1.3 Utilidad

Utility

Working Division: ESTACION DE BOMBEO SEVERINO
SEVERINO PUMPING STATION (ELECTRICAL)

Description	Calculation Details		Unit	Quantity	Remarks
Numero Circuitos Circuit Number					
	2×2.0 mm² (16 mm) or 2×14 AWG / φ1/2"				
CN-1	24+7+3	= 34	m		
CN-2	30+10+6+5	= 51	m		
CN-3	11.5+6.5+13+25+10×2	= 76	m		
CN-4	51 +10+10	= 71	m		
CN-10	60+20+23	= 103	m		
CN-21	39+24+12+13+5	= 93	m		
CN-22	41+8+49+14+10	= 122	m		
CN-23 + CN-24	23+60+45+9+14+7+5	= 163	m		
CN-25	51+16+10+8	= 85	m		
CN-26	35+12	= 47			
	3×2.0 mm² (16) or 3×14 AWG / φ1/2"	865	m		
CN-3		19	m		
CN-4		30	m		
CN-10		62	m		
CN-21		17	m		
CN-22	19+3	= 22	m		
CN-23		4	m		
CN-25	46+6	= 52	m		
CN-26		57	m		
CN-13		3	m		
CN-14	4.5+6+4	= 14.5 ≒ 15.0	m		
	5×2.0 mm² (16) or 5×14 AWG / φ1/2"	271	m		
CN-13	5+5+5+5+4	= 24	m		
CN-14	5+5+5+5	= 20	m		
		44	m		

Working Division: ESTACION DE BOMBEO SEVERINO
SEVERINO PUMPING STATION (ELECTRICAL)

Description	Calculation Details	Unit	Quantity	Remarks
	2×5.3mm² (16) or 2×10 AWG/φ1/2"			
CN-5,6,7,8,9 →	60+30+27+9+11+30+41+48+20+5=281	m		
	2×3.5mm² (16) or 2×12 AWG/φ1/2"			
CN-15	54+8 = 62	m		
CN-16	71+27+10 = 108	m		
CN-17	17+68+3 = 88	m		
CN-27	73+5+38+3 = 119	m		
CN-28	41+3+6+69+3 = 122	m		
	499	m		
	2×2.0mm² (16) or 2×14 AWG/φ1/2"			
CN-39	112+83+6+5+5+16+12 = 239	m		
CN-40	34+15+61+12+12+131+93+21 = 367	m		
CN-13	23+12+12+12+22+12+5 = 98	m		
CN-14	6+10.6+11.5+39+10.5+4 = 81.6 ≒ 82	m		
	786	m		
	2×5.3mm² (16) or 2×10 AWG/φ1/2"			
CN-11	155+45+7 = 167	m		
CN-12	50+35 = 85	m		
CN-33	71+10 = 81	m		
CN-34	70+20 = 90	m		
	423	m		
	4×5.3mm² (22) or 4×10 AWG/φ3/4" (CV CABLE)			
CN-18	≤5	m		
TELEFONOS	(TELEPHONE)			
	2×0.8 (16) or 2×20 AWG/φ1/2"			
	45.0+24+31+28+28+85+24+14+10+13 = 302	m		
2×0.8 (22)	30 = 30	m		
2×0.8 (28)×2	47.5×2 = 95	m		

Working Division: ESTACION DE BOMBEO SEVERINO
SEVERINO PUMPING ST. (ELECTRICAL)

Description	Calculation Details	Unit	Quantity	Remarks
2×(2×0.8)(16)	18	m		
4×(2×0.8)(22)	36	m		
6×(2×0.8)(16,22)	6	m		
8×(2×0.8)(22×2)	6	m		
Resumen (Summary)				
Conductor (Wire + Cable)				
2×0.8 mm²	(302 + 18×2 + 36×4 + 6×6 + 6×8 + 10×2) →	m	800	
2.0 mm²	{865 + 786)×2 + 27×3 + 44×5} ×1.05	m	4600	
3.5 mm²	499×2 × 1.05	m	1050	
5.5 mm²	(281×2 + 65×4) ×1.05	m	870	
CV CABLE 5.5×2	423 × 1.05	m	450	
" 4C-2.2mm²	79 ×1.05	m	85	
" 4C-3.5mm²	20 ×1.05	m	24	
" 4C-5.5mm²	65 ×1.05	m	70	
Conduit Pipe				
16 mm pipe	(865+786 + 271 + 44 + 499 + 281) ×1.05	m	2900	
16 mm pipe (telephone)	(302+18+6) ×1.05	m	345	
22 mm pipe (")	(36+6+12) ×1.05	m	60	
28 mm pipe (")	95 ×1.05	m	100	
22 mm pipe (lighting	65 ×1.05	m	70	
	EL. 70°, 65°, 60°, 55°, 50°, 46°, EWR, Diesel			
Tumbler Switch	16 + 6 + 3 + 5 + 6 + 14 + 2 + 1 + 7(spare)	set	60	
Threeway	3 + 4 + 4 + 4 + 3 + 1 + 1 + 5(spare)	set	25	
Convenience Outlet. 12V-20A.	47 + 13 (spare)	set	50	
Safety Switch (3P×230V×50A)		set	3	

Working Division: ESTACION DE BOMBEO SEVERINO PUMPING STATION (ELECTRICAL)

Description	Calculation Details	Unit	Quantity	Remarks
Alumbrado				
Panel de Alumbrado (Lighting Panel)		set	3	
Tipo A-1 (Type A-1) Fl 40w x 2		set	60	
Tipo A-2 (Type A-2) Fl 40w x 1		set	37	
Tipo B-1 (Type B-1) Fl 40w x 2		set	2	
Tipo B-2 (Type B-2) Fl 40w x 1		set	53	
Tipo C (Type C) Fl 40w x 1		set	32	
Tipo D-1 (Type D-1) Fl 40w x 2		set	32	
Tipo D-2 (Type D-2) Fl 40w x 1		set	11	
Tipo E (Type E) Il 60w x 1		set	10	
Tipo F (Type F) Il 60w x 1		set	48	
Tipo G (Type G) ML 400w x 1		set	36	
Tipo H (Type H) ML 400w x 1		set	21	

Working Division: ESTACION DE BOMBEO SEVERINO / SEVERINO PUMPING STATION (ELECTRICAL)

Description	Calculation Details	Unit	Quantity	Remarks
TELEPHONE FACILITIES				
PABX		set	1	
MDF		set	1	
Battery and charger		set	1	
	EL 70.², 65.°, 60.°, 55.°, 50.°, 46.°+74.°			
Telephone	5(floor) + 5(wall) + 2 + 1 + 2 + 2 + 2 +/= 20	set	30	
Malla de Tierra (Grounding Mesh)				
Conductor de Principale (Main Conductor) HDCC 100mm²/4 AWG		m	3200.0	
Conductor Conexiones (Connection Conductor) HDCC 38mm²/2 AWG		m	600.0	
Copper plate 1.0m x 1.0m x 3mm		nos.	12	
Copper rod D19mm x 2.4M		nos.	15	
Clamp for copper plate and rod		nos	30	
Volumenes De Excavacion (Excavation Volume)				
Patio de 138kV SEVERINO (138kV Switchyard)	(Profundidad Zanja) (Ancho de Zanja)			
	L1(58.5x7+29x11) x D0.8 x W0.5	m³	V1 291.4	
Patio de Transformadores Principales (Main Transformer Yard)				
	L2(44x4+16x10) x D0.5 x W0.5	m³	V2 134.4	
Interconexiones de Patio de 138kV y Patio Transformadores con Est. Bombeo				
/connections between 138kV Switchyard, Transformer Yard and Pumping St.				
	L3(175x2+6) x 0.5 x 0.5	m³	V3 142.4	
	VT = V1+V2+V3 = 568.2 ≒ 570			
		m³	570.0	

Item No.	Descripción	Unidad	Cantidad
1	Acondicionador de aire tipo paquete. Capacidad de refrigeración: 45.600 Kcal/h, 9460 CMH. Capacidad de calefacción: 16340 Kcal/h. Calentador eléctrico incorporado 19 kw. Condensadores externos. 220v, 3ø, 60 Hz. 65% prefiltros lavables.	set	1
2	Acondicionador de aire tipo paquete, Capacidad de refrigeración 19700 kcal/h, 3580 CMH. Capacidad de calefacción 6450 kcal/h. Calentador eléctrico incorporado 7.5 kw. Condensador externo 220v, 3ø, 60 hz. 65% prefiltros lavables.	set	1
3	Ventilador centrífugo, 38000 CMH x 50 mm wc x 11 kw 220 v, 3ø, 60 Hz.	No.	2
4	Ventilador extractor de hélice, contra explosión ø 250 x 1020 CMH, 3 mm wc, 220 v, 1ø, 60 hz.	No.	1
5	Ventilador extractor de hélice, ø 250 x 1020 CMH, 3 mm wc 220v, 1ø, 60 Hz.	No.	1
6	Ventilador extractor de hélice, ø 200 x 540 CMH, 3 mm wc.	No.	1
7	Registro de ventilación		
	EL. 65		
	UR - VHS 500 x 200, Q = 500 CMH	No.	6
	UR - VHS 400 x 200, Q = 430 CMH	No.	7
	EL. 60		
	UR - VHS 850 x 300, Q = 1790 CMH	No.	6
	UR - VHS 730 x 300, Q = 1530 CMH	No.	7
	EL. 55		
	UR - VHS 900 x 300, Q = 2200 CMH	No.	6
	UR - VHS 900 x 300, Q = 1890 CMH	No.	7

Item No.	Descripción	Unidad	Cantidad
	EL. 50 UR - VHS 900 x 250, Q = 1450 CMH	No.	6
	UR - VHS 900 x 300, Q = 1840 CMH	No.	5
	EL.45 UR - VHS 300 x 200, Q = 300 CMH	No.	12
8	Rejillas de retorno EL.70-2 RG- 950 x 400 Q = 2020	No.	3
	RG- 900 x 400 Q = 1825	No.	1
	RG- 750 x 300 Q = 1060	No.	2
	RG- 750 x 300 Q = 944	No.	1
	RG- 800 x 300 Q = 1160	No.	1
9	Difusores		
	EL. 70.2 Descarga regulable		
	AD ø 250, Q = 780	No.	8
	AD ø 250, Q = 1020	No.	1
	AD ø 250, Q = 1100	No.	2

