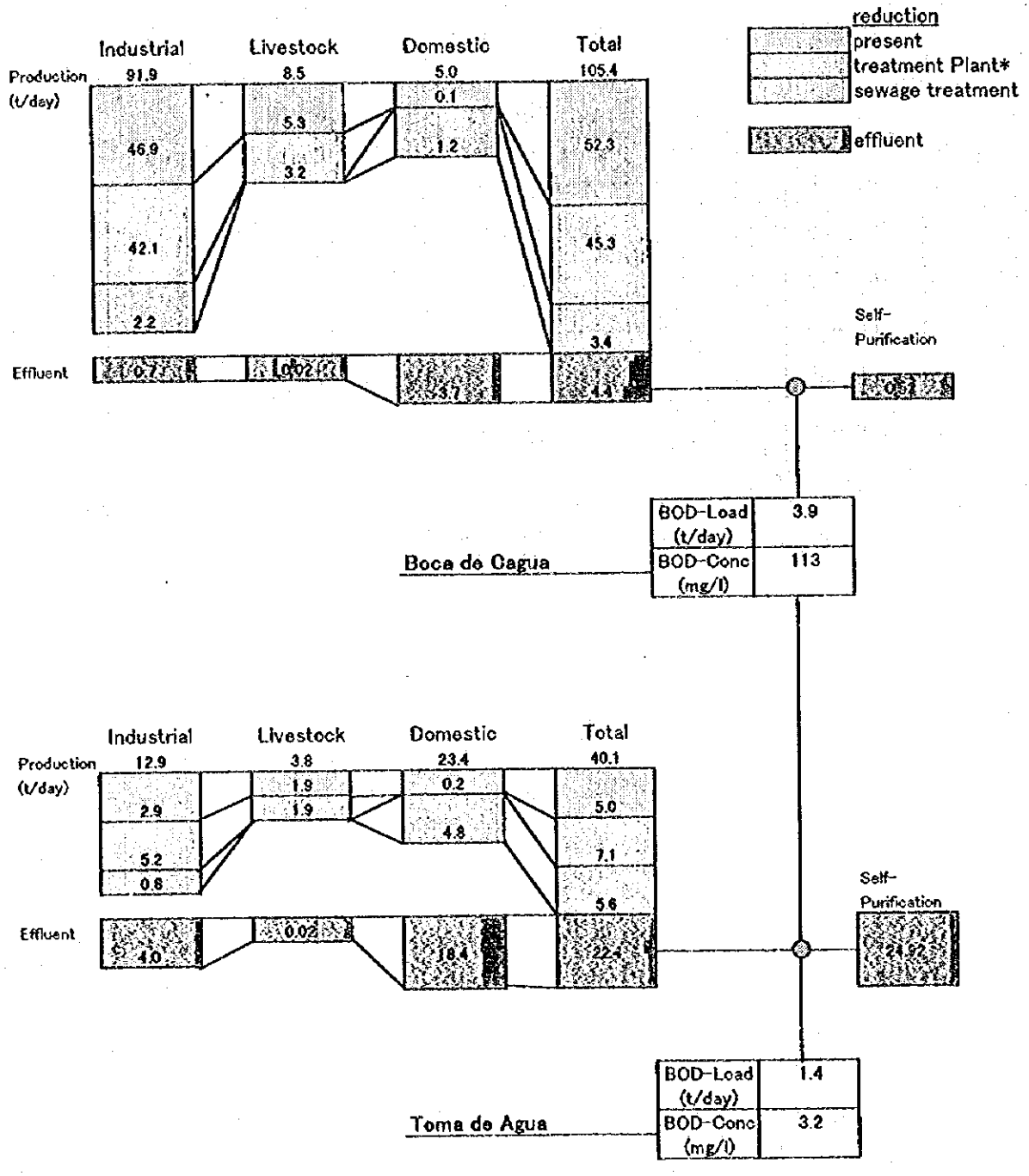
THE STUDY ON
THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA

JAPAN INTERNATIONAL COOPERATION AGENCY

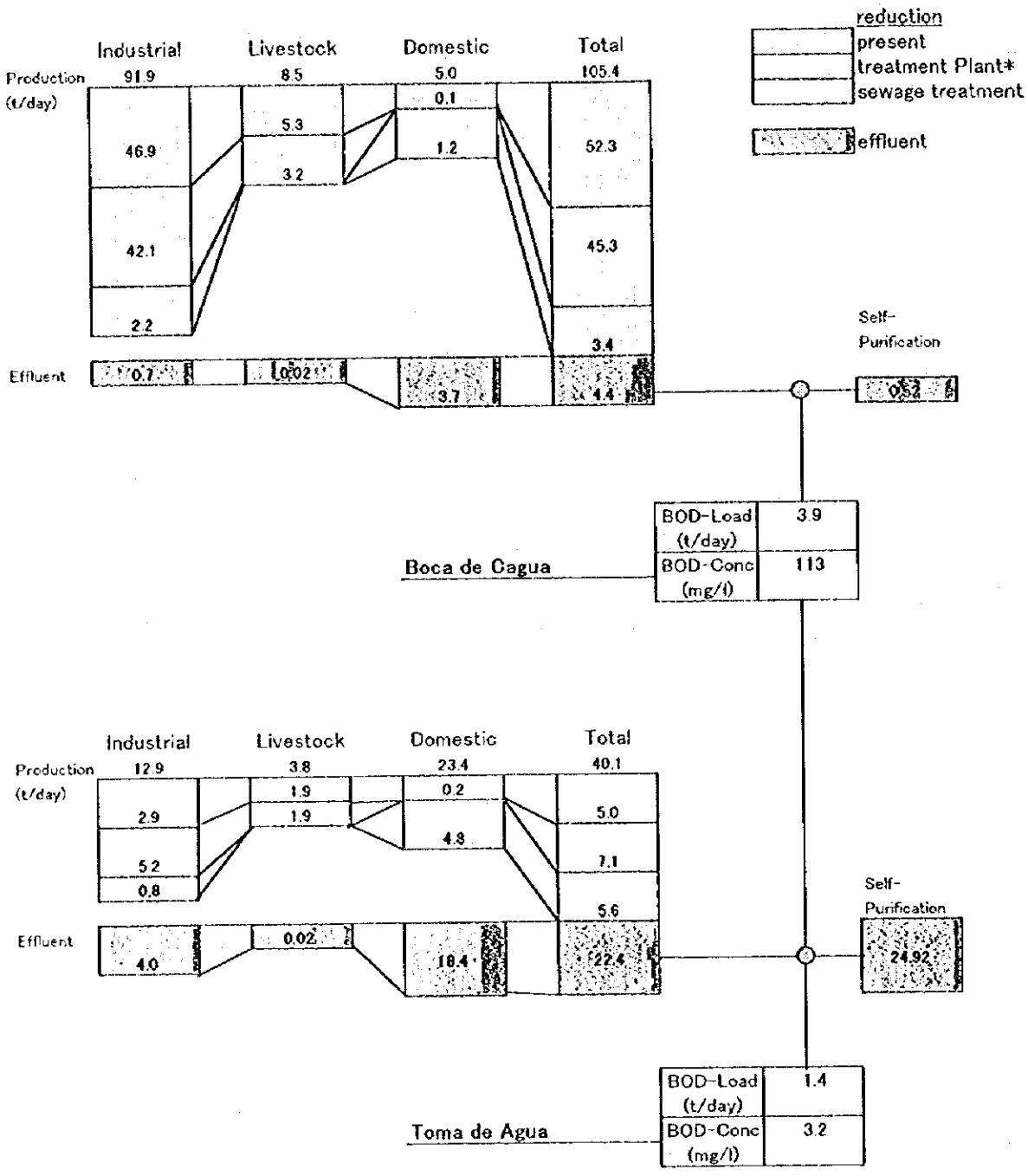
Fig. 2.3-1 (2/3) Relation Between Wastewater Discharge and Installation Cost of Treatment Plant



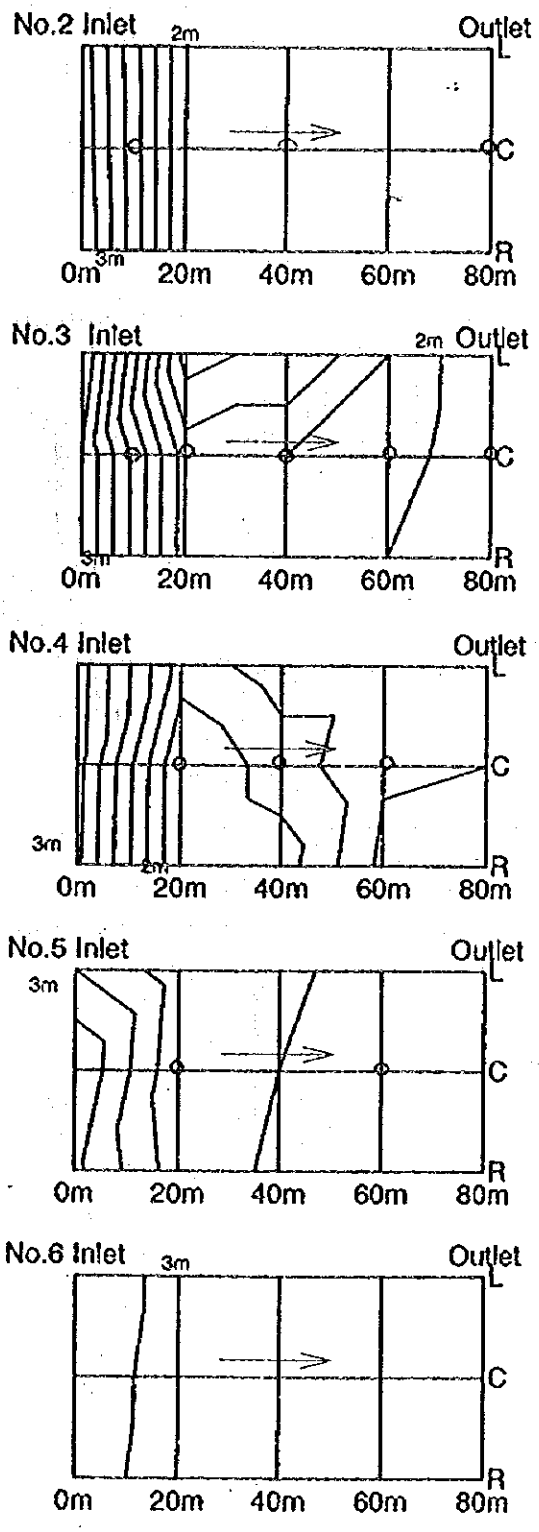
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 2.3-1 (3/3) Relation Between Wastewater Discharge and Installation Cost of Treatment Plant
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 2.6-1 Pollution Load Balance (2010)
JAPAN INTERNATIONAL COOPERATION AGENCY	

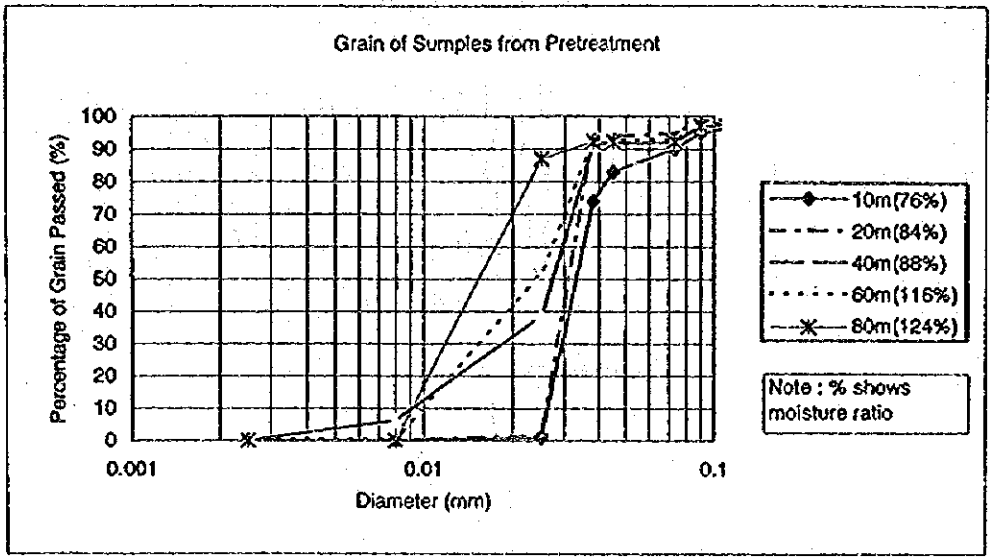


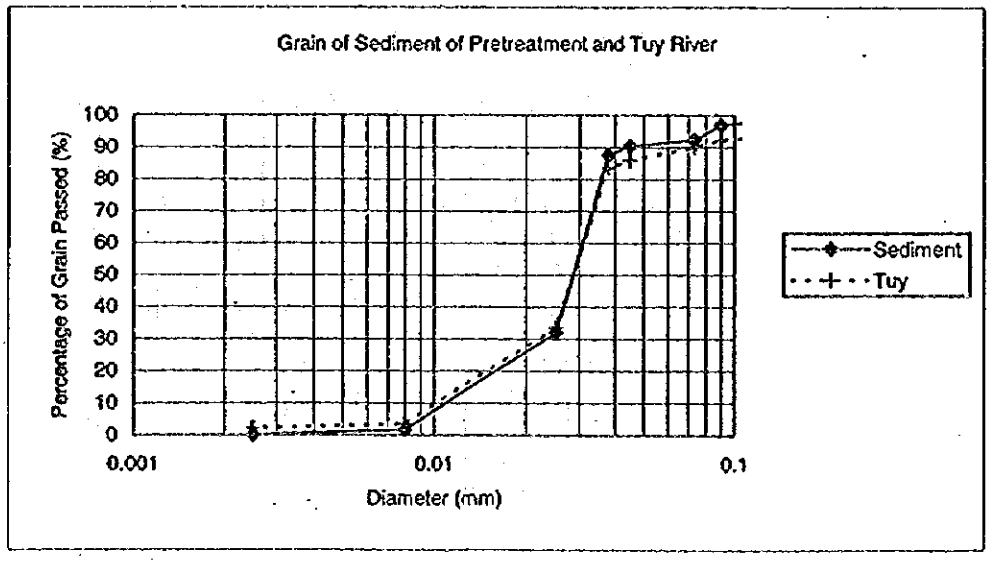
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.6-1 Pollution Load Balance (2010)



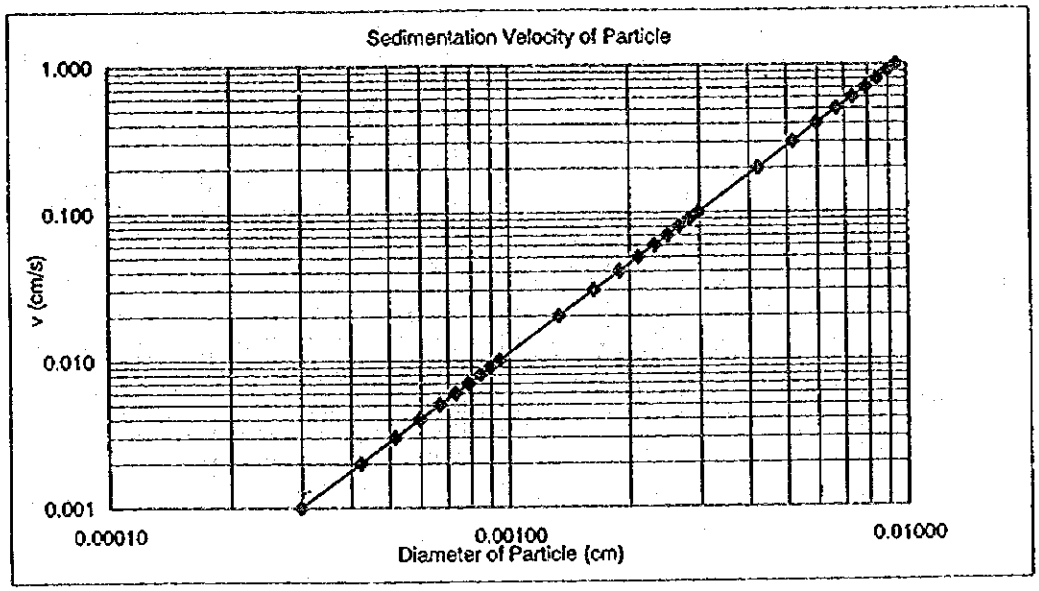
Notes : Pond No.1 was being cleaning.
: o is Sampling Point.