Item No.	Descripción	Unidad	Cantidad
	AD ø 250, Q = 630 CMH	No.	2
	AD ø 250, Q = 580 CMH	No.	4
10	Compuerta de regulación de caudal, 850 x 200	No.	1
11	Compuerta de regulación de caudal, 200 x 150	No.	1
12	Compuerta para incendios 1100 x 330	No.	1
	TOMA DE AIRE compuesta por: Persiana exterior, malla contra insectos, registro interior, con filtros		
13	Toma de aire 1800 x 2400 Q = 37950 CMH	No.	2
14	Toma de aire 400 x 200 Q = 300 CMH	No.	1
15	Toma de aire 450 x 200 Q= 650 CMH	No.	1

Item No.	Descripción	Unidad	Cantidad
16	Chapa galvanizada para ductos de ventilación		
	Cal 22	kg.	2979
	Cal 24	kg.	1455
17	Chapa galvanizada para aire acondicionado		
	Cal 22	kg	345
	Cal 24	kg	506
18	Tubería para refrigerante para acondicionadores	m	
	diam 19.05 mm	m	24
	diam 15.88 mm	m	24

Item No.	Description of Works	Unit	Quantity
1	Pachaged air conditioner, refrigeration capacity 45.600 Kcal/h, 9460 CMH, Heating capacity 16340 Kcal/h, Built in Electric heater 19 kw. Outdoor condensing units. 220v, 3ø, 60 Hz. 65% prefilters cleanable.	set	1
2	Packaged air conditioner, refrigeration capacity 19700 kcal/h, 3580 CMH, heating capacity 6450 kcal/h. Built in Electric heater 7.5 kw. Outdoor condensing units. 220v, 3ø, 60 hz. 65% prefilters, cleanable.	set	1
3	Multiblade tan, 38000 CMH x 50 mm wc x 11 kw 220 v, 3ø, 60 Hz.	No.	2
4	Propeller fan exhaust type explosion proof ø 250 x 1020 CMH, 3 mm wc, 220 v, 1ø, 60 hz.	No.	1
5	Propeller fan exhaust type, ø 250 x 1020 CMH, 3 mm wc 220v, 1ø, 60 Hz.	No.	1
6	Propeller fan exhaust type, ø 200 x 540 CMH, 3 mm wc.	No.	1
7	Ventilating Registers		
	EL. 65		
	UR - VHS 500 x 200, Q = 500 CMH	No.	6
	UR - VHS 400 x 200, Q = 430 CMH	No.	7
	EL. 60		
	UR - VHS 850 x 300, Q = 1790 CMH	No.	6
	UR - VHS 730 x 300, Q = 1530 CMH	No.	7
	EL. 55		
	UR - VHS 900 x 300, Q = 2200 CMH	No.	6
	UR - VHS 900 x 300, Q = 1890 CMH	No.	7

Item No.	Description of Works	Unit	Quantity
	EL. 50 UR - VHS 900 x 250, Q = 1450 CMH	No.	6
	UR - VHS 900 x 300, Q = 1840 CMH	No.	5
	EL.45 UR - VHS 300 x 200, Q = 300 CMH	No.	12
8	Return grilles EL.70-2 RG- 950 x 400 Q = 2020	No.	3
	RG- 900 x 400 Q = 1825	No.	1
	RG- 750 x 300 Q = 1060	No.	2
	RG- 750 x 300 Q = 944	No.	1
	RG- 800 x 300 Q = 1160	No.	1
9	Diffusers		
	EL. 70.2 Ajustable air discharge		
	AD ø 250, Q = 780	No.	8
	AD ø 250, Q = 1020	No.	1
	AD ø 250, Q = 1100	No.	2

Item No.	Description of Works	Unit	Quantity
	AD ø 250, Q = 630	No.	2
	AD ø 250, Q = 580	No.	4
10	Volume Damper, 850 x 200	No.	1
11	Volume Damper, 200 x 150	No.	1
12	Fire Damper 1100 x 330 Louvers: Outside, insect screen, inside register, with filters.	No.	1
13	Louvers 1800 x 2400 Q = 37950 CMH	No.	2
14	Louver 400 x 200 Q = 300 CMH	No.	1
15	Louver 450 x 200 Q= 650 CMH	No.	1

Item No.	Description of Works	Unit	Quantity
16	Ventilation zinc plated steel		
	Cal 22	kg.	2979
	Cal 24 & over	kg.	1455
17	Air Conditioning, zinc plated steel		
	Cal 22	kg	345
	Cal 24 & over	kg	506
18	Refrigerant pipe for air Conditioners	m	
	diam 19.05 mm	m	24
	diam 15.88 mm	m	24

Item No.	Description of Works	Unit	Quantity
1	Multiblade fan, 20160 CMH x 35 mm wc x 4 kw, 220 V, 3 phase, 60 hz	No.	1
2	Intaque louvers, 1800 x 1800, Q = 20160 CMH Outside, insect secreen, inside register, with filter	No.	1
3	Ventilating Registers		
	UR - VHS, 400 x 200, Q= 1480	No.	12
	UR - VHS, 200 x 150, Q= 510	No.	4
	UR - VHS, 200 x 150, Q= 180	No.	2
4	Ventilating zinc plated steel		
	gage 22	kg	450
	gage 24	kg	616

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Item No.	Description of Works	Unit	Quantity
1	Multiblade fan,15480 CMH x 27 mm wc x 2.3 kw, 220 V, 3 diámetros, 60 hz	No.	1
2	Intake louver, outside, insect screen, inside register, with filters, 1200 x 1500 mm Q= 15480 CMH	No.	1
3	Ventilating Registers		
	UR - VHS, 400 x 200, Q= 1480 CMH	No.	12
	UR - VHS, 200 x 150, Q= 240 CMH	No.	4
	UR - VHS, 200 x 150, Q= 180 CMH	No.	2
4	Ventilating zinc plated steels		
	gage (22)	kg	394
	gage (24)	kg	604

Severino Pumping Station Suply Air Conditioning Sheet Area Calculation

SECTION	SIZE	TOTAL LENGTH	PERIMETER	GAGE 22	GAGE 24
V - A	1100 x 350	11	2.9	31.9	
A - B	950 x 350	3	2.6	7.8	
B -C	800 x 350	3	2.3	6.9	
C - D	750 x 300	3	2.1	6.3	
D - E	670 x 250	3	1.84		5.52
E -F	500 x 250	4	1.50		6.0
A - 1	250 x 200	2.5	0.9		2.25
A -2	250 x 200	4.5	0.9		4.05
B - 1	250 x 200	2.5	0.9		2.25
B - 2	250 x 200	4.5	0.9		4.05
C - 1	250 x 200	2.5	0.9		2.25
C - 2	250 x 200	4.5	0.9		4.05
D - 1	250 x 200	2.5	0.9		2.25
D - 2	250 x 200	4.5	0.9		4.05
E - 1	250 x 220	2.0	0.94		1.88
F - 1	350 x 250	3.0	1.2		3.6
F - 2	350 x 250	3.0	1.2		3.6
V - 6	500 x 350	13.0	1.7		22.1
G - H	460 x 300	7,0	1.52		10.64
H - I	420 x 200	4,0	1.24		4.96
G - 1	250 x 200	2,0	0.9		1.8
G - 2	250 x 200	2.5	0.9		2.25
H - 1	250 x 200	3.0	0.9		2.7
H - 2	250 x 200	3,0	0.9		2.7
I - 1	250 x 200	3.0	0.9		2.7
I - 2	250 x 200	3.0	0.9		2.7
		SUBTOTAL m²		**53**	**98**
		WEIGHT Kg		**345**	**506**

Total equivalent length include special form areas

V1 Severino Pumping Station Ventilation System 1
Sheet area Calculation

SECTION	SIZES mm x mm	PERIMETER	SPECIAL FORM AREAS	AREAS GAGE 22	AREAS GAGE 24
V - A	1100 x 1000	4.20	30	21.00	
A - B	1.100 x 950	4.10	15	20.60	
B - C	1100 x 720	3.64	7	18.00	
C- D	875 x 450	2.65		13.00	
D - 25	450 x 200	1.30			9.44
25 - 26	425 x 200	1.25			3.75
26 - 27	400 x 200	1.20			6.00
27 - 28	335 x 200	1.07			3.21
28 - 29	275 x 200	0.95			4.75
29 - 30	250x 200	0.90			2.70
D - 19	840 x 450	2.58	3	7.74	
19 - 20	740 x 450	2.38			7.14
20 - 21	720 x 400	2.24			8.96
21 - 22	600 x 400	2.00			8.00
22 - 23	580 x 300	1.76			7.04
23 - 24	325 x 300	1.25			5.00
C - 13	1000 x 500	3.00	3	9.00	
13 - 14	875 x 500	2.75		11.00	
14 - 15	740 x 500	2.48			9.92
15 - 16	740 x 400	2.28			9.12
16 - 17	550 x 400	1.90			7.60
17 - 18	350 x 350	1.40			5.60
B - 7	900 x 400	2.60	2	5.20	
7 - 8	780 x 400	2.36		7.08	
8 - 9	675 x 400	2.15			8.60
9 - 10	550 x 400	1.90			7.60
10 - 11	550 x 300	1.70			6.80
11 - 12	300 x 300	1.20			4.80
A - 1	400 x 250	1.30			2.60
1 - 2	360 x 250	1.22			3.66
2 - 3	340 x 250	1.18			4.72
3 - 4	290 x 250	1.08			4.32
4 - 5	290 x 200	0.98			3.92
5 - 6	250 x 200	0.90			3.60
SUBTOTAL M2			60	112.62	148.85

V2 Severino Pumping Station Ventilation System 2
Sheet area Claculation

SECTION	SIZES mm x mm	PERIMETER	SPECIAL FORM AREAS	AREA GAGE 22	AREA GAGE 24
V - E	1100 x 1000	4.20	31	21.00	
E - F	1.100 x 960	4.12		20.60	
F - G	1200 x 600	3.60	25	36.00	
G - H	1200 x 600	3.00		21.60	
H - I	1200 x 550	3.50		14.00	
I - J	1200 x 530	3.46		10.38	
J - K	850 x 450	2.00	11	20.80	
K - L	420 x 200	1.24			9.92
L - 24	250 x 250	1.00			1.00
24 - 25	250 x 220	0.94			3.76
25 - 26	250 x 200	.090			4.50
26 - 27	250 x 150	0.80			2.40
L - 28	250 x 150	0.80			4.00
28 - 29	250 x 150	0.80			2.40
K - K1	790 x 450	2.48	3	7.44	
K1 - 19	750 400	2.30		9.20	
19 - 20	700 x 360	2.12			8.48
20 - 21	650 x 290	1.88			7.52
21 - 22	425 x 250	1.35			5.40
K1 - 23	425 x 200	1.25			5.00
J - 15	670 x 400	2.14			4.28
15 - 16	600 x 350	1.90			5.70
16 - 17	450 x 350	1.60			6.40
17 - 18	350 x 250	1.20			4.80
F - 8	960 x 400	2.72	8	10.88	
8 - 9	900 x 400	2.60		15.60	
9 - 10	900 x 360	2.52		10.08	
10 - 11	800 x 350	2.30		9.20	
11 - 12	650 x 350	2.00			8.00
12 - 13	550 x 300	1.70			6.80
13 - 14	300 x 300	1.20			4.80
E - 1	350 x 300	1.30			5.20
1 - 2	350 x 300	1.30			7.80
2 - 3	350 x 290	1.28			5.12
3 - 4	350 x 270	1.24			4.96
4 - 5	350 x 240	1.18			4.72
5 - 6	300 x 220	1.04			4.16
6 - 7	250 x 200	0.90			3.60
SUBTOTAL M2			78	206.75	130.72

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Severino Pumping Station Ventilation System

Summary : Weight of Sheets

Ventilation system 1

Gage 22 (60+112.62)	=	172.62 m^2
Gage 24 (	=	148.85 m^2

Ventilation system 2

Gage 22 (78+206.75)	=	284.75
Gage 24	=	130.72

Total Gage 22	=	457.4 m^2
Total Gage 24	=	279.57 m^2

Weights :	Gage 22	=	6.52 Kg/m^2 x 457 m^2
		=	2979 Kg
	Gage 24	=	5.22 Kg/m^2 x 279 m^2
		=	1456 Kg

Estación de bombeo Severino

Calculo de áreas de chapa para ductos. Sistema de aire acondicionado

SECCION	DIMENSIONES	LONGITUD	PERIMETRO	GAGE 22	GAGE 24
V - A	1100 x 350	11	2.9	31.9	
A - B	950 x 350	3	2.6	7.8	
B -C	800 x 350	3	2.3	6.9	
C - D	750 x 300	3	2.1	6.3	
D - E	670 x 250	3	1.84		5.52
E -F	500 x 250	4	1.50		6.0
A - 1	250 x 200	2.5	0.9		2.25
A -2	250 x 200	4.5	0.9		4.05
B - 1	250 x 200	2.5	0.9		2.25
B - 2	250 x 200	4.5	0.9		4.05
C - 1	250 x 200	2.5	0.9		2.25
C - 2	250 x 200	4.5	0.9		4.05
D - 1	250 x 200	2.5	0.9		2.25
D - 2	250 x 200	4.5	0.9		4.05
E - 1	250 x 220	2.0	0.94		1.88
F - 1	350 x 250	3.0	1.2		3.6
F - 2	350 x 250	3.0	1.2		3.6
V - 6	500 x 350	13.0	1.7		22.1
G - H	460 x 300	7,0	1.52		10.64
H - I	420 x 200	4,0	1.24		4.96
G - 1	250 x 200	2,0	0.9		1.8
G - 2	250 x 200	2.5	0.9		2.25
H - 1	250 x 200	3.0	0.9		2.7
H - 2	250 x 200	3,0	0.9		2.7
I - 1	250 x 200	3.0	0.9		2.7
I - 2	250 x 200	3.0	0.9		2.7
		SUBTOTAL m²		**53**	**98**
		PESO Kg		**345**	**506**

La longitud equivalente incluye formas especiales

V1 Estación de bombeo Severino
Calculo de áreas de chapa de ductos, instalación 1

SECCION	DIMENSIONES	PERIMETRO	AREAS DE FORMAS ESPECIALES	AREAS GAGE 22	AREAS GAGE 24
V - A	1100 x 1000	4.20	30	21.00	
A - B	1.100 x 950	4.10	15	20.60	
B - C	1100 x 720	3.64	7	18.00	
C- D	875 x 450	2.65		13.00	
D - 25	450 x 200	1.30			9.44
25 - 26	425 x 200	1.25			3.75
26 - 27	400 x 200	1.20			6.00
27 - 28	335 x 200	1.07			3.21
28 - 29	275 x 200	0.95			4.75
29 - 30	250x 200	0.90			2.70
D - 19	840 x 450	2.58	3	7.74	
19 - 20	740 x 450	2.38			7.14
20 - 21	720 x 400	2.24			8.96
21 - 22	600 x 400	2.00			8.00
22 - 23	580 x 300	1.76			7.04
23 - 24	325 x 300	1.25			5.00
C - 13	1000 x 500	3.00	3	9.00	
13 - 14	875 x 500	2.75		11.00	
14 - 15	740 x 500	2.48			9.92
15 - 16	740 x 400	2.28			9.12
16 - 17	550 x 400	1.90			7.60
17 - 18	350 x 350	1.40			5.60
B - 7	900 x 400	2.60	2	5.20	
7 - 8	780 x 400	2.36		7.08	
8 - 9	675 x 400	2.15			8.60
9 - 10	550 x 400	1.90			7.60
10 - 11	550 x 300	1.70			6.80
11 - 12	300 x 300	1.20			4.80
A - 1	400 x 250	1.30			2.60
1 - 2	360 x 250	1.22			3.66
2 - 3	340 x 250	1.18			4.72
3 - 4	290 x 250	1.08			4.32
4 - 5	290 x 200	0.98			3.92
5 - 6	250 x 200	0.90			3.60
SUBTOTAL M2			60	112.62	148.85

V2 Estación de bombeo Severino
Calculo de áreas de chapa de ductos, instalación 2

SECCION	DIMENSIONES	PERIMETRO	AREAS DE FORMAS ESPECIALES	AREA GAGE 22	AREA GAGE 24
V - E	1100 x 1000	4.20	31	21.00	
E - F	1.100 x 960	4.12		20.60	
F - G	1200 x 600	3.60	25	36.00	
G - H	1200 x 600	3.00		21.60	
H - I	1200 x 550	3.50		14.00	
I - J	1200 x 530	3.46		10.38	
J - K	850 x 450	2.00	11	20.80	
K - L	420 x 200	1.24			9.92
L - 24	250 x 250	1.00			1.00
24 - 25	250 x 220	0.94			3.76
25 - 26	250 x 200	.090			4.50
26 - 27	250 x 150	0.80			2.40
L - 28	250 x 150	0.80			4.00
28 - 29	250 x 150	0.80			2.40
K - K1	790 x 450	2.48	3	7.44	
K1 - 19	750 400	2.30		9.20	
19 - 20	700 x 360	2.12			8.48
20 - 21	650 x 290	1.88			7.52
21 - 22	425 x 250	1.35			5.40
K1 - 23	425 x 200	1.25			5.00
J - 15	670 x 400	2.14			4.28
15 - 16	600 x 350	1.90			5.70
16 - 17	450 x 350	1.60			6.40
17 - 18	350 x 250	1.20			4.80
F - 8	960 x 400	2.72	8	10.88	
8 - 9	900 x 400	2.60		15.60	
9 - 10	900 x 360	2.52		10.08	
10 - 11	800 x 350	2.30		9.20	
11 - 12	650 x 350	2.00			8.00
12 - 13	550 x 300	1.70			6.80
13 - 14	300 x 300	1.20			4.80
E - 1	350 x 300	1.30			5.20
1 - 2	350 x 300	1.30			7.80
2 - 3	350 x 290	1.28			5.12
3 - 4	350 x 270	1.24			4.96
4 - 5	350 x 240	1.18			4.72
5 - 6	300 x 220	1.04			4.16
6 - 7	250 x 200	0.90			3.60
SUBTOTAL M2			78	206.75	130.72

Sistema de Vantilación de Severino

Resumen de Peso de Chapa para ductos

Sistema de ventilación 1

Gage 22 (60+112.62)	=	172.62 m^2
Gage 24	=	148.85 m^2

Sistema de ventilación 2

Gage 22 (78+206.75)	=	284.75
Gage 24	=	130.72

Total Gage 22	=	457.4 m^2
Total Gage 24	=	279.57 m^2

Pesos :	Gage 22	=	6.52 Kg/m^2 x 457 m^2
		=	2979 Kg
	Gage 24	=	5.22 Kg/m^2 x 279 m^2
		=	1456 Kg

INSTALACIONES SANITARIAS

REPORTE DE CANTIDADES

SANITARY INSTALATIONS

QUANTITES REPORT.

1-3-24

AGUA POTABLE

DOMESTIC WATER.

JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Date: Fecha: Calculated by: Calculado por: Sheet Hoja of de

INSTALACIONES SANITARIAS / AGUA POTABLE
SANITARY INSTALATIONS / DOMESTIC WATER

CANTIDADES DE OBRA
QUANTITIES

			TOTAL TOTAL	PREC PRIC
CODOS 90	20	☒☒☒☒☐	23	22.0
BEND 90°	25			33.4
	32	☐	2	53.7
TEE	20	☒	5	29.10
TEE PIPE	25	☒	5	44.0
	32	☐	2	84.45
REDUCER	32-25	1	1	14.60
REDUCER	32-20	1	1	14.60
	25-20	☐	3	5.96
	20-13	1	1	3.8
UNIVERSAL JOINT	32	☒☒☐	14	21.24
	25	☐	4	14.2
	20	☒☒☒☒☒☒☒☒☒☒☒☐	58	9.25
JUNTA EXP. EXPANSION JOINT	32	1	1 ✓	161.1
GRIFOS FAUCETS	(12 mm)	☐	4 ✓	
NEPLO SOLD.	32			
NIPLE	25			
	20	☒☒	10	8.66
VALVULA CHIP GATE VALVE	32	1	1.0 ✓	
	25			
	20	☒☒1	11.0 ✓	
MANGUERA PIPE	32		24.45	62.3
	25		5.0	42.1
	20		82.45	83.3

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INSTALACIONES SANITARIAS / AGUA POTABLE
SANITARY INSTALATIONS. / DOMESTIC WATER
CANTIDADES DE OBRA
QUANTITIES.

— TUBERIA / PIPE.

ϕ 20 mm → 0.95, 5.7, 6.10, 0.4, 0.15, 0.10, 0.4, 20, 11.5, 2.8, 1.9, 2.4, 0.4, 1.10, 0.55, 1.95, 21.5, 0.6, 0.6, 0.85, 0.95, 0.7, 0.3, 0.95, → 82.45

ϕ 25 mm → 0.8, 1.80, 1.20, 1.2 → 5.0

ϕ 32 mm → 0.80, 1.5, 2.1, 0.40, 19.65 → 24.45

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

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INSTALACIONES SANITARIAS / AGUA POTABLE
SANITARY INSTALLATIONS / DOMESTIC WATER
CONVERSIÓN DE ACCESORIOS A LONGITUD EQUIVALENTE DE TUBERÍA
CONVERSION OF ACCESSORIES TO EQUIVALENT LENGTH PIPE

CODOS 90° — 20 — 22 × 22.19/33.7 → 15.0
BEND 90° — 25 —
32 — 2 × 53.74/62.3 → 1.73

TEE — 20 — 5 × 23.19/33.7 → 4.33
TEE PIPE — 25 — 5 × 42.91/42.12 → 5.02
32 — 2 × 84.45/62.30 → 2.71

REDUCIDORES — 32×25 — 1 × 14.66/62.3 → 0.24
REDUCER — 32×20 — 1 × 14.66/62.3 → 0.24
25×20 — 1 × 5.70/42.12 → 0.42
20×13 — 1 × 3.62/33.7 → 0.11

UNIVERSALES — 20 — 55 × 0.25/33.7 → 15.72
UNIVERSAL JOINT — 25 — 4 × 14.22/42.12 → 1.35
32 — 14 × 21.24/62.3 → 4.77

NIPLES — 20 — 1 × 8.66/33.7 → 2.57
NIPLES.

EQUIVALENT PIPE
TUBERÍA EQUIVALENTE

Pipe — 20 — 35.26 ≅ 35.0 + 82.45 = 117.45 ≅ 118
25 — 7.49 ≅ 7.0 + 5.0 = 12.0 ≅ 12.0
32 — 9.69 ≅ 10.0m + 24.95 = 34.95 ≅ 35.0

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

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SANITARY INSTALATIONS / EQUIPMENT
CANTIDADES DE OBRA.
QUANTITIES

CONEXION - BOMBAS TANQUE HIDRONEUMATICO
CONECTION - PUMPS / PRESSURE VESSEL

- TUBERIA ϕ 32 mm 0.8, 0.8, 1.6, 1.0, 0.6, 0.4, 0.4, 0.8, 0.30, 0.20, 0.20, 1.5, 0.50
  PIPE 9.2 m //

L Eq.

- UNIVERSALES ϕ 32 mm — 19.0 + 12 = 31.0 → 10.57
  UNIVERSAL JOINT
- CODOS 90° ϕ 32 mm — 3.0 — 2.59
  BEND 90°
- TEE ϕ 32 mm — 6.0 — 1.36
  TEE PIPE
- VALVE GATE ϕ 32 mm — 6.0 — ✓
- VALVES CHECK ϕ 32 mm — 6.0 — ✓
  CHECK VALVE
- VALV GATE ϕ 20 mm — 6.0 — ✓
  GATE VALVE
- UNIV ϕ 20 mm — 3.0 — 0.82
  UNIVERSAL JOINT
- GRIFO ϕ 1/2 — 1.0 — ✓
  FAUCET
- MANOMETROS — 2.0 — ✓
  PRESSURE GAUGE

14.52
+ 9.20

23.72 ≃ 24.00 m { TOTAL LENGTH / LONGITUD TOTAL ϕ 32 mm

0.8 m { ϕ 20 mm

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1-3-29

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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INSTALACIONES SANITARIAS / AGUA POTABLE
SANITARY INSTALATIONS / DOMESTIC WATER
- CANTIDADES DE OBRA DE LA RED. / RESUMEN
QUANTITIES OF THE NET / **SUMMARY**

ACCESORIO ACCESSORY	DIA DIAMETER (mm)	UNID UNIT	CANT QUANTITY
CODOS 90°	20	U	23
BEND 90°	25	"	
	32	"	5
TEE	20	U	5
TEE PIPE	25	"	5
	32	"	8
REDUCTORES	32 - 25	U	1
REDUCER	32 - 20	"	1
	25 - 20	"	3
	20 - 13	"	1
UNIVERSALES	20	U	61
UNIVERSAL JOINT	25	"	4
	32	"	45
JUNTA EXPANSION EXPANSION JOINT	32	U	1
GRIFOS FAUCETS	13	U	5
NEPLO NIPLE	20	U	10
	25	"	
	32	"	
VALVULA DE COMPUERTA GATE VALVE	20	U	13
	25	"	
	32	"	7
VALVULA CHECK CHECK VALVE	32	"	6
TUBERIA PIPE	20	m	99.3
	25	m	5.0
	32	m	33.65
PRESSURE GAUGE MANOMETRO		U	1.0

ACCESORIO ACCESSORY	DIA DIAMETER (mm)	UNID UNIT	CANTIDAD QUANTITY
(*) TUBERIA TOTAL	20	m	145
	25	m	12
TOTAL PIPE	32	m	59

(*) NOTA: LA TUBERIA TOTAL INCLUYE LA LONGITUD DE LA TUBERIA Y LA LONGITUD DE TUBERIA EQUIVALENTE POR ACCESORIOS.

NOTE: THE TOTAL PIPE INCLUDE THE PIPE LENGTH AND THE EQUIVALENT LENGTH PIPE FOR ACCESSORIES.

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RED DE INCENDIOS

FIRE FIGHTING NET

1-3-81

JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

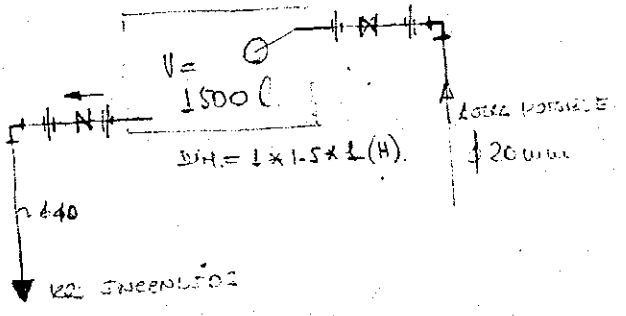
JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Date:
Fecha:
Calculated by:
Calculado por:
Sheet of
Hoja de

INSTALACIONES SANITARIAS. / INCENDIOS Y AGUA POTABLE
SANITARY INSTALATIONS / FIRE AND DOMESTIC WATER



TANQUE SUPERIOR: (T.S)

FIRE QUANTITIES.

INCENDIOS:

Coc° 40 mm	1		0.33
Universales 40 mm	5		4.33
Vcalc 40	1		
TUB 40 mm			1.90
			6.56

DOMESTIC WATER QUANTITIES.

AGUA POTABLE			LEQ.
TEE	32	1	1.36
RCL	32 x 20	1	0.24
UNIV	20	10	[illegible]
VAL	20	1	
173.18 VAL TEE	20	1, 173.18	5.13
TUB = 3.5, 5.65, 2.3, 4.95, 0.4 =			16.8
			26.30

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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Hoja de

60 - 2½"
50 - 2"
40 - 1½"

INSTALACIONES SANITARIAS / INCENDIOS.
SANITARY INSTALATIONS / FIRE
CANTIDADES. DE OBRA.
QUANTITIES

DESCRIPTION / DESCRIPCION.		NIVEL / ELEVATION 70	65	60	55	50	45	ANECCION TANQUE BOMBA RED	TOTAL / TOTAL
CODOS. 90° / BEND 90°	65								8.0
	50								4.0
	40								31.0
TEE / TEE PIPE	65								9.0
	50								2.0
	40								2.0
UNIVERSAL / UNIVERSAL JOINT	65								41.0
	50								10.0
	40								41.0
REDUCTORES / REDUCER	65-50								5.0
	50-40								8.0
	65-40								3.0
JUNTA EXP / EXPANSION JOINT	65								2.0
	50								1.0
	40								2.0
VAL. COMPUERTA / VAL CHECK	65								2.0
	65								1.0
TUBERIA / PIPE	65								48.61
	50								28.5
	40								193.3
EXTINGUIDORES / EXTINGUISHER									20
CARTINCA (BOX) / HYDRANT BOX									13
MANOMETRO / GAUGE									1.0
SOPORTES TUB. / SUPPORTS.	65								193.
	50								29
	40								49

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1-3-33

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Date: Fecha:
Calculated by: Calculado por:
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INSTALACIONES SANITARIAS. (INCENDIOS)
SANITARY INSTALLATIONS. (FIRE)

CANTIDADES DE OBRA
QUANTITIES. of WORK

— TUBERIA / PIPE

ϕ 40 mm : 0.10, 2.6, 0.4, 19.30, 1.10, 2.4, 0.10, 0.4, 1.9, 0.2, 10.4, 3.10 / 0.1, 2.4, 15.9, 0.10, 2.40, / 0.1, 2.40, 0.3, 21.8, 2.4, 0.2, / 0.10, 2.4, 0.3, 21.8, 0.10, 2.40, / 0.1, 2.4, 8.2, 0.8, 0.1, 2.4, 14.5, / 0.1, 2.4, 16.4, 7.2, 0.1, 2.4, 16.10, / = (193.3)

ϕ 50 mm 2.8, 1.10 / 1.6, 4.4, 1.1, 0.4 / 1.6, 1.6, 4.40, 0.4 / 4.40 / 4.20 / (27.5)

ϕ 65 mm 1.11 / 4.4, 1.6, 1.40, 5.0 / 5.0 / 5.0 / 5.0, 5.4, 2.4 /.