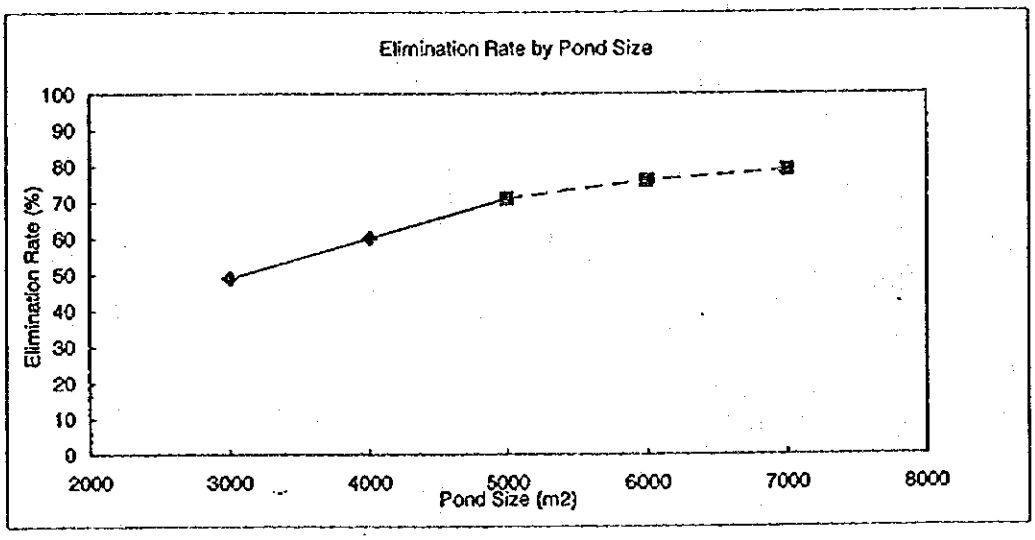
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 3.2-1 Sediment Depth in Pre-Treatment Plant



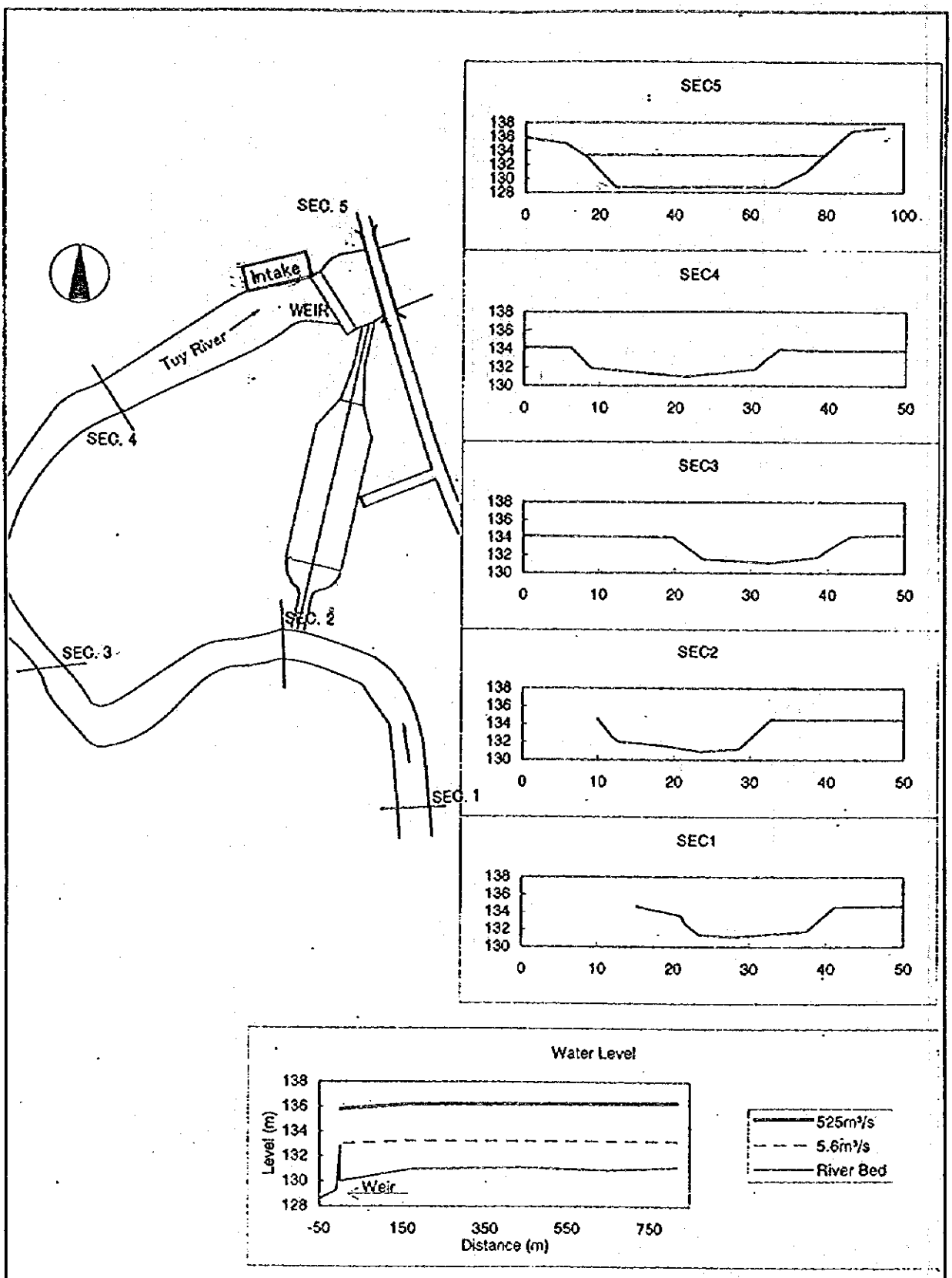


THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 3.2-2 Grain Size Distribution of Sediment





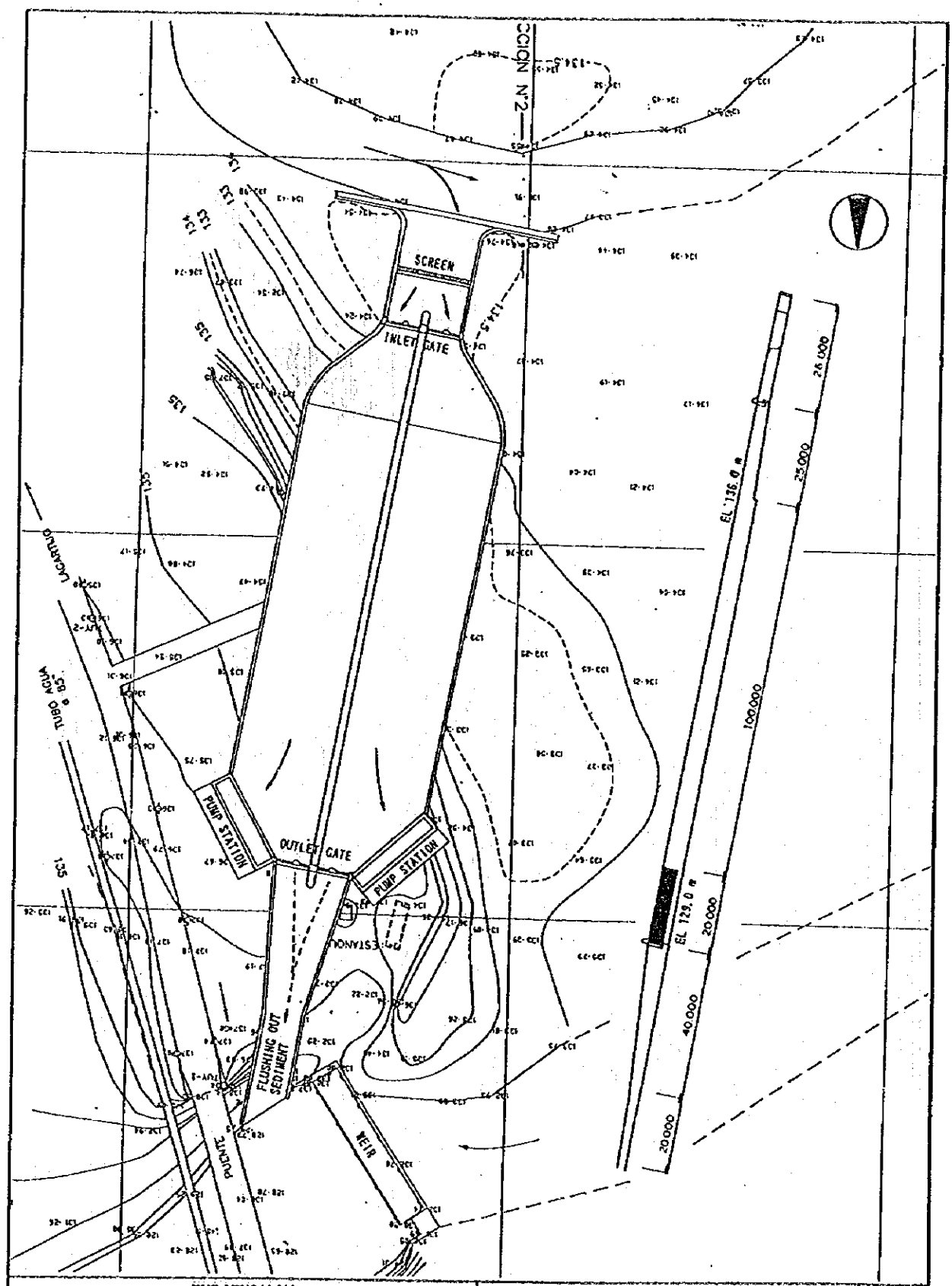
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 3.3-1 Elimination Curve of Sand Settling Pond



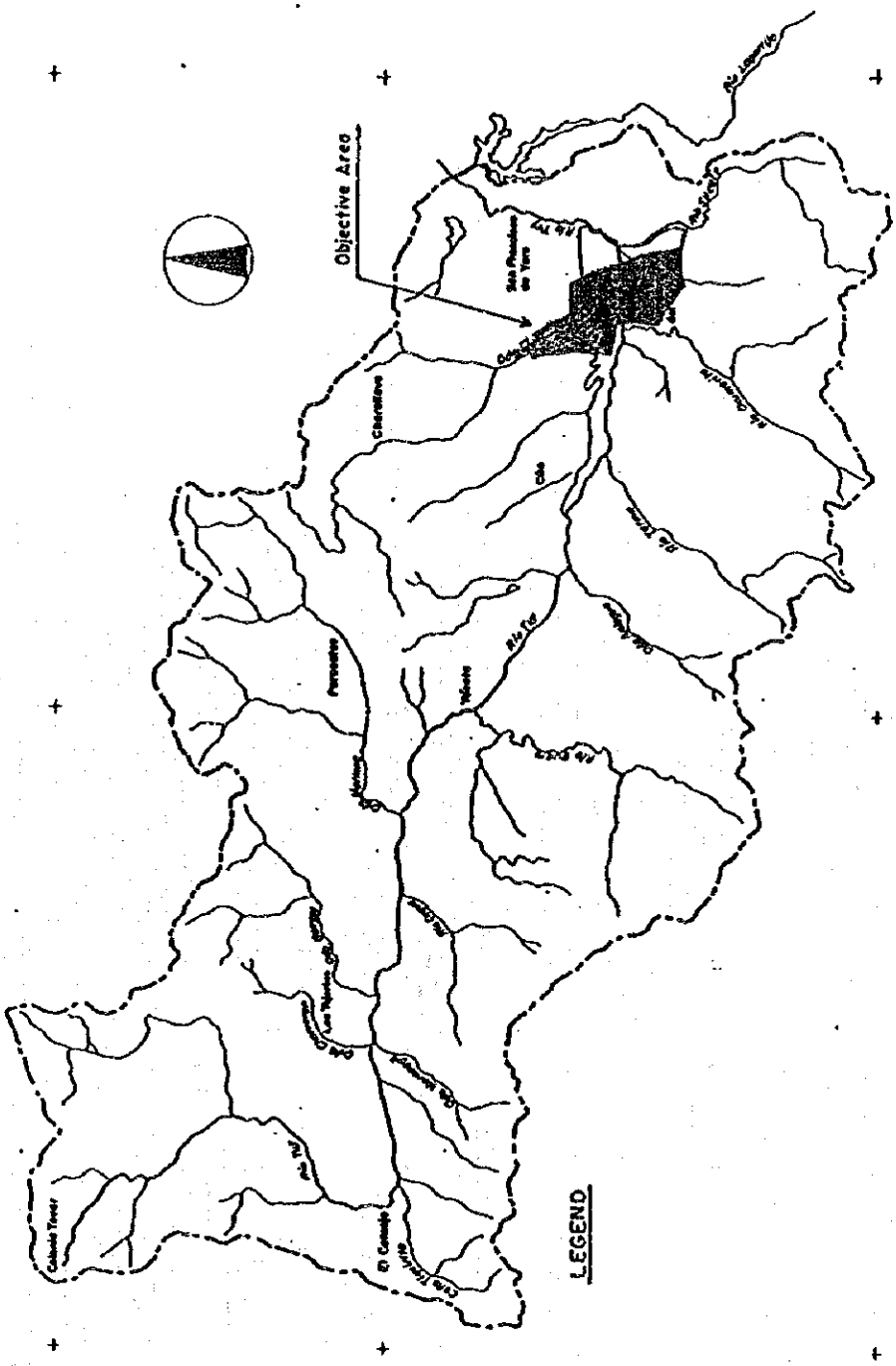
THE STUDY ON
THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA

JAPAN INTERNATIONAL COOPERATION AGENCY

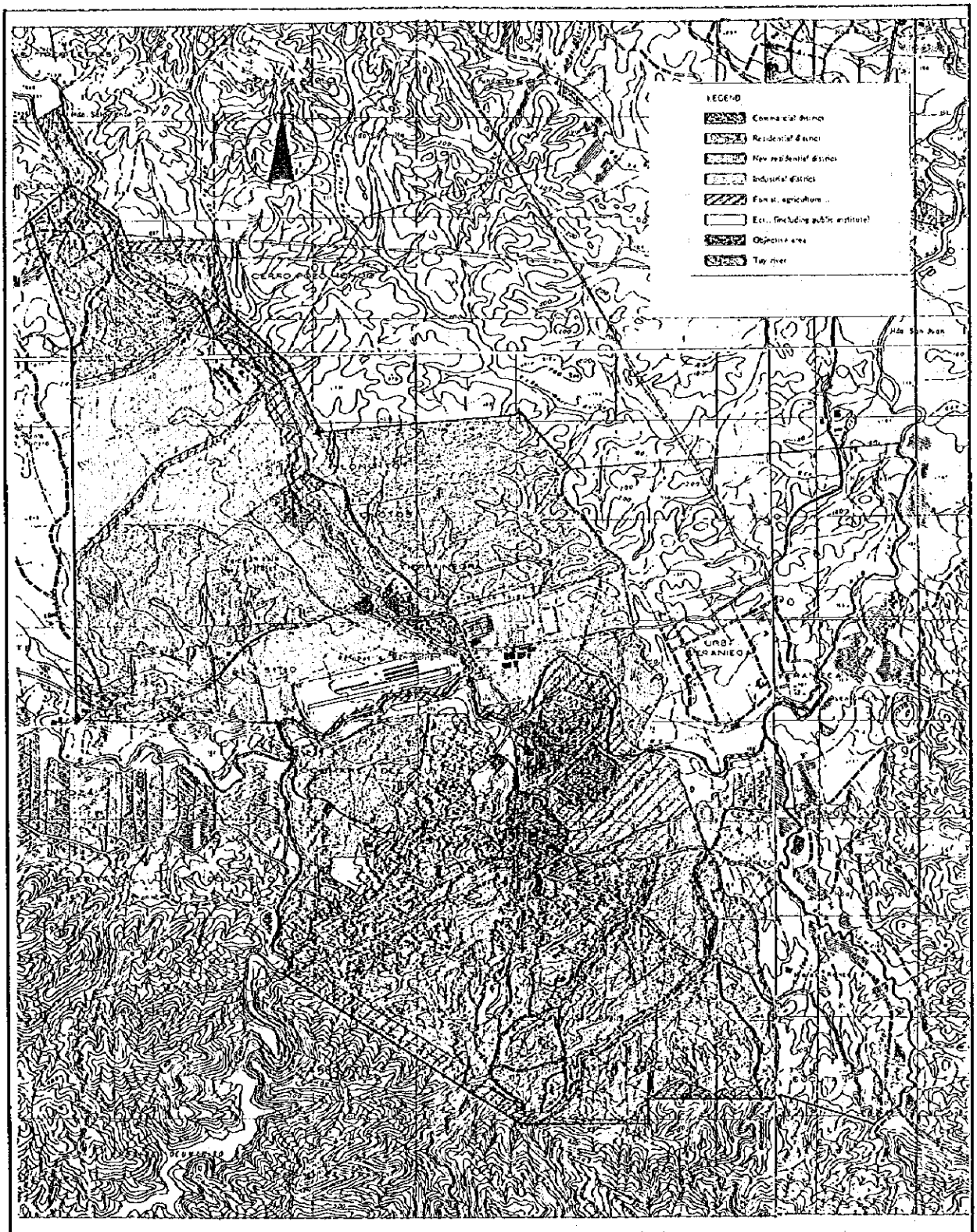
Fig. 3.5-1 Water Level of the Tuy River



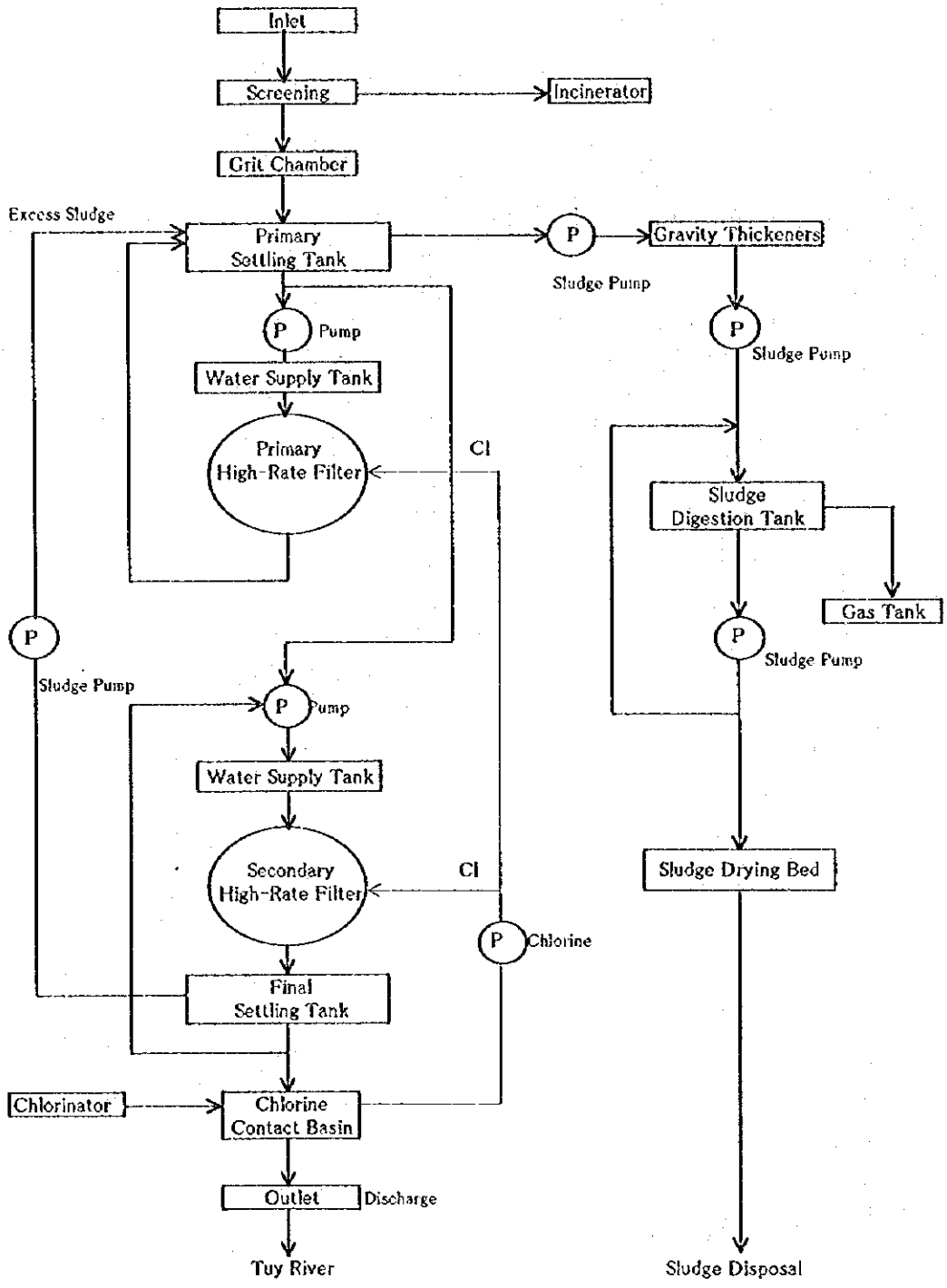
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 3.6-1 Preliminary Design of Sand Settling Pond



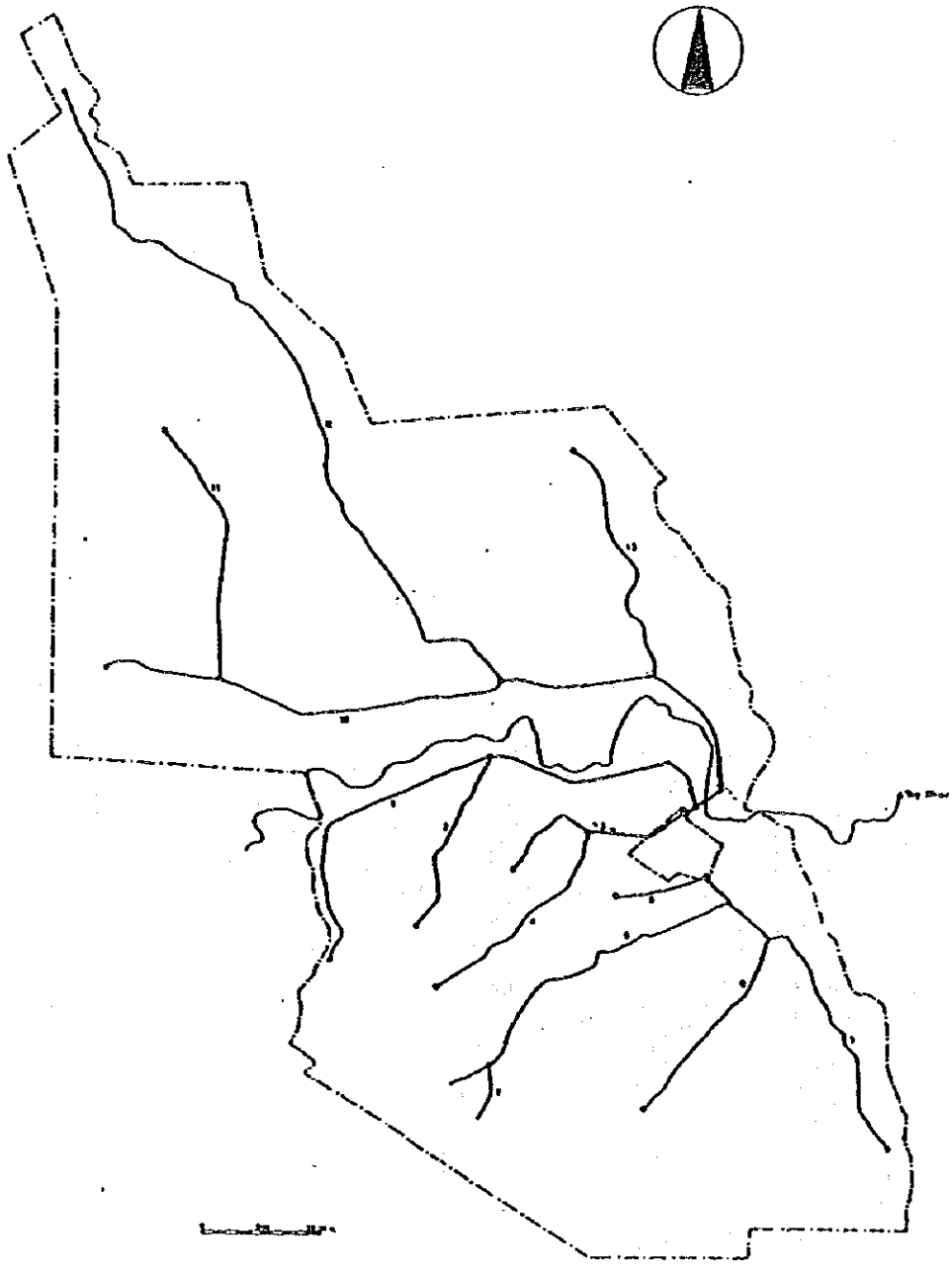
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 4.2-1 Location of Objective Area
JAPAN INTERNATIONAL COOPERATION AGENCY	



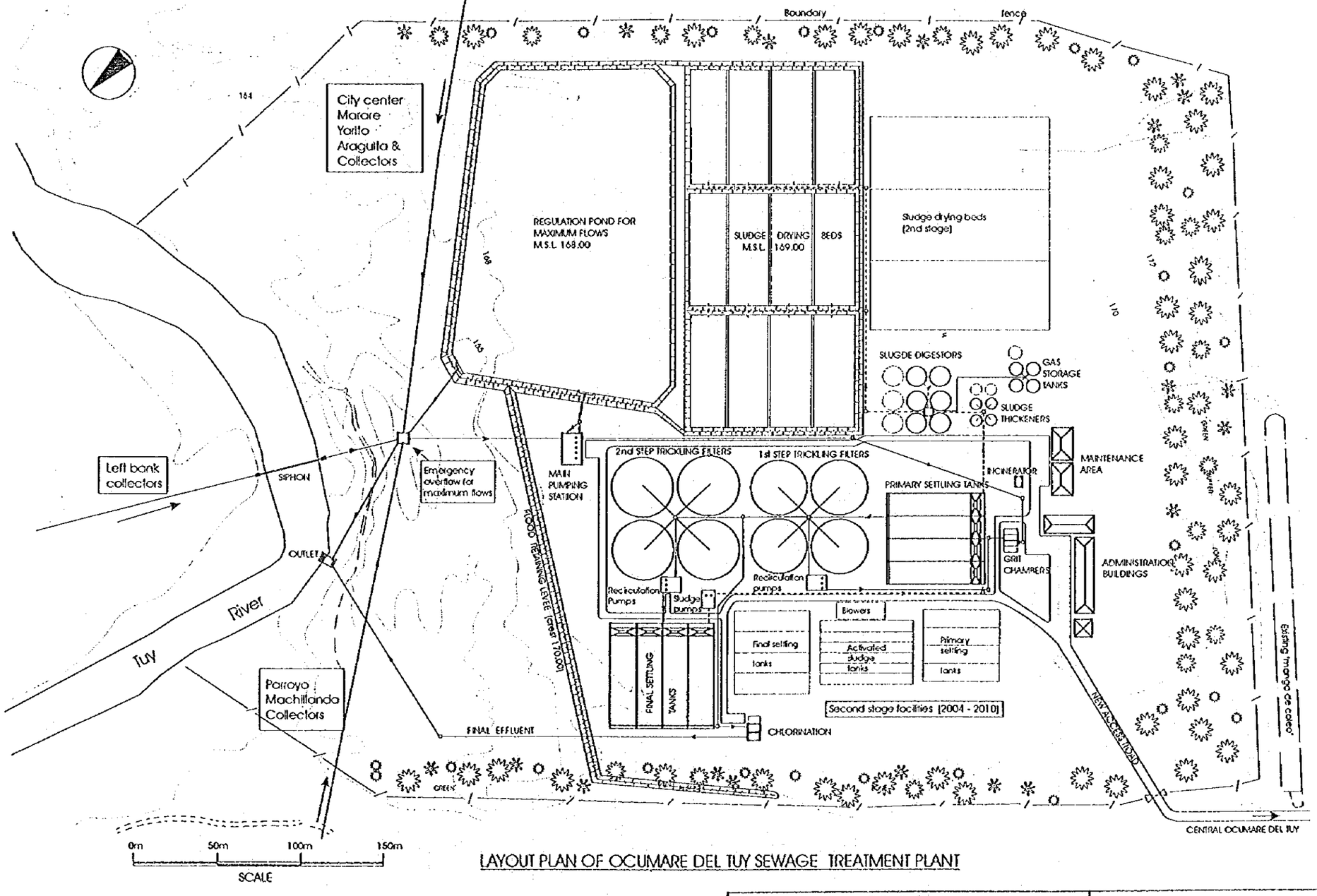
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 4.2-2 Urban Development Plan by MINDUR
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 4.4-1 Flow of Proposed Sewage Treatment Process