INJECTION / TANK – PUMP – NET
INYECCION / TANQUE – BOMBA – RED EN ϕ 65 mm 0.5, 0.2, 1.2, 1.0, 2.5, 0.4 3.5

(49.31)

SUPPORTS OF PIPE
— SOPORTES DE TUBERIA SE CONSIDERA: 1 SOPORTE POR CADA METRO.

SOPORTES — ϕ 40 mm — 193.
Nº SUPPORTS 50 mm — 29.
65 mm — 49

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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INSTALACIONES SANITARIAS / EQUIPOS - TRATAMIENTO DE AGUAS.
SANITARY INSTALATIONS / EQUIPMENT -
- CANTIDADES DE OBRA.
QUANTITIES OF WORKS

CONECTION / CONECCION	HYDRANT PUMP / BOMBA DE INCENDIOS	—	TANK - NET / TANQUE - RED.
	Nº		COND EQUIV
PIPE / TUBERIA	ϕ 65 mm	6.0	6.0
UNIVERSAL JOINT / UNIVERSALES	ϕ 65 mm	15	
BEND 90° / CODO 90°	ϕ 65 mm	3.0	
TEE PIPE / TEE	ϕ 65 mm	3.0	
GATE VALUE / VALVULA COMPUERTA	ϕ 65 mm	3.0 ✓	
CHECK VALUE / VALVULA CHECK	ϕ 65 mm	2.0 ✓	
MANOMETRO - PRESSURE GAUGE		1.0	

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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Hoja de

INSTALACIONES SANITARIAS (INCENDIOS) / SANITARY INSTALATIONS (FIRE)
CANTIDADES DE OBRA / QUANTITIES
CALCULATION OF EQUIVALENT PIPE
- CALCULO DE TUBERIA EQUIVALENTE

		#				m
COLOS. BENDS	65	8	x	5.5/78.3		5.3
	50	4		26.82/72.58		1.5
	40	31		18.65/56.6		10.2
TEE TEE PIPES	65	9	x	74.07/78.3		8.5
	50	2.0	x	29/72.58		0.4
	40	2.0	x	28.14/56.6		1.0
UNIVERSAL JOINT	65	41	x	112.64/78.3		59.5
	50	10	x	60.04/72.58		8.2
	40	41	x	50.13/56.6		26.3
REDUCER	65	8.0	x	58.27/78.3		3.7
	50	8.0	x	28.75/72.58		3.2
	40	3.0	x	22.02/56.6		4.6
SUPORTS.	65	193	x	1.92/78.3		4.7
	50	29	x	1.11/72.58		0.44
	40	49	x	1.0/56.6		0.90

TUBERIA EQUIVALENTE - EQUIVALENT PIPE

65 mm	81.7	48.3		130.31
50 mm	14.34	28.50		42.84
40 mm	53.00	193.3		246.30

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Date: Fecha:
Calculated by: Calculado por:
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INSTALACIONES SANITARIAS / INCENDIOS / RESUMEN
SANITARY INSTALATIONS / FIRE / **SUMMARY**

- CANTIDADES DE OBRA.
QUANTITIES

ACCESSORY ACCESORIO	DIAMETER DIA mm	UNIT UNIDAD	QUANTITY CANTIDAD
CODOS 90° BEND 90°	65	u	8.0
	50	"	4.0
	40	"	31.0
TEE TEE PIPE	65	u	9.0
	50	"	2.0
	40	"	2.0
UNIVERSAL UNIVERSAL JOINT	65	u	41.0
	50	"	10.0
	40	"	41.0
REDUCTORES REDUCER	65-50	u	5.0
	50-40	"	8.0
	65-40	"	3.0
JUNTA DE EXPANSION EXPASION JOINT	65	u	2.0
	50	"	1.0
	40	"	2.0
VALVULAS			
DE COMPUERTA GATE VALVE	65	u	3.0
	40	u	1.0
VALVULA CHECK CHECK VALVE	65	u	2.0
	40	u	1.0
EXTINGUIDORES EXTINGUISHER		u	20
CAJETINES (BOX) HYDRANT BOX		u	13.0
MANOMETRO PRESSURE GAUGE		u	1.0
SOPORTES SUPPORT	65	u	193
	50	"	29
	40	"	49

ACCESSORY ACCESORIO	DIAMETER DIA	UNIT UNIDAD	QUANTITY CANTIDAD
TUBERIA PIPE	65	m	48.61
	50	m	28.51
	40	m	193.8
(*) TUBERIA TOTAL TOTAL PIPE	65	m	130.31
	50	m	42.84
	40	m	253.0

(*) NOTA : LA TUBERIA TOTAL INCLUYE LA LONGITUD DE LA TUBERIA Y LA EQUIVALENTE POR ACCESORIOS ; NO INCLUYE VALVULAS, EXTINGUIDORES, MANOMETROS

NOTE : THE TOTAL PIPE INCLUDE THE PIPE LENGTH AND THE EQUIVALENT LENGTH FOR ACCESSORIES ; NOT INCLUDE VALVES, EXTINGUISHER AND PRESSURE GAUGE

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RED DE DESAGUE Y VENTILACION

DRAINAGE AND VENTILATION

NET

JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

LA ESPERANZA-POZA HONDA TRANSBASIN (TRASVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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INSTALACIONES SANITARIAS. / DESAGUE
CANTIDADES DE OBRA. INTERIORES. INCLUYE HASTA LA CAJA DE REVISION
QUANTITIES INTERIOR, INCLUDING UNTIL CATCH BARIN

ACCESORIO. ACCESSORY	ϕ mm	AMBIENTE / ENVIRONMENT: SHOWER ROOM	KITCHEN	RESTROOM SK	RESTROOM LAVADOS	BATTERY ROOM	TOTAL	UNIT PRICE
- REJILLA. FLOOR TRAP.	50		1	1	1	1	6	4238
	75			1		1	2	4238
- SIFON	50		1	1	1	1	6	2492
SIPHON U	75			1			1	5610
- ADAPTADOR PARA SIFON / ADAPTER FOR SIPHON of 50 a 1½"			1				5	1683
- CODO 45° BEND.	50.							
	75				1		1	1551
	110							
- CODO 90° BEND	50.			1			15	990
	75					1	10	1551
	110						2	2673
REDUCER - REDUCTOR. DE 75 a 50		1	1		1		4	1683
110 a 50								
110 a 75								
JOINT - UNION	50						11	561
	75			1			13	682
	110				1		6	1122
YEE - YEE	50	1	1		1		5	1364
	75							
	110				1		1	4598
REDUCER YEE - YEE REDUCTORA DE ϕ 75 a 50				1	1		2	3047
110 a 50					1		1	1830
110 a 75					1		2	7610
- CODO 90° CON RAMAL DE VENTILACION (Y) BEND 90° WITH VENT BRANCH.								
- TUBERIA. DESAGUE DRAINAGE PIPE	ϕ 50 mm	2.40	3.60	1.80	3.2	3.5	14.5	8250
	ϕ 75 mm	3.14	2.70	5.14	2.45	4.48	6.70	24.61	18370
	ϕ 110 mm				7.09			7.09	20350
- SIFON 1½" SIPHON					1			2	28426

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1-3-39

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INSTALACIONES SANITARIAS / DESAGUE

CANTIDADES DE OBRA

QUANTITIES

LONGITUD DE TUBERIAS.

PIPE LENGTH.

- SHOWER ROOM.

$\phi 50$ —— 1.70 + 0.70 = 2.40

$\phi 75$ —— 1.30, 0.196, 1.65 = 3.144

$\phi 110$ ——

- KITCHEN

$\phi 50$ —— 0.5, 1.4, 1.70 = 3.60

$\phi 75$ —— 0.85, 0.20, 1.65 = 2.70

- RESTROOM.

SK —— $\phi 50$ —— 1.80, = 1.80

75 —— 2.80, 0.50, 0.192, 1.65 = 5.14

URINARIOS

$\phi 50$ — 0.35, 0.5, 0.55, 0.75, 0.5, 0.55 = 3.2

$\phi 75$ — 0.5, 1.95, = 2.45

$\phi 110$ — 1.2, 1.65, 1.75, 0.20, 0.188, 210 = 7.09

LAVATORY SINK

LAVABOL. $\phi 50$ → 0.50, 0.80, 0.5, 1.15, 0.55 = 3.5

$\phi 75$ → 0.75, 1.9, 0.18, 1.65 = 4.48

- BATHROOM

$\phi 75$ mm — L = 6.20 + 0.50 = 6.70 m

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INSTALACIONES SANITARIAS / DESAGUE
SANITARY INSTALLATIONS / DRAINAGE
CANTIDADES DE OBRA / QUANTITIES
CONVERSION DE ACCESORIOS A LONGITUDES DE TUBERIA
CONVERSION OF ACCESSORIES TO EQUIVALENT LENGTH PIPE

COSTO DE LA TUBERIA POR METRO. ϕ50 mm — 2750 //
COST OF THE PIPE PER METER ϕ75 mm — 6123.3 //
ϕ110 mm — 6783.30 //

CALCULO DE LA TUBERIA EQUIVALENTE
CALCULATION OF EQUIVALENT PIPE

ACCESSORY			Nº	EQUIVALENT LENGTH LONGITUD EQUIVALENTE (m).
ACCESORIO				
- REJILLA FLOOR TRAP	ϕ50		6 * 7338/2750	16.0 ✓
	ϕ75		7 * 7338/6123.3	2.4 ✓
- SIFON SIPHON	ϕ50		6 * 2426/2750	5.4 ✓
	75		1 * 5610/6123.3	0.9 ✓
- ADAPTADOR ADAPTER	ϕ50		5 * 1683/2750	3.1 ✓
	75		1 * 1551/6123.3	0.3 ✓
- CODO 45° BEND 45°	50		15 * 990/2750	5.4 ✓
- CODO 90° BEND 90°	50		10 * 1551/6123.3	2.5 ✓
	75		2 * 2613/6783.3	0.79 ✓
	110			
- REDUCTOR 75-50 REDUCER	50		4 * 1683/2750	2.4 ✓
- UNION JOINT	50		11 * 561/2750	2.24 ✓
	75		13 * 682/6123.3	1.40 ✓
	110		6 * 1122/6783.30	0.99
- YEE YEE PIPE	50		5 * 1369/2750	2.50 ✓
	110		1 * 4578/6783.3	0.70
- YEE REDUCTORA 75/50 REDUCER YEE	50		2 * 3047/2750	2.2 ✓

ϕ50 → 59.94 + 14.5 = 74.44 //
ϕ75 → 7.50 + 24.61 = 32.11 //
ϕ110 → 2.48 + 7.09 = 9.57 //

- SIFON ϕ 1 1/2 — 50 — $2 * \frac{28429}{2750} = 20.9$
SIPHON

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INSTALACIONES SANITARIAS / DESAGUE
SANITARY INSTALATIONS / DRAINAGE
— REJILLAS DE PISO Y TRAMPAS DE LIMPIEZA.
FLOOR TRAP. 2ND. FLOOR CLEANOUT
SE COLOCARAN 5 REJILLAS DE PISO
SHALL ARRANGE 5 FLOOR TRAP.
3 → RESTROOM
1 → KITCHEN
1 → SHOWER ROOM

+ TRAMPAS DE LIMPIEZA. / FLOOR CLEANOUT

ϕ 110 mm → SE COLOCARAN A LA SALIDA DE LOS INODOROS. (3) → RESTROOM
SHALL ARRANGE IN THE WATER CLOSET OUTLET.
ϕ 75 mm → SE COLOCARAN. (2) RESTROOM
SHALL ARRANGE
ϕ 50 mm → SE COLOCARA (2) RESTROOM. +(1) KITCHEN → (3)
SHALL ARRANGE

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SANITARY INSTALATIONS / DRAINAGE
CANTIDADES DE OBRA / EXTERIOR
QUANTITIES / EXTERIOR

LONGITUD DE TUBERIA PVC
PVC PIPE LENGTH

FROM	TO		ϕ 75 mm	ϕ 110 mm
DE	C-5	a C-4	5.7	
	C-1	a C-2	2.70	
	C-2	a C-3		9.0
	C-3	a C-4		01.70
	C-4	a C-6		6.70
	C-6	a C-7		3.40
	C-7	a TANKE SEPTICO / SEPTIC TANK		1.10
	CH-1	a SEPTIC TANK / TANKE SEPTICO		0.60
			8.4	30.50 m

CONNECTION OF SEPTIC TANK TO UNLOADING
ENLACE DE TANQUE SEPTICO A DESCARGA. ϕ 110 mm

DE	TAN SEPT	— C8	1.0
FROM	C-8	to a C-9	3.5
	C-9	a C-10	8.0
	C-10	a C-11	9.0
	C-11	a C-12	9.0
	C-12	a C-13	10.0
	C-13	a C-14	10.0
	C-14	a DESCARGA	10.0
			61.50 m

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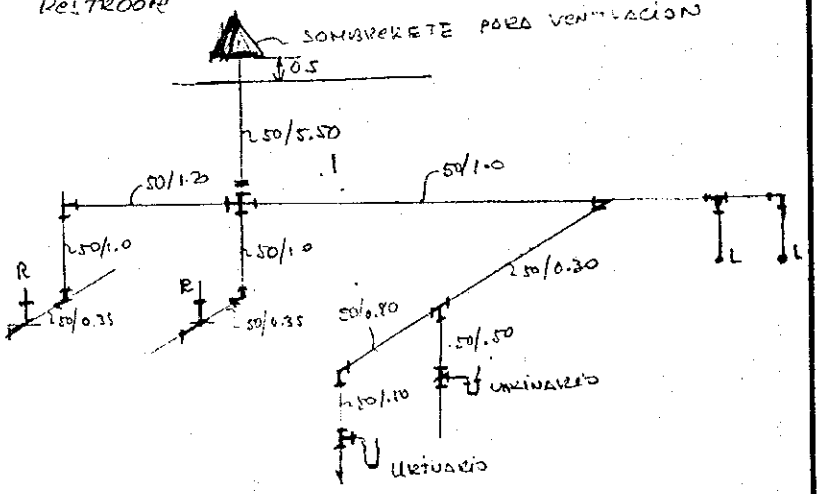
SANITARY INSTALATIONS / VENTILATION
CALCULO DE TUBERIAS / ISOMETRIAS Y CANTIDADES DE OBRA.

- TODAS LAS TUBERIAS DE VENTILACION SERAN ϕ 50 mm PVC Y SE UBICARON EN EL RELLENO



QUANTITIES.

CANTIDADES DE OBRA. ACCESSORY	DIAMETER		QUANTITIES
CODO 90°	0.50 mm	⊡	5.0 (36.0)
BEND	0.50 mm	⊡	4.0 (34.0)
TEE PIPE	0.50 mm		0.75, 1.0, 1.2, 0.35, 1.0, 0.5, 0.5, 0.4, 0.3, 1.0, 5.5 = 12.5 (72.58)
PIPE. SOMBRERETE	0.80 mm		1.0

CONVERSION DE ACCESORIOS A TUBERIA EQUIVALENTE.

CODO	36.0/72.58 × 5.0	1.85
TEE	34.0/72.58 × 4.0	1.87
SOMBRERETE	60.0/72.58 × 1.0	0.56
		4.28

TOTAL TUBERIA = 12.5 + 4.28 = 16.78 m ≅ 17.0 m
TOTAL VEPE

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SANITARY INSTALATIONS. / DRAINAGE AND VENTILATION / **SUMMARY**

CANTIDADES DE OBRA.
QUANTITIES.

ACCESORIO. ACCESSORY	DIA DIAMETER (mm)	UNID. UNIT	CANTIDAD. QUANTITIES
REJILLA FLOOR TRAP	50	u	6
	75	u	2
SIFON SIPHON	50	u	6
	75	u	1
ADAPTADOR ADAPTER	50 - 1 1/2"	u	5
CODO 45° BEND 45°	75	u	1
CODO 90° BEND 90°	50	u	21
	75	u	10
	110	u	2
REDUCTOR REDUCER	75 - 50	u	4
UNION JOINT	50	u	11
	75	u	13
	110	u	6
YEE YEE/PIPE	50	u	5
	110	u	1
YEE REDUCTORA REDUCER YEE	75 - 50	u	2
	110 - 75	u	1
SIFON SIPHON	1 1/2"	u	2
CODO 90° CON RAMAL VENTILACION BEND 90° WITH VENT BRANCH	110	u	2.
TEE TEE PIPE	50	u	5

ACCESORIO ACCESSORY	DIA DIAMETER (mm)	UNID UNIT	CANTIDAD. QUANTITIES
TUBERIA PIPE	50	m	27.0
	75	m	24.6
	110	m	7.1
(*) TUBERIA TOTAL TOTAL PIPE	50	m	91.0
	75	m	32.0
	110	m	102.0.
TRAMPAS DE LIMPIEZA FLOOR CLEANOUT	50	m	5.0
	75	m	3.0
	110	m.	3.0
SOMBRERETE CAP.	80	u	1.0

(*) NOTA: LA TUBERIA TOTAL INCLUYE LA LONGITUD DE LA TUBERIA Y LA EQUIVALENTE POR ACCESORIOS, NO INCLUYE REJILLAS, TRAMPAS DE LIMPIEZA

NOTE: THE TOTAL PIPE INCLUDE THE PIPE LENGTH AND THE EQUIVALENT LENGTH FOR ACCESSORIES, NOT INCLUDE FLOOR TRAP AND FLOOR CLEANOUT.