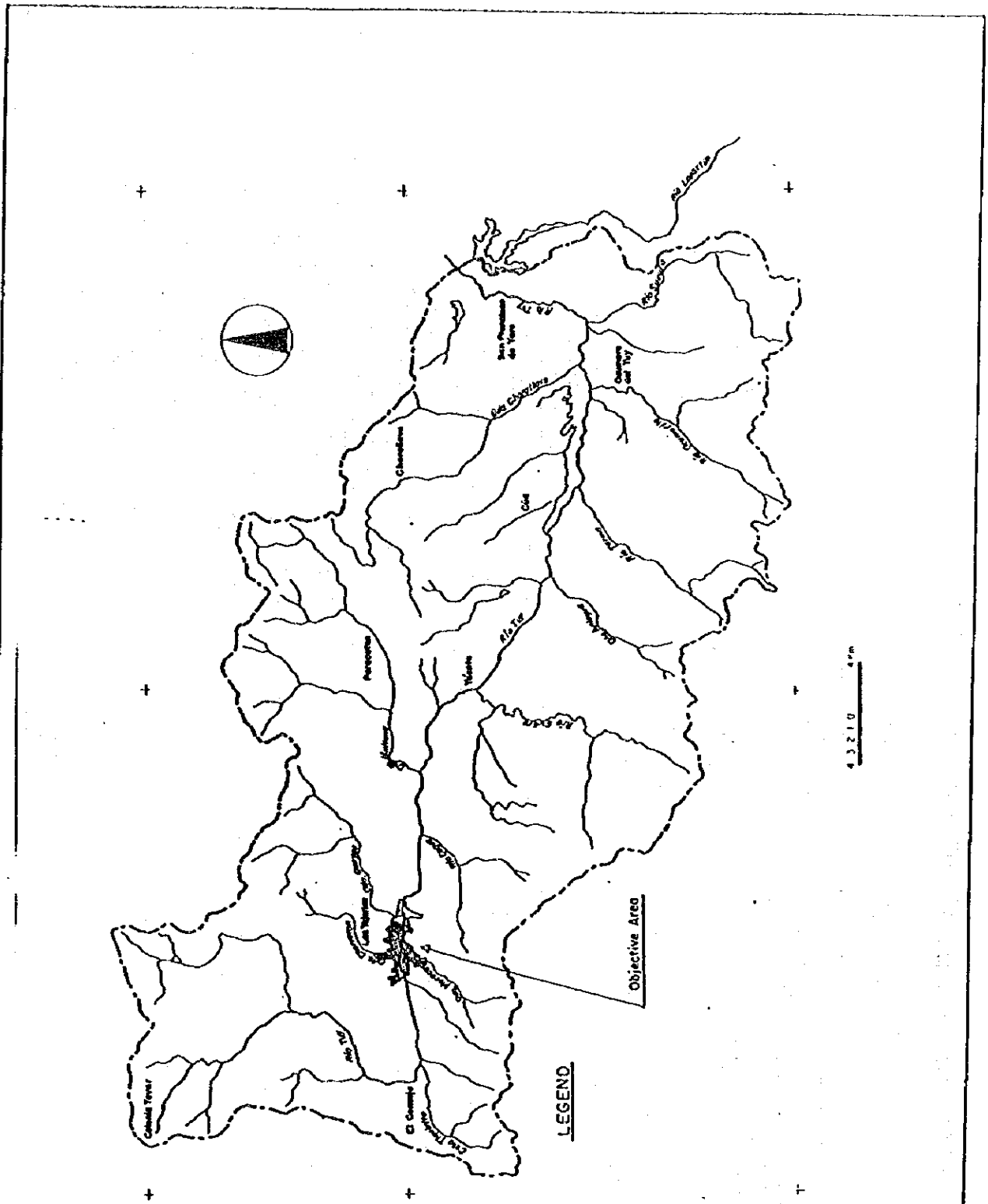


THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 4.4-2 Drainage Pipe Network (Main Drainage)
JAPAN INTERNATIONAL COOPERATION AGENCY	

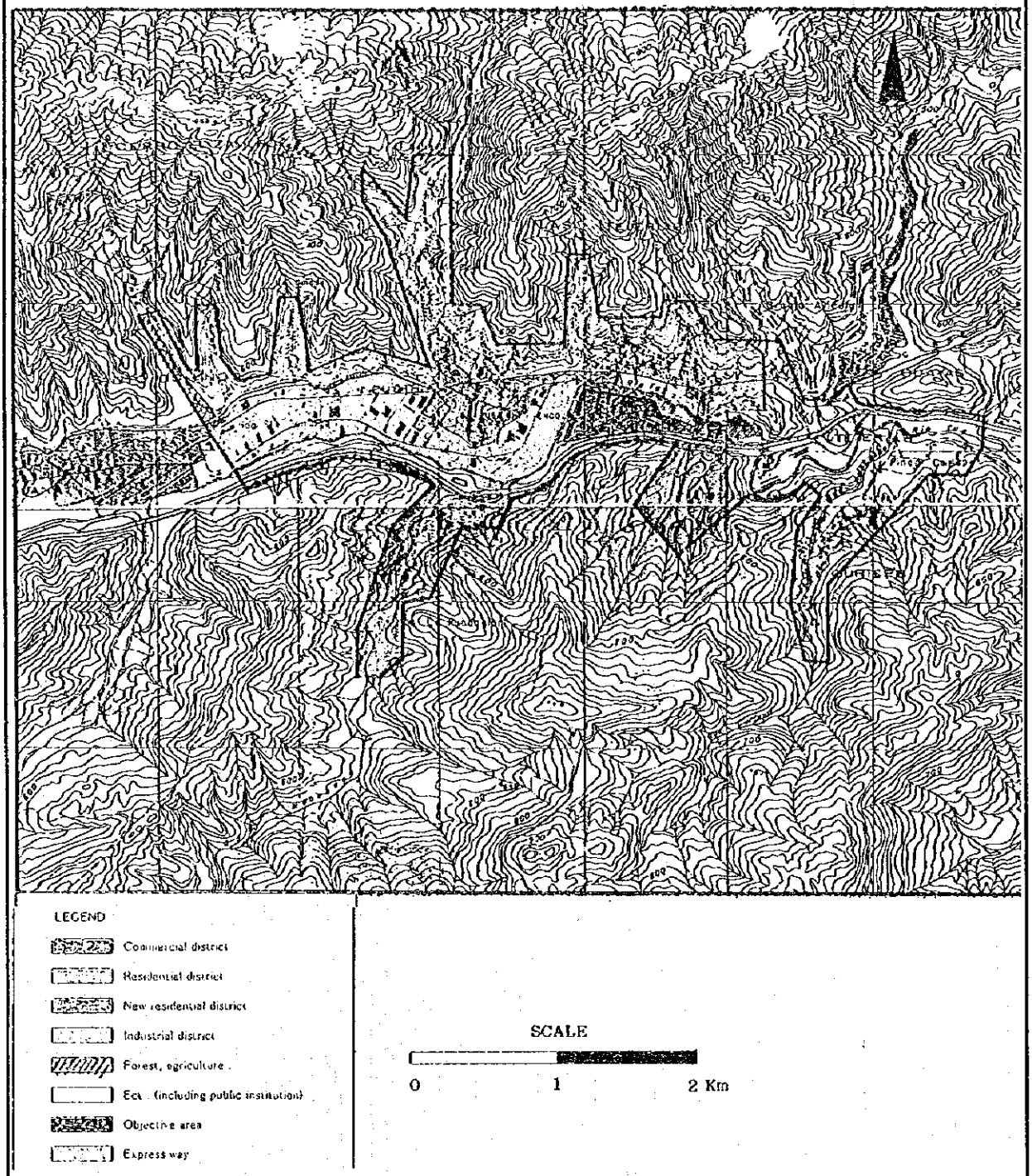


LAYOUT PLAN OF OCUMARE DEL TUY SEWAGE TREATMENT PLANT

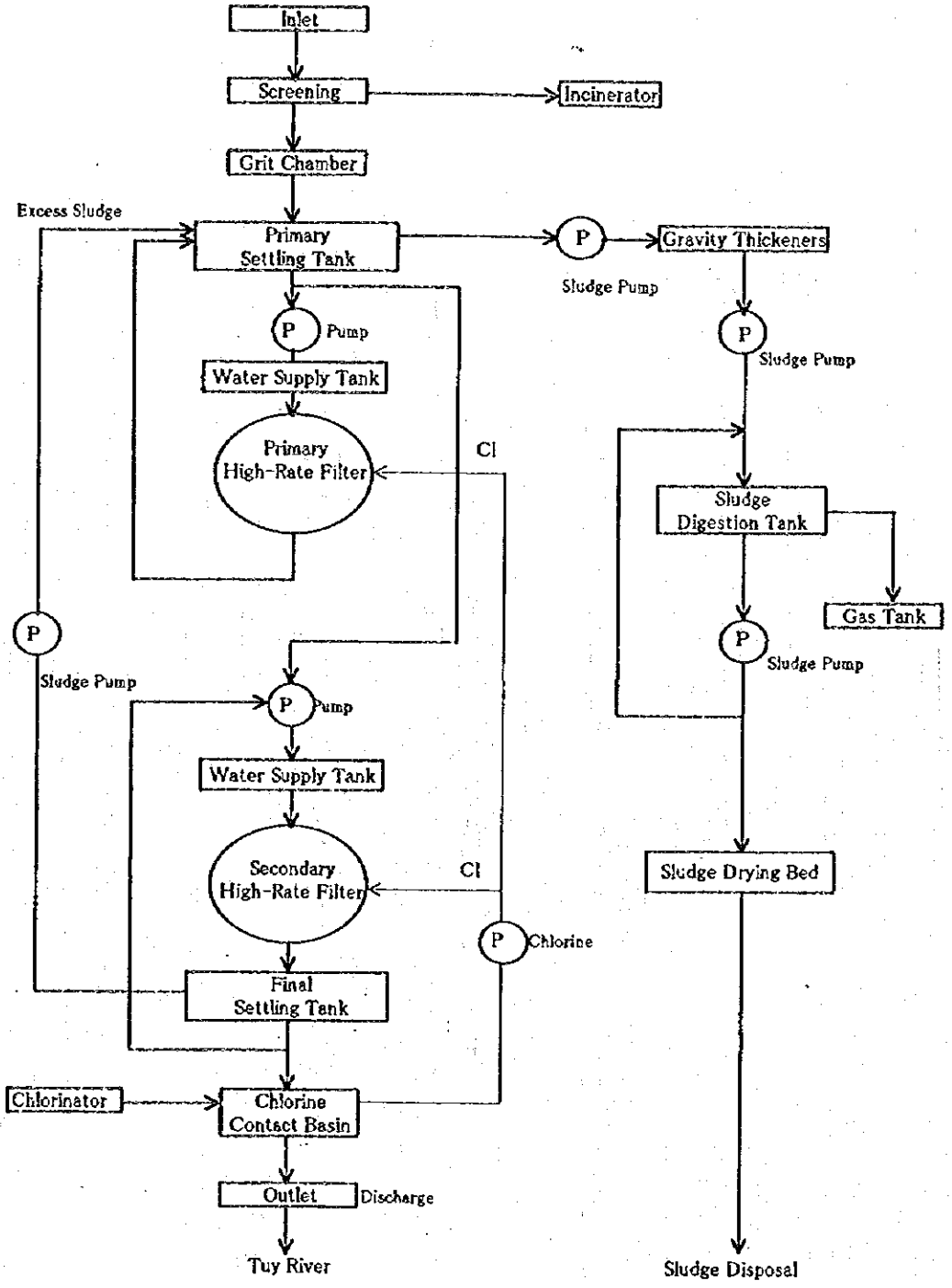
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 4..4-3 Outline of Sewage Treatment Plant



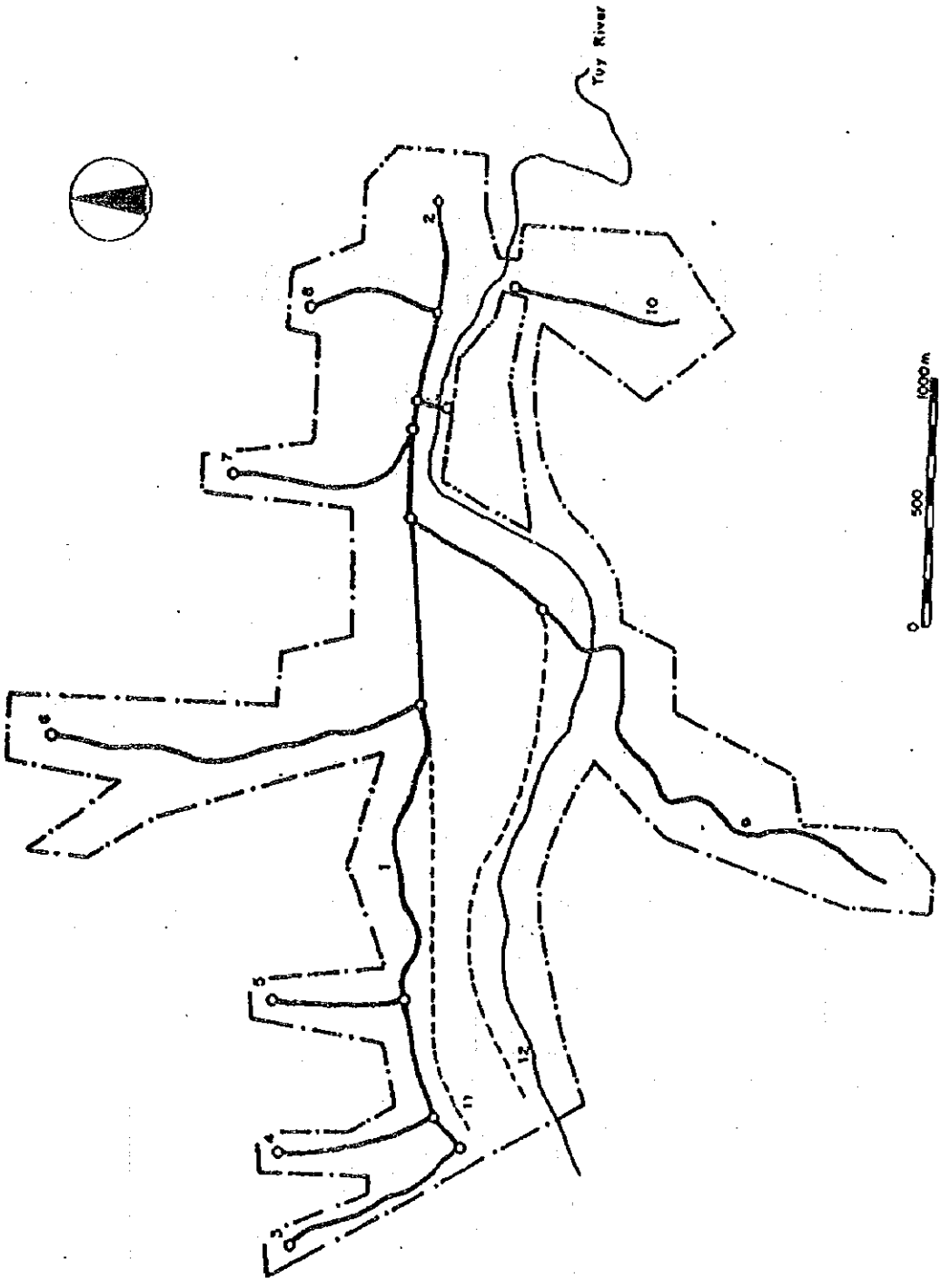
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 5.2-1 Location of Objective Area
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 5.2-2 Urban Development Plan by MINDUR
JAPAN INTERNATIONAL COOPERATION AGENCY	

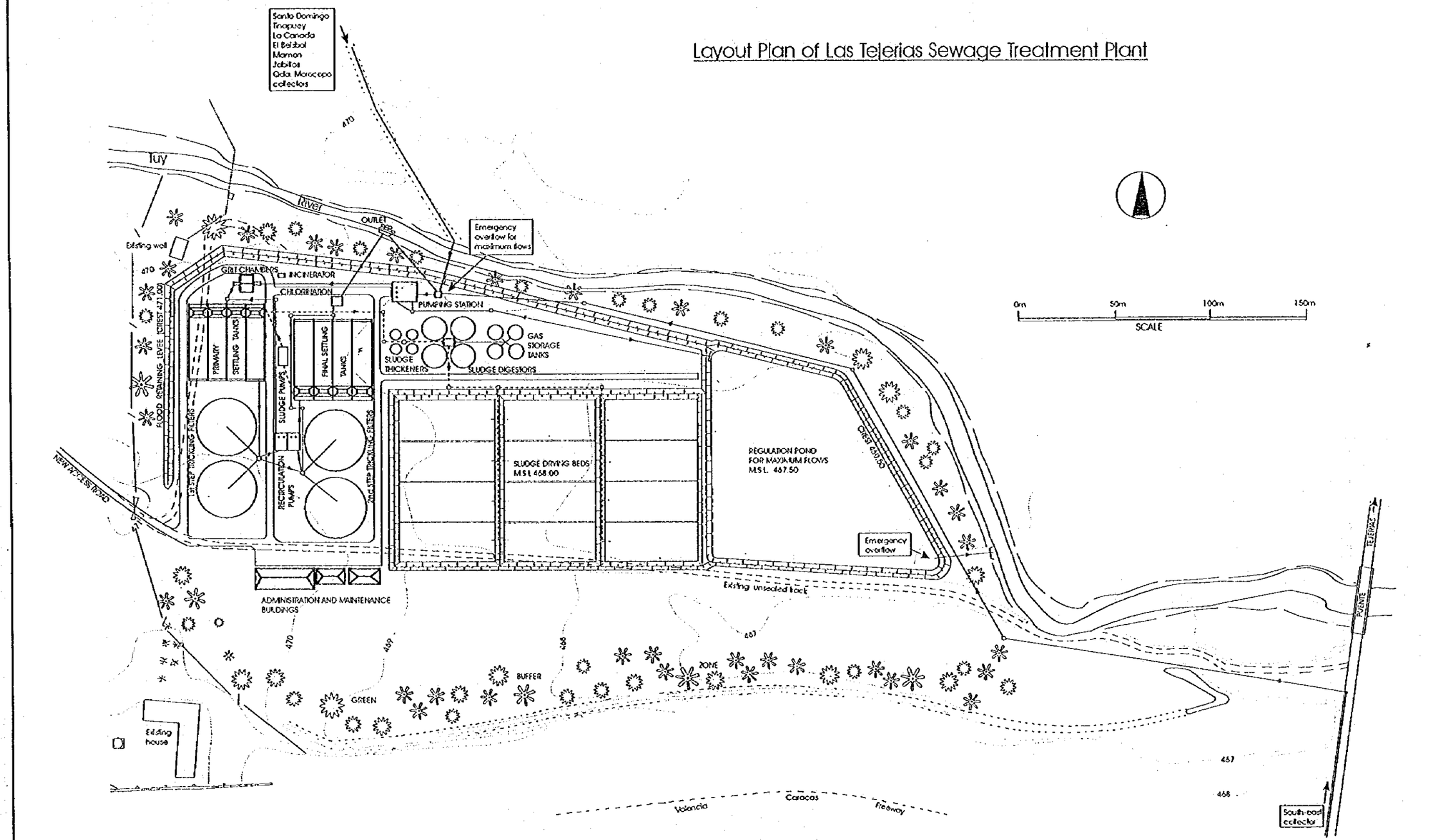


THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.4-1 Flow of Proposed Sewage Treatment Process

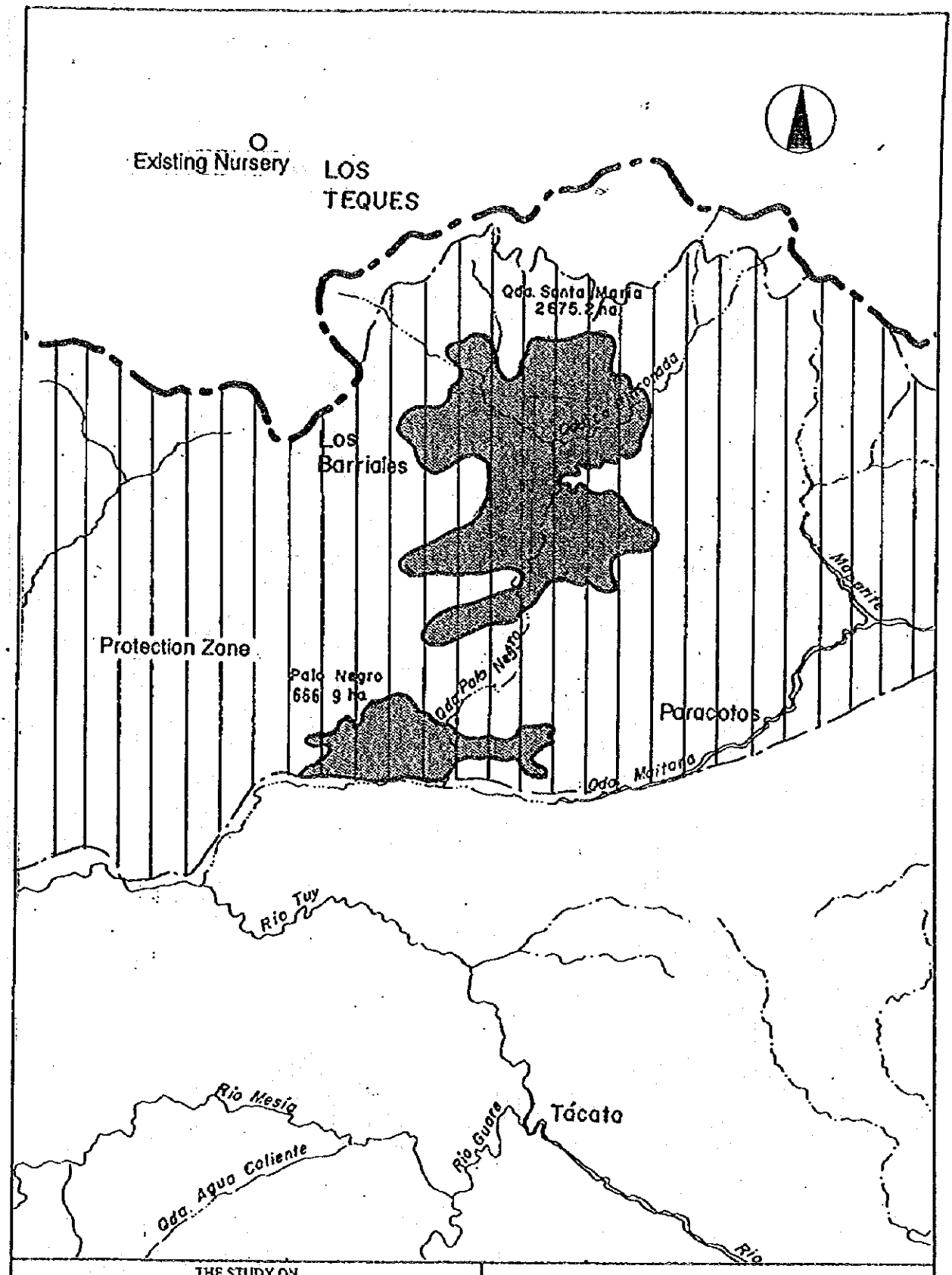


THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.4-2 Drainage Pipe Network (Main Drainage)

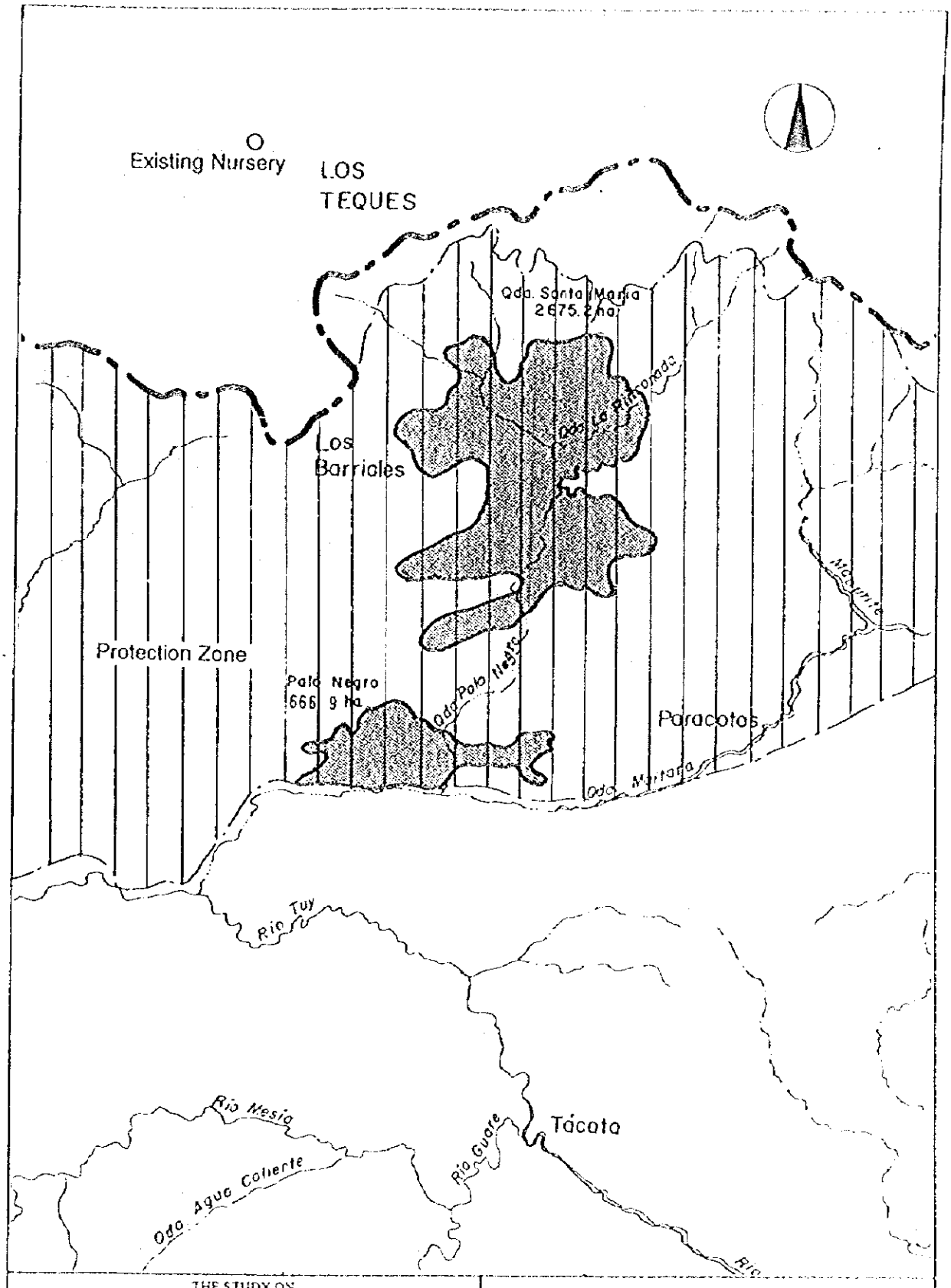
Layout Plan of Las Tejerias Sewage Treatment Plant



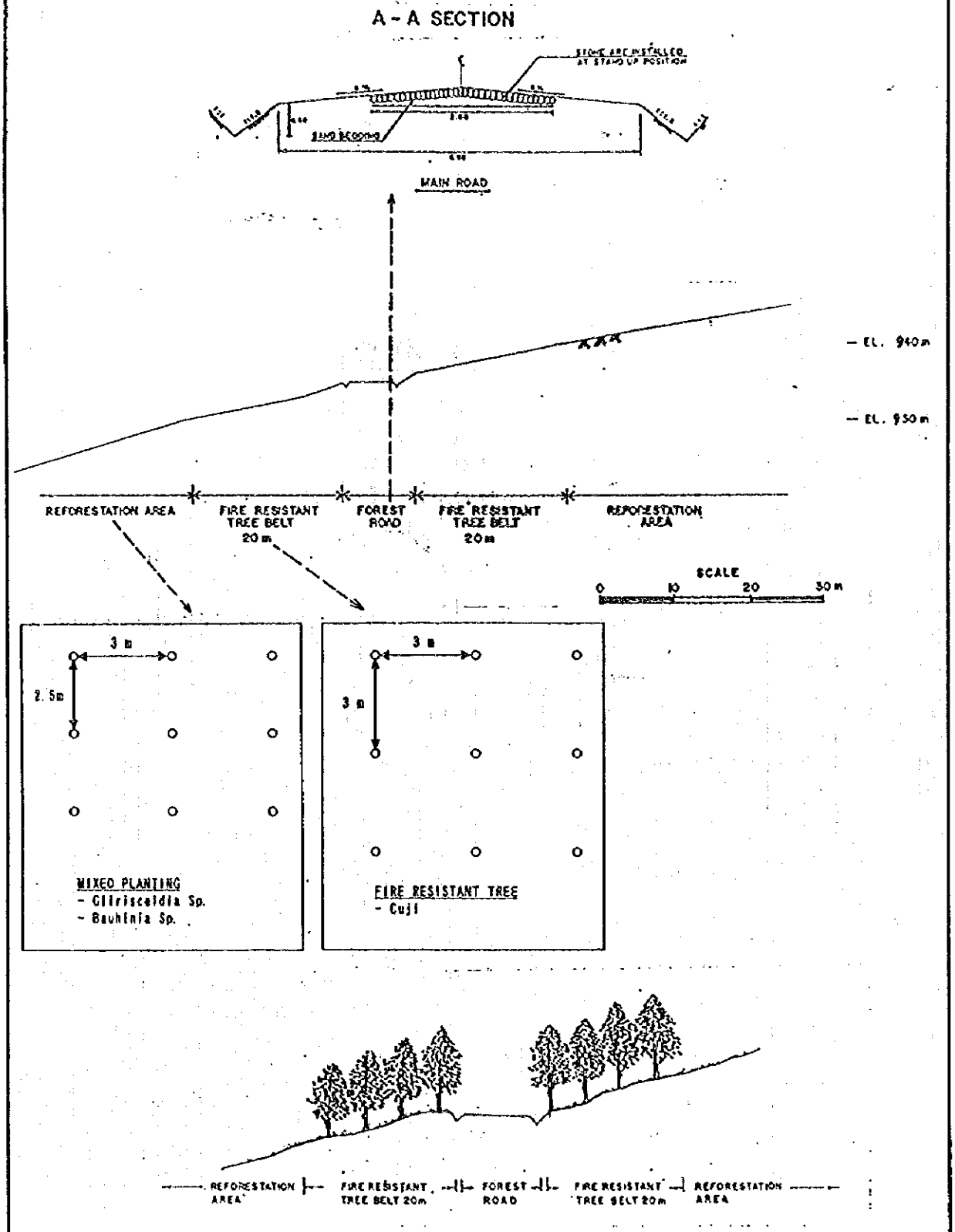
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 5.4-3 Outline of Sewage Treatment Plant
JAPAN INTERNATIONAL COOPERATION AGENCY	