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1-3-45

2. Tuberia de Carga

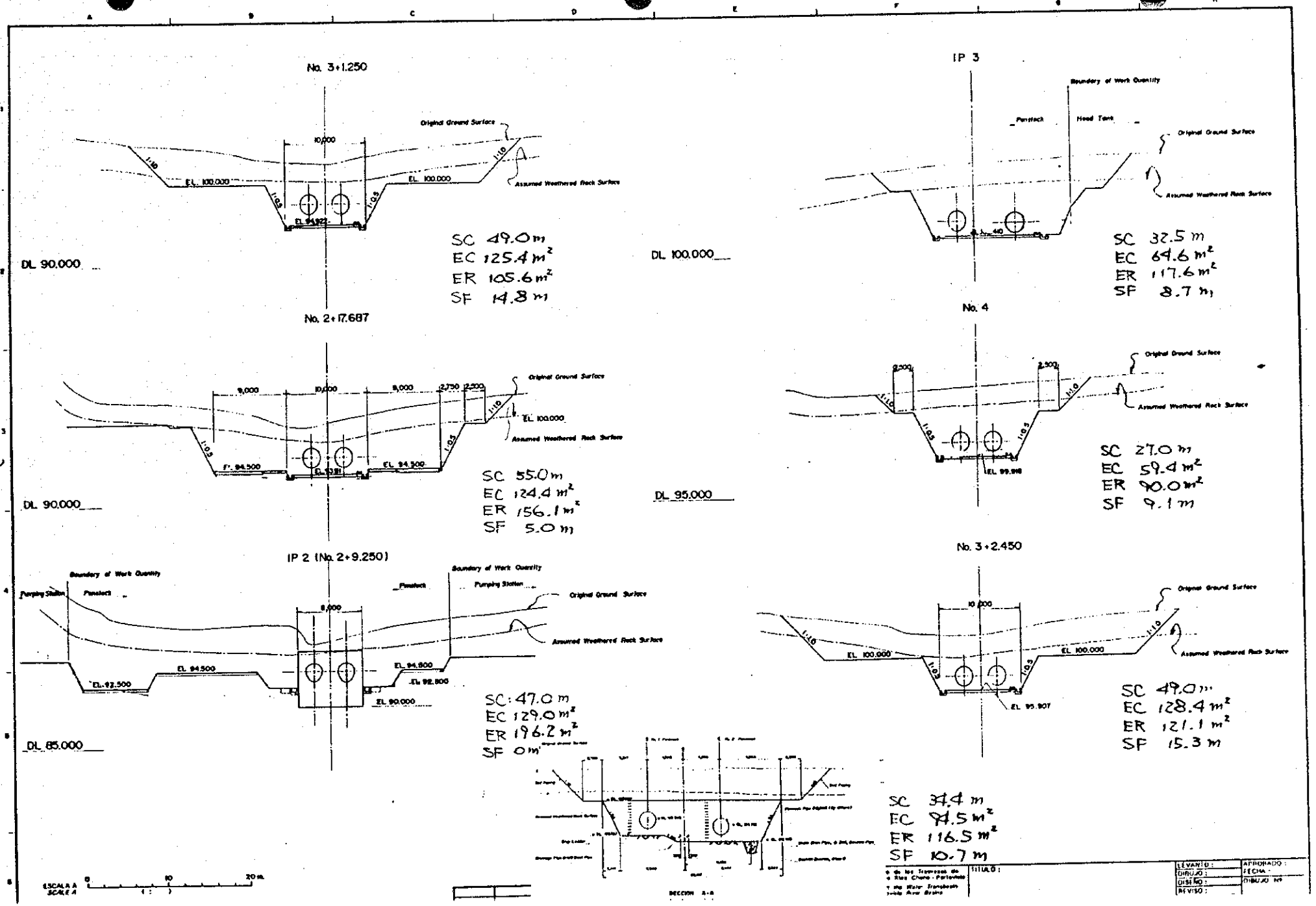
Penstock

Working Division: 3. Severino Penstock

Description	Calculation Details	Unit	Quantity	Remarks
3.1	EARTHWORK			
101	Clearing the site 2,416	m^2		see calculation paper and sections attached.
102	Open-cut excavation, in common, for penstock line 5,771	m^3		
103	Open-cut excavation, in weathered rock, for penstock line			
	weathered rock & rock 7,008 m^3			
	of which 95% for weathered rock			
	7,008 × 0.95 = 6,658	m^3		
104	Open-cut excavation, in rock, for penstock line			
	5% for rock			
	7,008 × 0.05 = 350	m^3		
106	Sod facing, for cut slope protection 584 m^2			

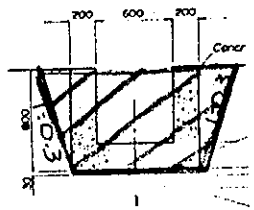
Penstock Earth Work

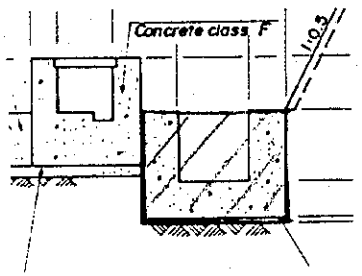
		Site Clearance		Excavation, common		Excavation, w. rock & rock		Sod Facing	
Sec. No.	Distance (m)	L (m)	A (m2)	A (m2)	V (m3)	A (m2)	V (m3)	L (m)	A (m2)
IP 2		47.0		129.0		196.2		0.0	
No.2+17.687	8.437	55.0	430.3	124.4	1,069.0	156.1	1,486.2	5.0	21.1
No.3+1.25	8.563	49.0	445.3	125.4	1,069.5	105.6	1,120.5	14.8	84.8
No.3+2.45	1.200	49.0	58.8	128.4	152.3	96.2	121.1	15.3	18.1
No.4	22.550	27.0	856.9	59.4	2,117.4	90.0	2,099.4	9.1	275.1
IP 3	14.020	32.5	417.1	64.6	869.2	117.6	1,455.3	8.7	124.8
Sec. A-A (Head Tank)	6.202	34.4	207.5	94.5	493.4	116.5	725.9	10.7	60.2
Total			2,416		5,771		7,008		584


No. 3+1.250
Original Ground Surface
Assumed Weathered Rock Surface
EL. 100.000
EL. 100.000
EL. 94.922
DL 90.000
SC 49.0 m
EC 125.4 m²
ER 105.6 m²
SF 14.8 m
IP 3
Boundary of Work Quantity
Penstock
Head Tank
Original Ground Surface
Assumed Weathered Rock Surface
DL 100.000
SC 32.5 m
EC 64.6 m²
ER 117.6 m²
SF 8.7 m
No. 2+17.687
Original Ground Surface
Assumed Weathered Rock Surface
EL. 100.000
EL. 94.500
EL. 94.500
DL 90.000
SC 55.0 m
EC 124.4 m²
ER 156.1 m²
SF 5.0 m
No. 4
Original Ground Surface
Assumed Weathered Rock Surface
EL. 99.918
DL 95.000
SC 27.0 m
EC 59.4 m²
ER 90.0 m²
SF 9.1 m
IP 2 (No. 2+9.250)
Boundary of Work Quantity
Pumping Station
Penstock
Penstock
Boundary of Work Quantity
Pumping Station
Original Ground Surface
Assumed Weathered Rock Surface
EL. 94.500
EL. 92.500
EL. 94.500
EL. 92.500
EL. 90.000
DL 85.000
SC: 47.0 m
EC 129.0 m²
ER 196.2 m²
SF 0 m
No. 3+2.450
Original Ground Surface
Assumed Weathered Rock Surface
EL. 100.000
EL. 100.000
EL. 95.907
SC 49.0 m
EC 128.4 m²
ER 121.1 m²
SF 15.3 m
SC 34.4 m
EC 94.5 m²
ER 116.5 m²
SF 10.7 m
ESCALA A
SCALE A
0
10
20 m.
SECCION A-A
TITULO:
LEVANTO:
DIBUJO:
DISEÑO:
REVISO:
APROBADO:
FECHA:
DIBUJO Nº

Working Division:

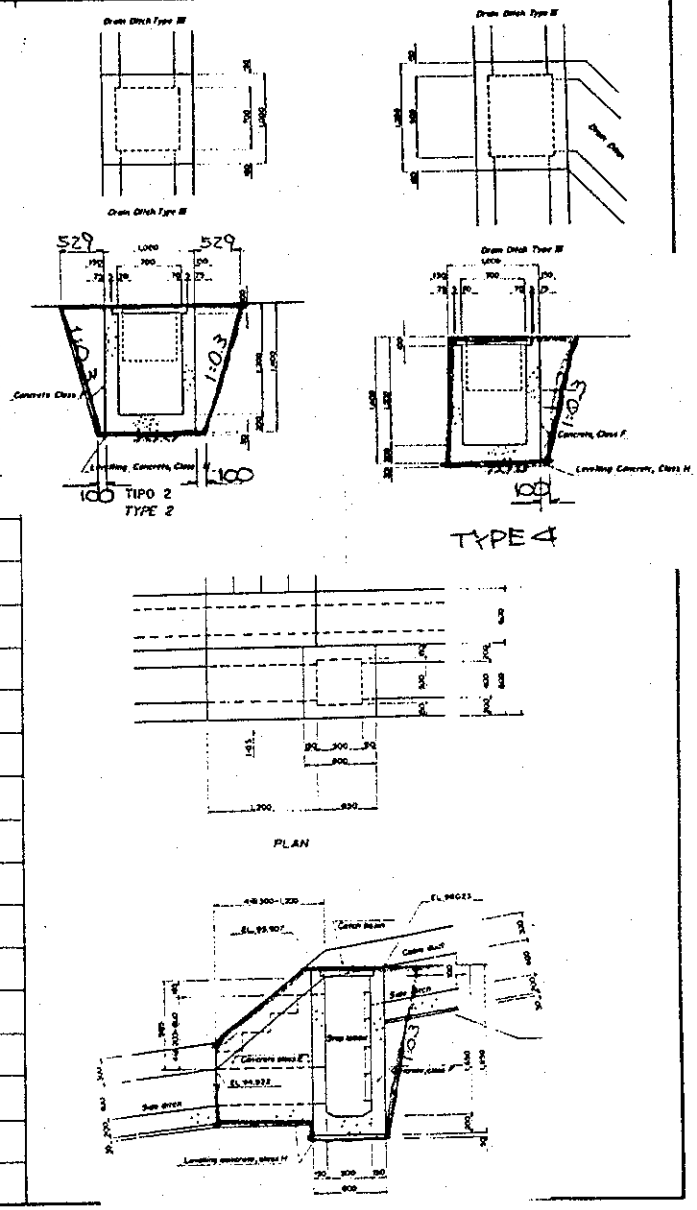
Description	Calculation Details	Unit	Quantity	Remarks
105	Trench excavation, in all classes, for side ditch and catch basin			
–	for side ditch			
	• Type III (drain ditch)			
	$l = \{7.745 + (2.5 + \sqrt{7.5^2 + 3.75^2}) \times 3 + \sqrt{0.882^2 + 0.441^2} - 5 \times 1.0\} \times 2$			
	$= 72.773$ m			
	$A = 0.83 \times 1.0 = 0.83 m^2$			
	$V = 0.83 \times 72.773 =$ 60.4 m^2			Location is shown on the drawings.
	• along (penstock line)			
	$l = \underset{IP1-2 \sim IP1-3}{60.243} + 3.0 + \underset{IP2-2 \sim IP2-3}{78.626} + 10.0 = 152 m$			
	$A = 0.63 \times 0.8 = 0.504 m^2$			
	$V = 0.504 \times 152 =$ 76.6 m^2			
	sub total 137	m^3		