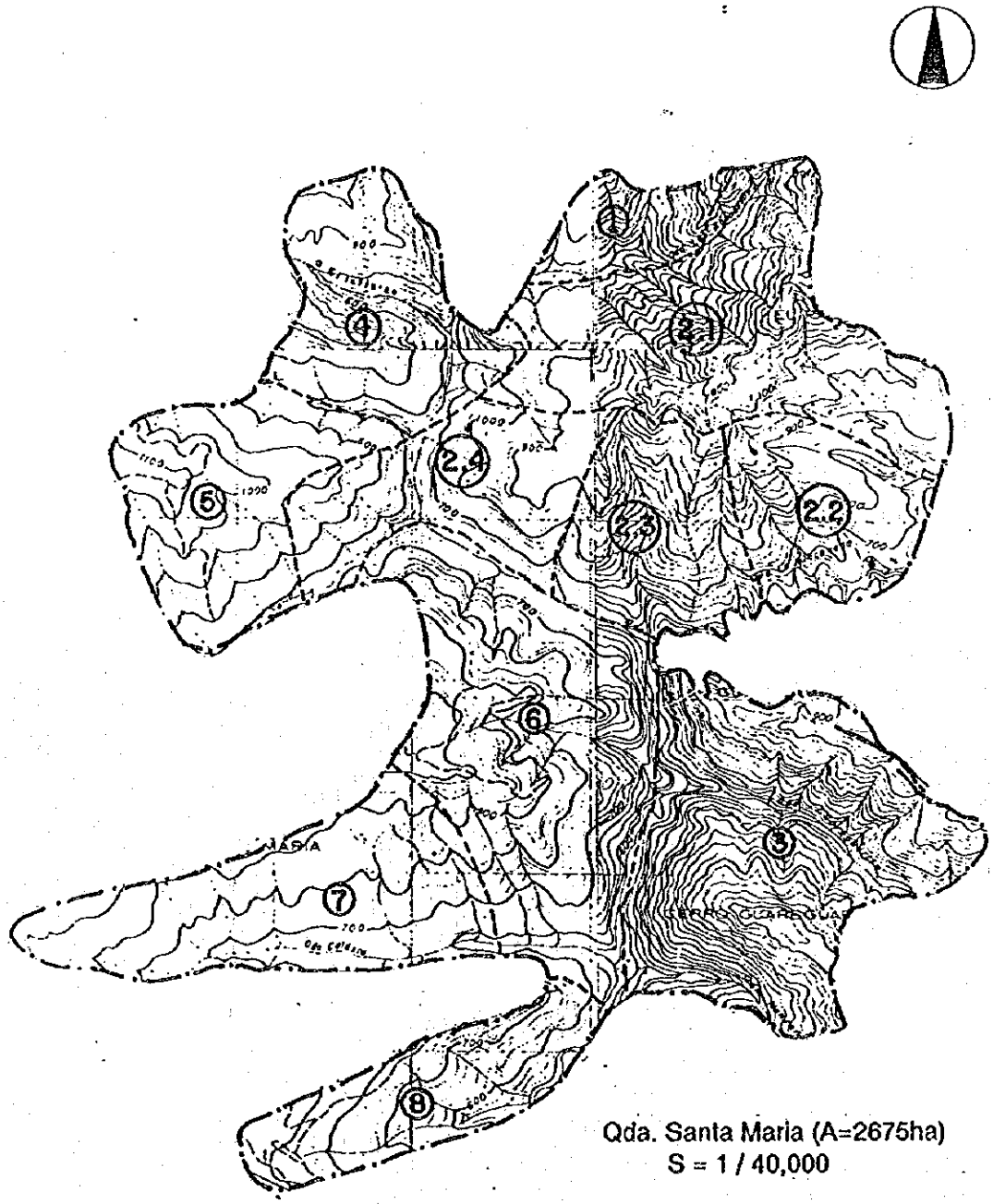
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 6.2-1 Objective Reforestation Site
JAPAN INTERNATIONAL COOPERATION AGENCY	



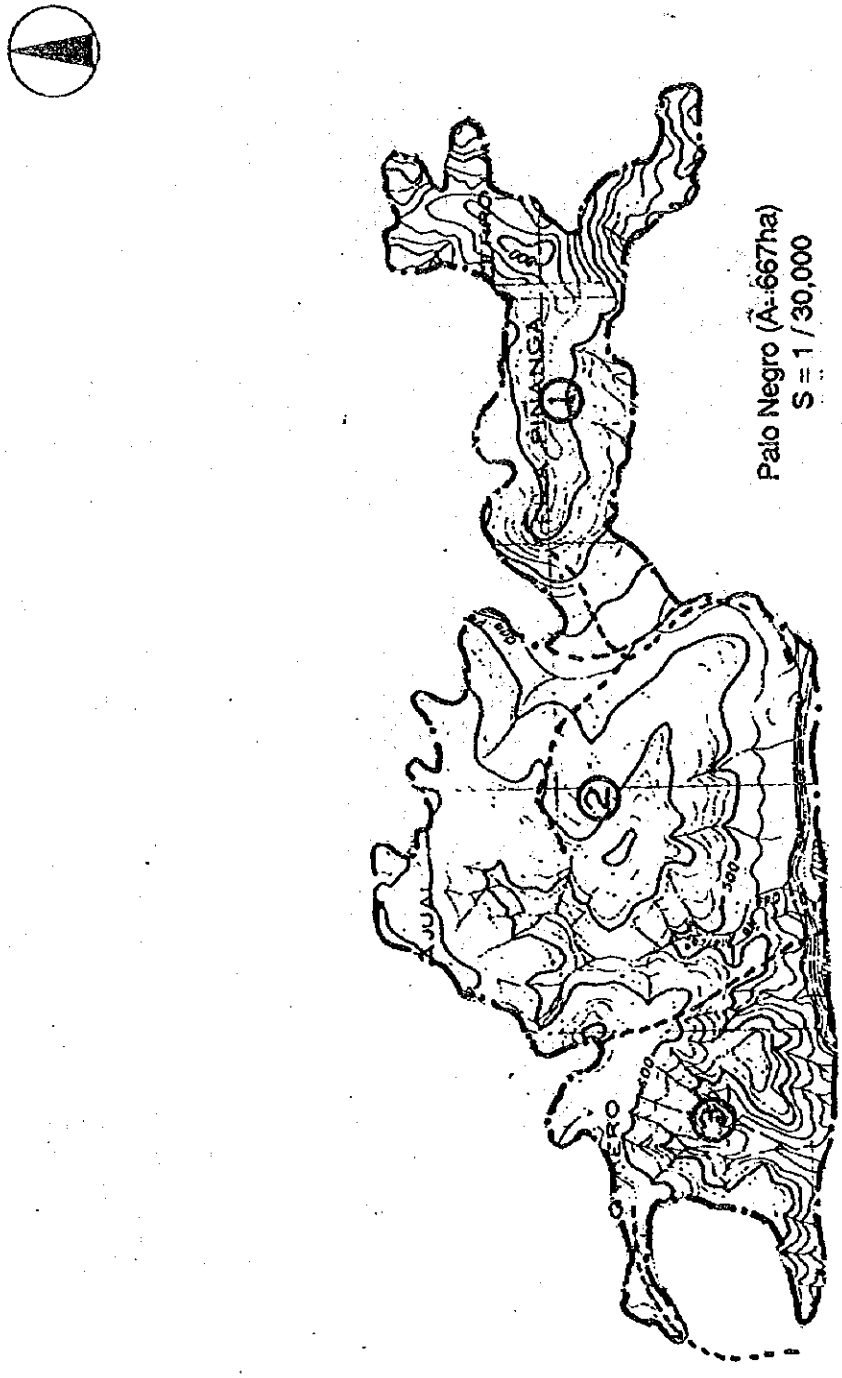
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 6.2-1 Objective Reforestation Site
JAPAN INTERNATIONAL COOPERATION AGENCY	



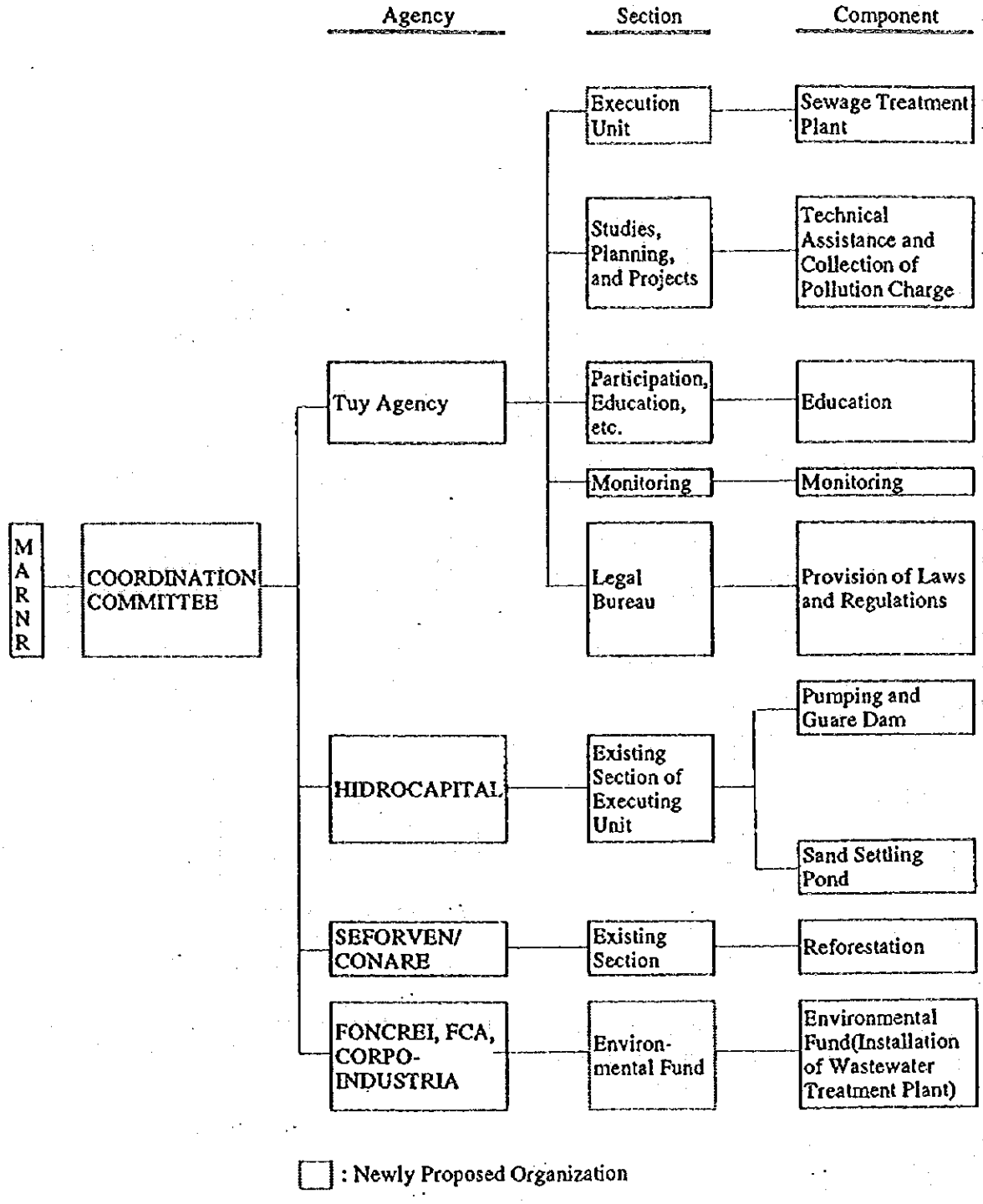
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 6.3-1 Planting Plan
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 6.3-2 Detail Map for Reforestation Site (1/2)



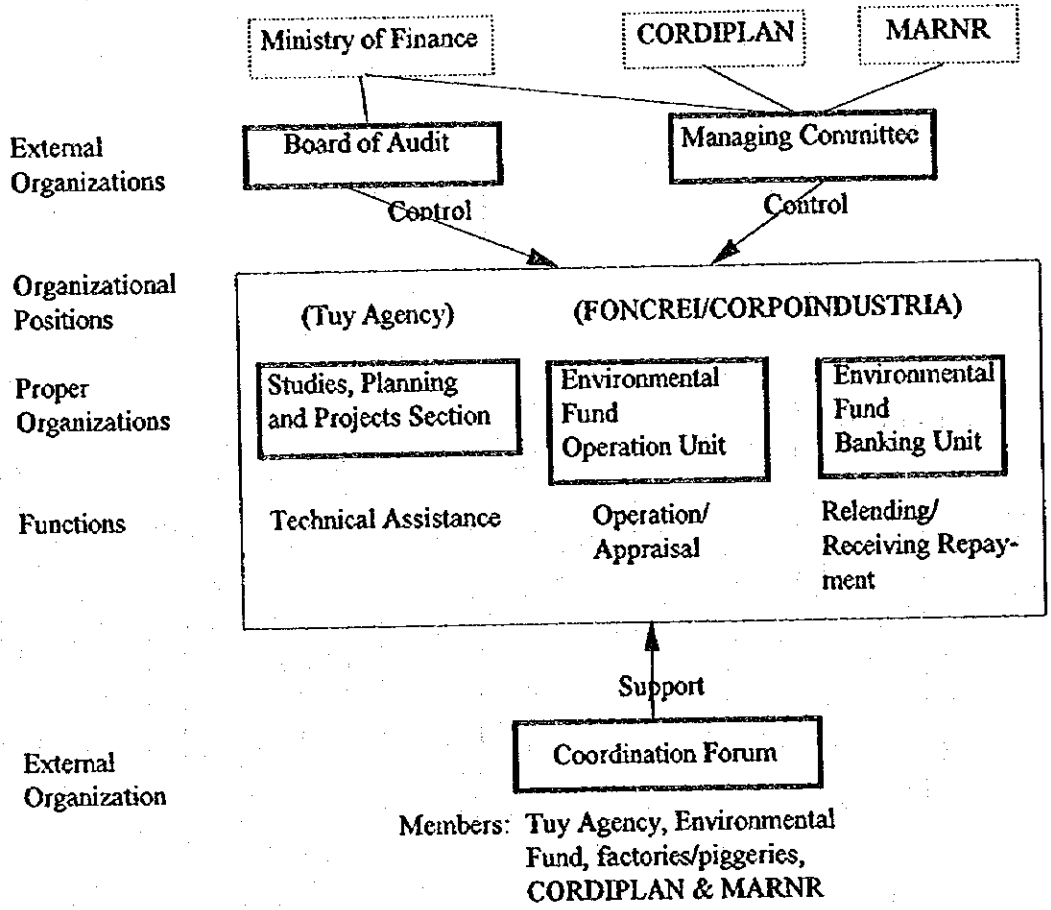
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 6.3-2 Detail Map for Reforestation (2/2) Site



THE STUDY ON
THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA

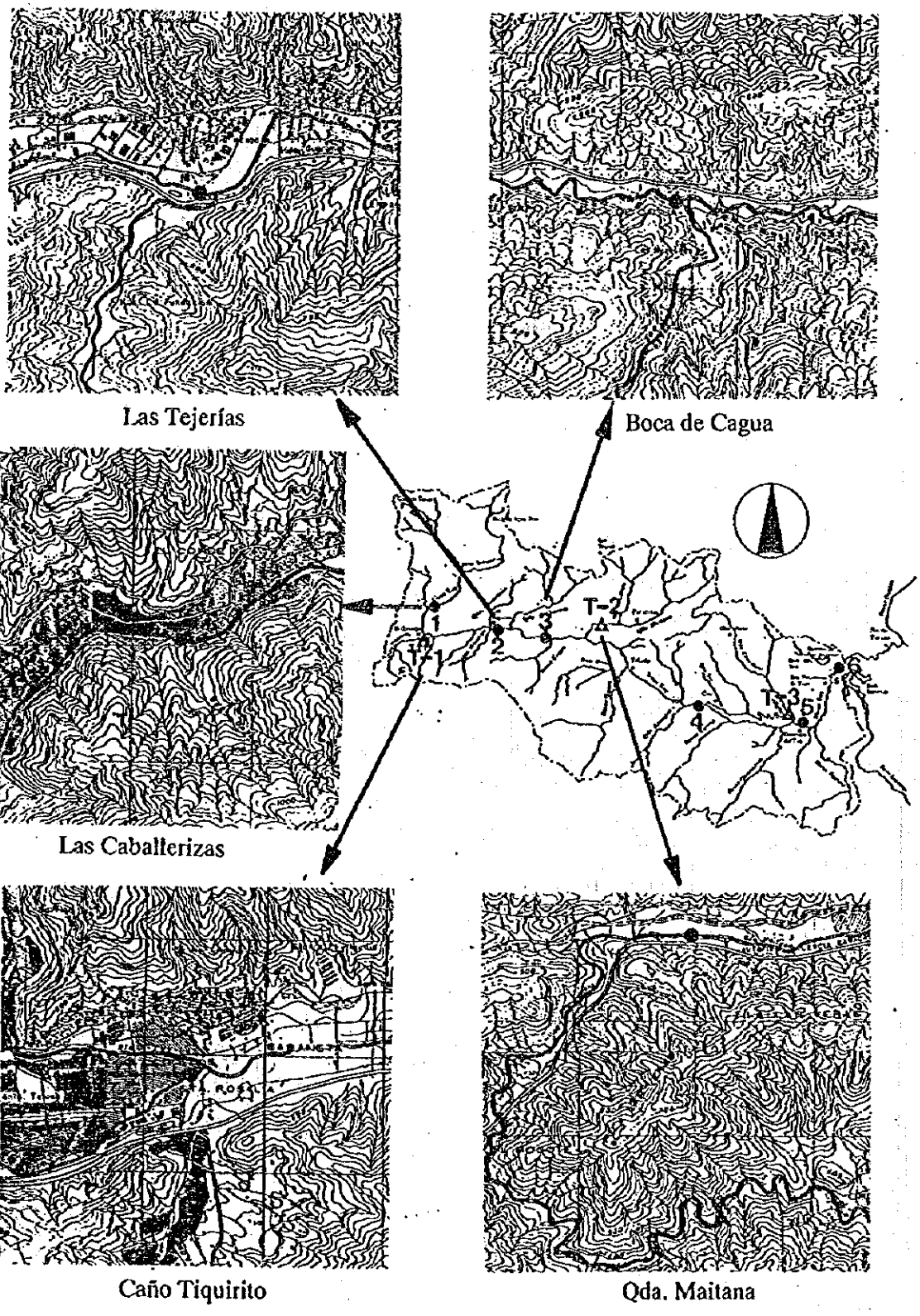
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2-1 Organization for Project Execution

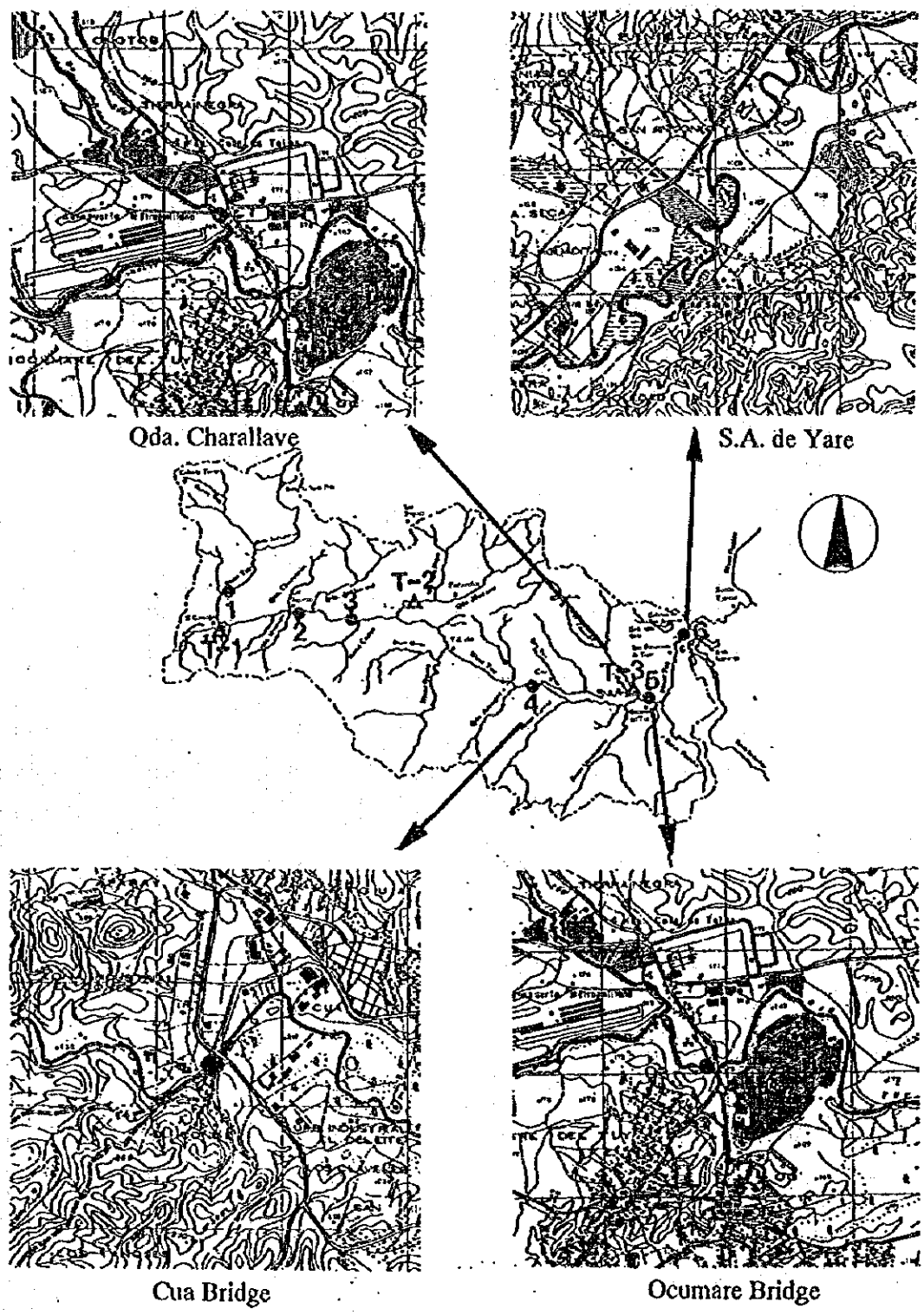


Note: FCA (Fondo de Credito Agropecuario) will perform banking functions for piggeries. However, it will not undergo any organizational change upon the introduction of the Environmental Fund.

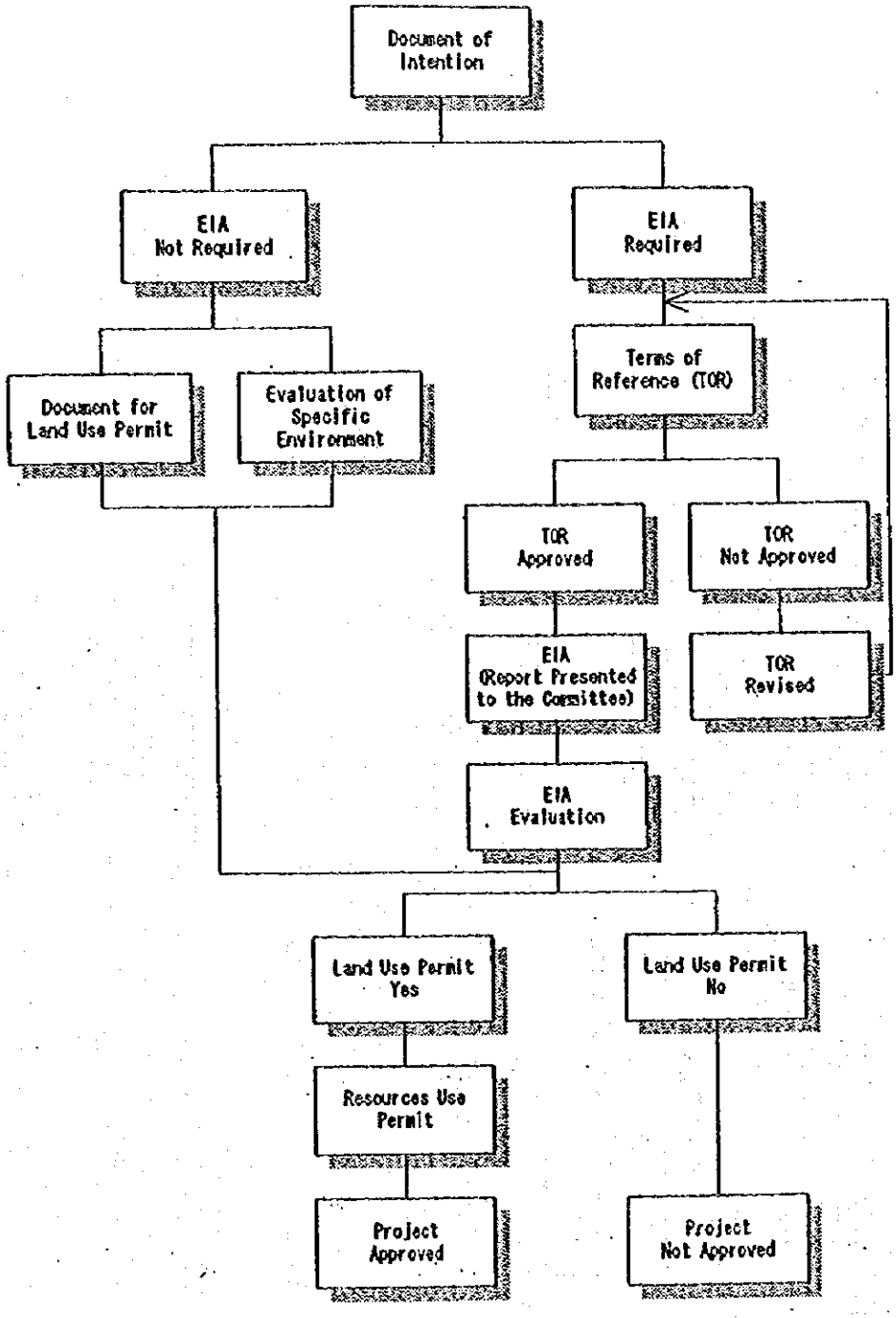
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 7.3-1 Organizations Relateol to the Environmental Fund
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 7.5-1 Location of Sampling Site (1/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 7.5-1 Location of Sampling Site (2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	

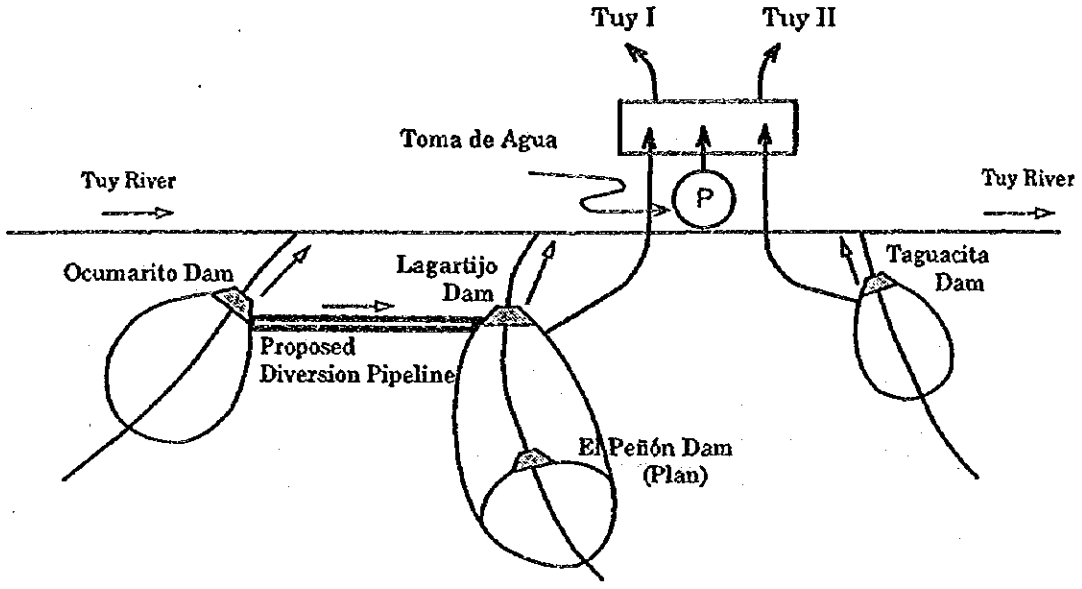


THE STUDY ON
THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN
IN THE REPUBLIC OF VENEZUELA

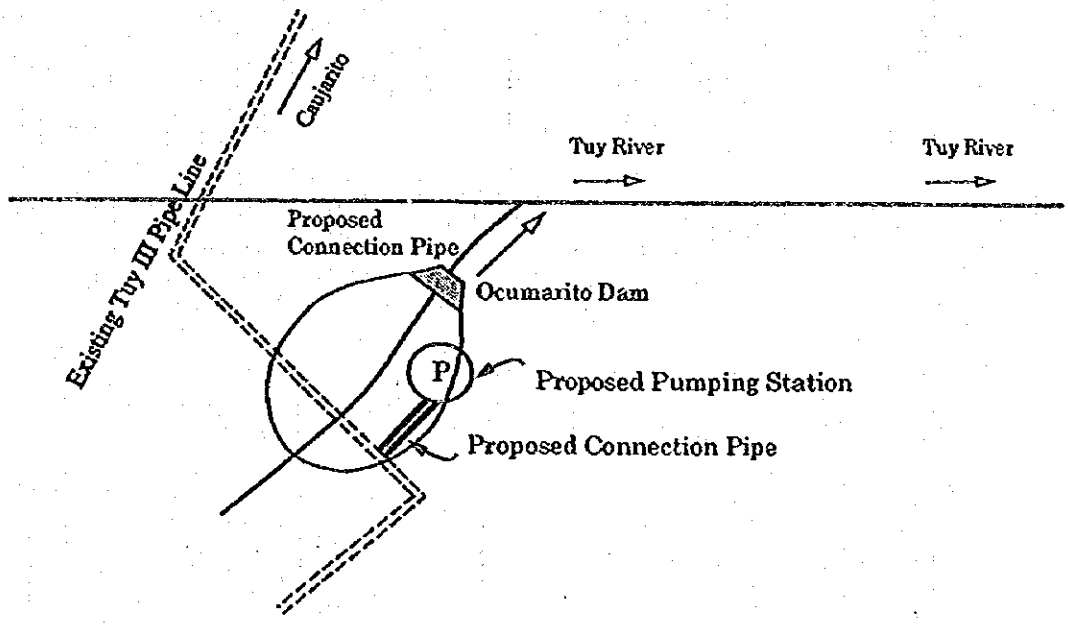
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 9.1-1 EIA Procedure

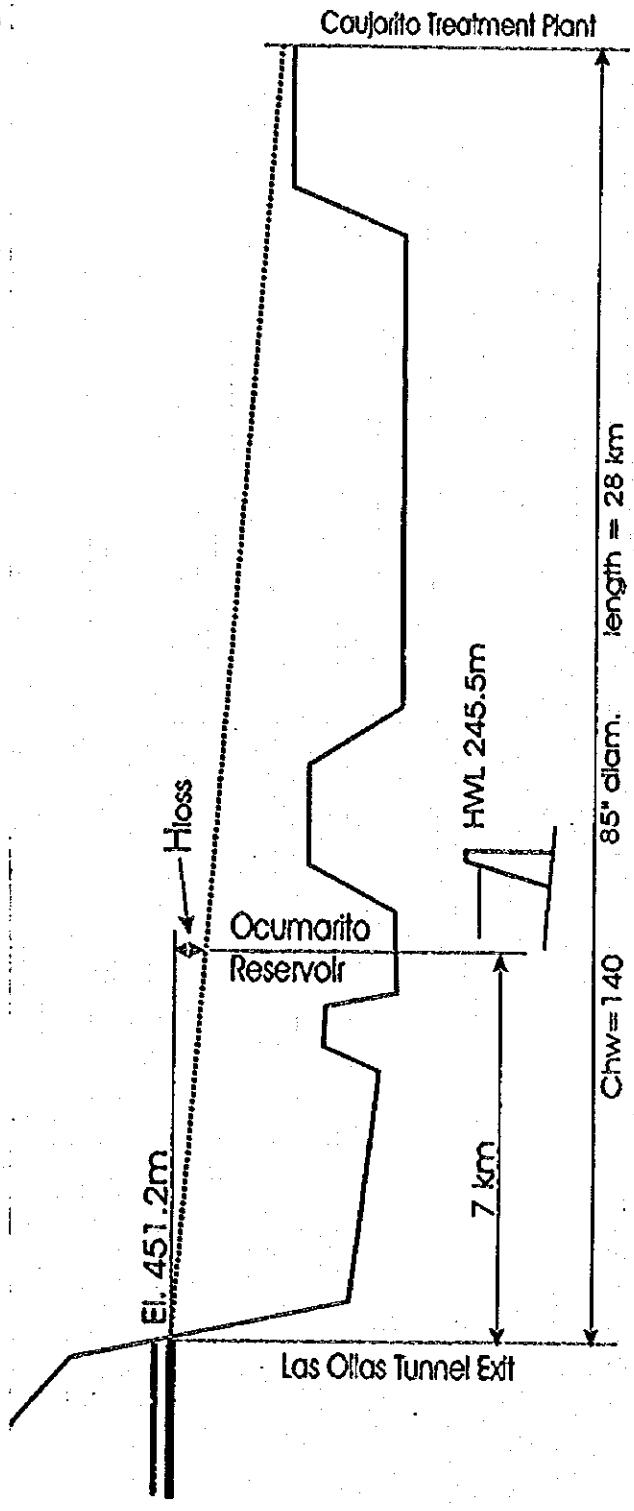
Ocumarito - Lagartijo Diversion Plan



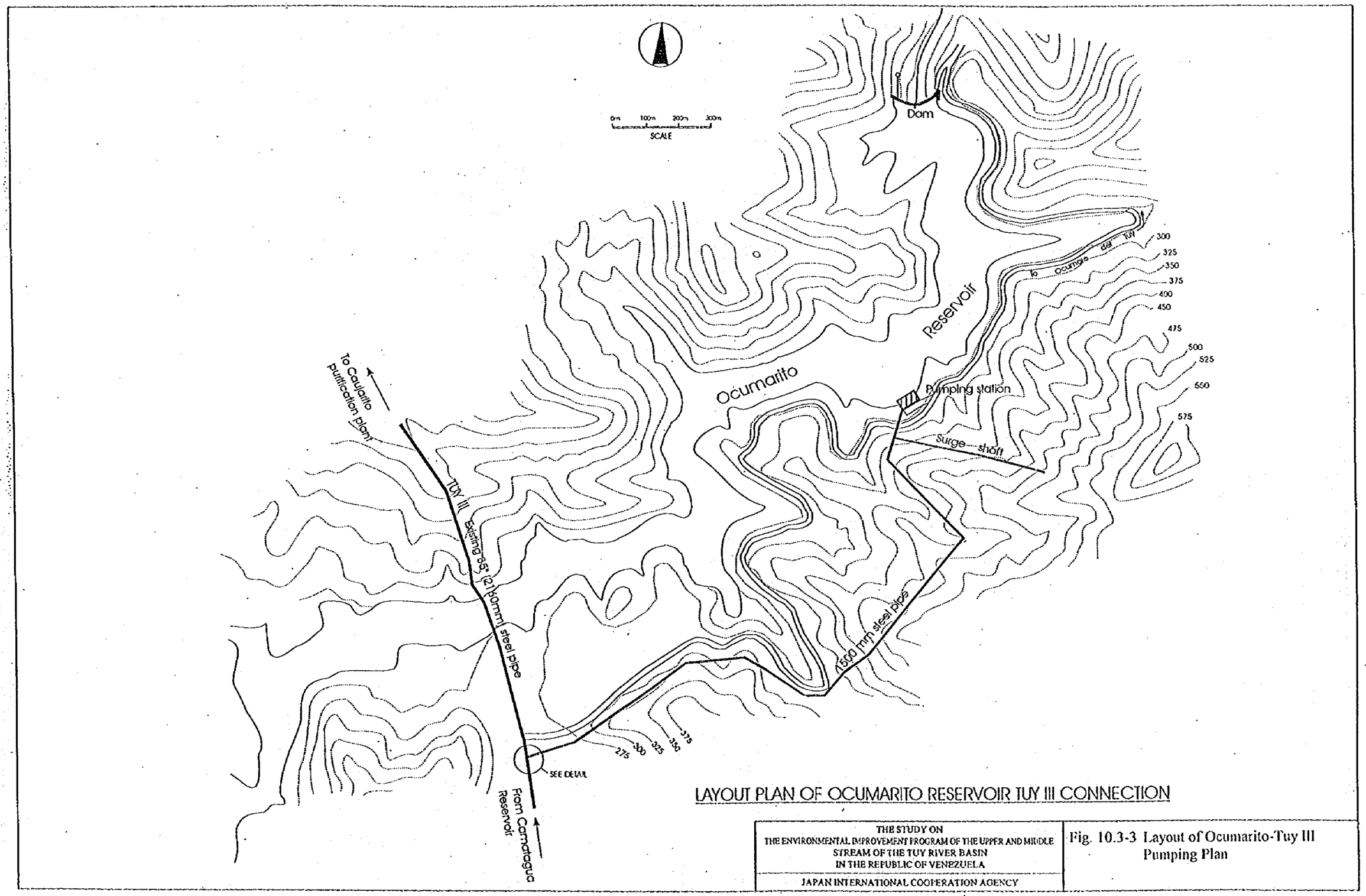
Pumping Plan to Tuy III Pipeline



THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 10.3-1 General Concept for Utilization Plan of the Ocumarito River
JAPAN INTERNATIONAL COOPERATION AGENCY	

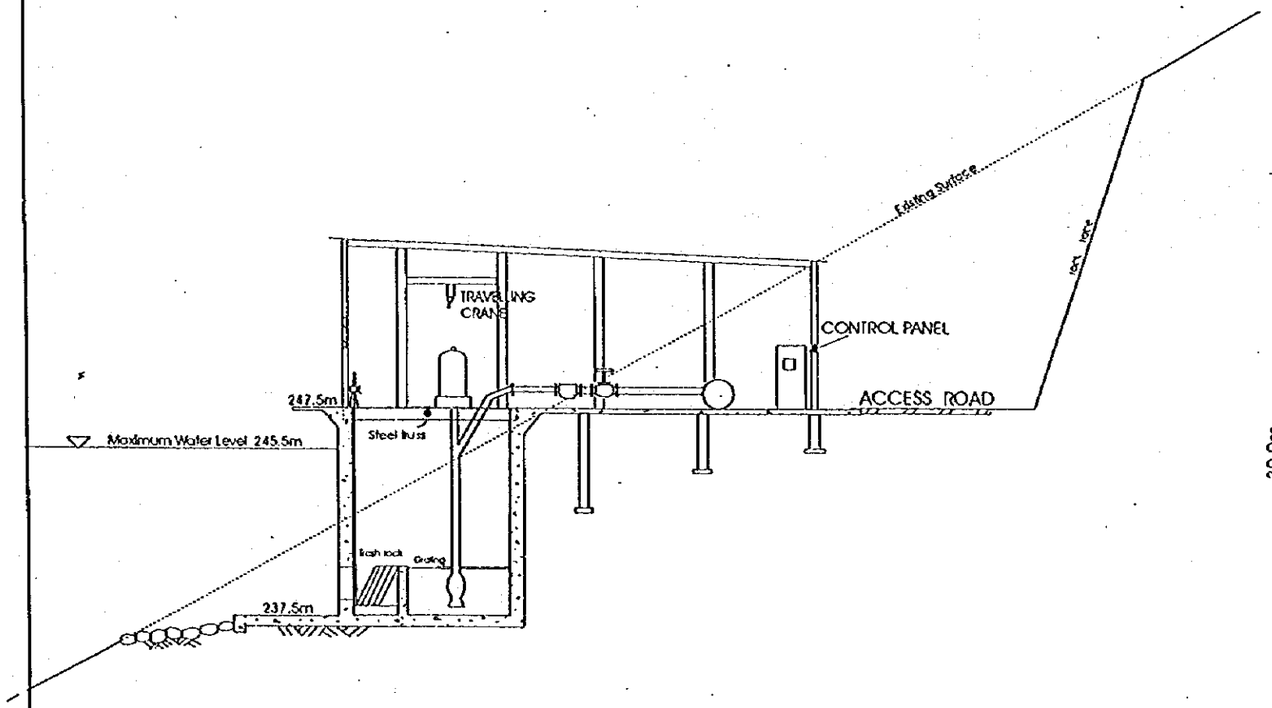


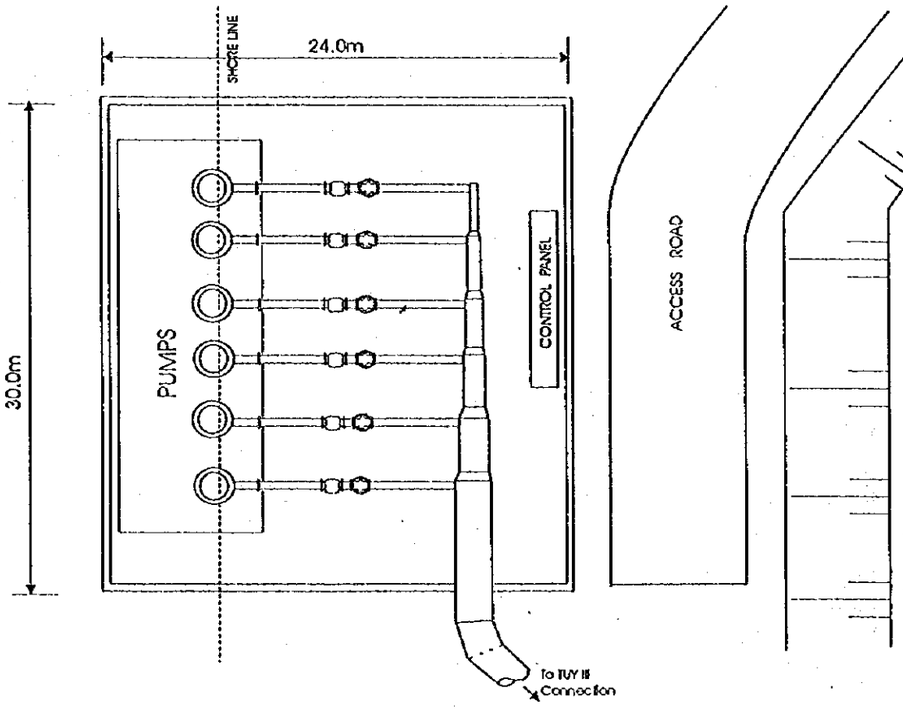
THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 10.3-2 Plan and Piezometric Profile of Tuy III Pipeline



LAYOUT PLAN OF OCUMARITO RESERVOIR TUY III CONNECTION

THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA	Fig. 10.3-3 Layout of Ocumarito-Tuy III Pumping Plan
JAPAN INTERNATIONAL COOPERATION AGENCY	





OCUMARITO RESERVOIR TUY III CONNECTION PUMPING STATION

THE STUDY ON THE ENVIRONMENTAL IMPROVEMENT PROGRAM OF THE UPPER AND MIDDLE STREAM OF THE TUY RIVER BASIN IN THE REPUBLIC OF VENEZUELA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 10.3-4 Structural Drawing of Ocumarito-Tuy III Pumping Station