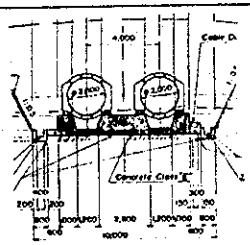
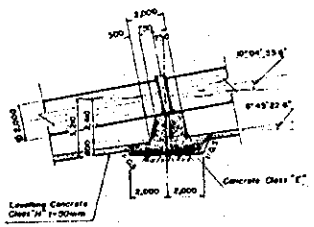
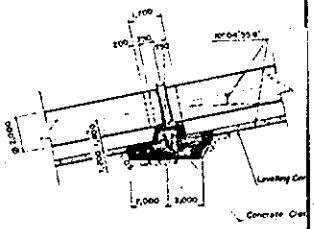
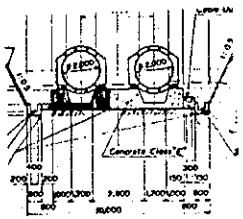
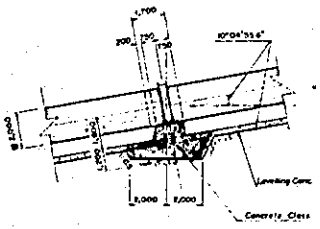


Working Division:

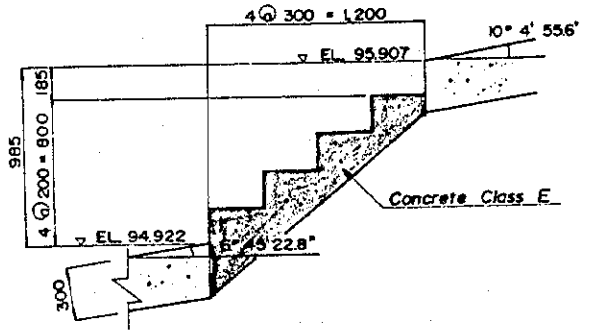
Description	Calculation Details	Unit	Quantity	Remarks
–	for catch basin			
	Type 2 6 nos			
	1.0×1.0×1.43×6 = 9 m³			
	Type 4 2 nos.			
	1.0×1.2×1.43×2 = 3.5 m³			
	catch basin of penstock line : 2 nos.			
	0.8×0.8×1.85×2 = 2.4 m³			
	$\frac{1.4+0.6}{2}$×1.0×2 = 2.0			
	sub total 17	m³		
	Total 137 + 17 = 154 m³			



Working Division: 3.2 Concrete Works

Description	Calculation Details	Unit	Quantity	Remarks
101	Concrete, class E, for bottom slab and saddle block along penstock line			 Type 1 & 2
-	bottom slab			
	$t = 0.3m$ $l = 64m$ $W = 7.2m$			
	$V = 0.3 \times 64 \times 7.2 = 140 m^3$			
-	saddle block			 TYPE 1  TYPE 2
	Type 1 1 no			
①	$\frac{2.0+1.5}{2} \times 1.4 \times (0.9 \times 2 + 2.6) = 10.8 m^3$			
②	$(0.2 \times 4.4 + \frac{1}{2} \times 4.0 \times 0.8) \times 7.2 = 17.9 m^3$			
	Type 2 2 nos.			 Type 2'
①	$\frac{1.9+1.7}{2} \times 0.8 \times (0.9 \times 2 + 2.6) \times 2 = 12.7 m^3$			
②	$(0.45 \times 4.7 + \frac{1}{2} \times 4.0 \times 0.75) \times 7.2 \times 2 = 52.1 m^3$			
	Type 2' 1 no			 TYPE 2'
①	$\frac{1.9+1.7}{2} \times 0.8 \times (0.9 + 0.9) = 2.6 m^3$			
②	$(0.45 \times 4.7 + \frac{1}{2} \times 4.0 \times 0.75) \times 3.2 = 11.6 m^3$			
	subtotal $108 m^3$			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	stair $\left\{ \frac{1.1+0.1}{2} \times 1.2 - 0.3 \times (0.6+0.4+0.2) \right\}$			
	$\times 7.2 = 2.6\ m^3 = 3\ m^3$			
	Total $140 + 108 + 3 = \underline{\underline{251\ m^3}}$			

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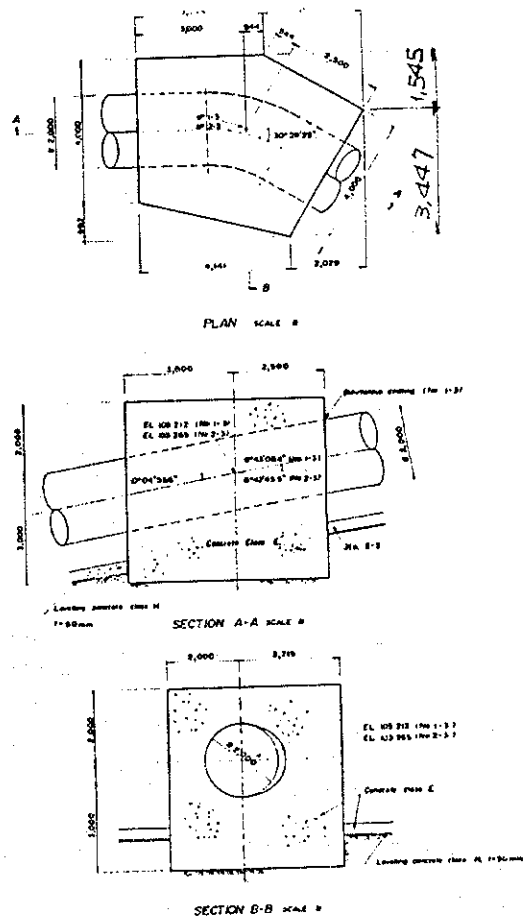
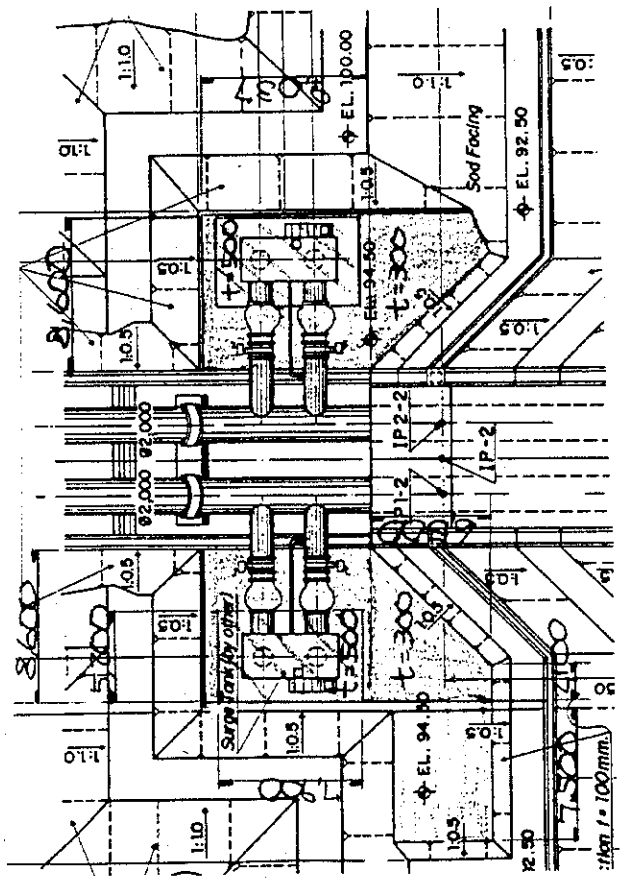
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
102	Concrete, class E, for anchor block			
	$V = 4.992 \times 6.170$			
	$- \frac{1}{2} \times (0.992 \times 4.141 + 2.029 \times 3.447 + 2.626 \times 1.545)$			
	$\times 5.0 \times 2$ nos.			
	$= 232 m^3$			



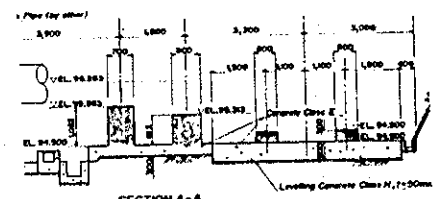
Working Division:

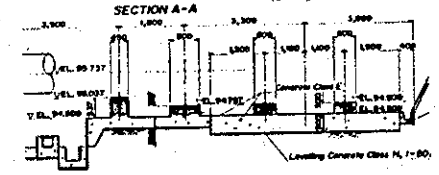
Description	Calculation Details	Unit	Quantity	Remarks
103	Concrete, class E, for foundation of surge tank and valves			
-	Slab			
	t=500 A= 5.2×7.9×2 = 82.16 m²			
	V= 0.5×82.16= 41.08 m³			
	t=300			
(1)	A= 8.6×9.037×2 + 7.5×5.5 + (8.6+2.1)/2 ×6.5 + ½×8.6×6.5 + ½×5.5×2.6 − 82.16 = 184.40 m²			
	V= 184.40×0.3 = 55.32 m³			
(2)	(0.250+0.659)/2 ×0.818×9.037×½ = 1.68 m³			
	sub total 227 m³			

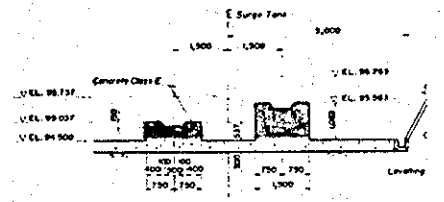


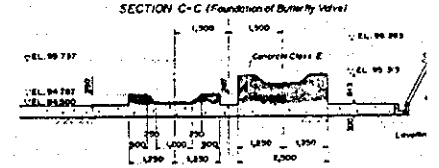
Working Division:

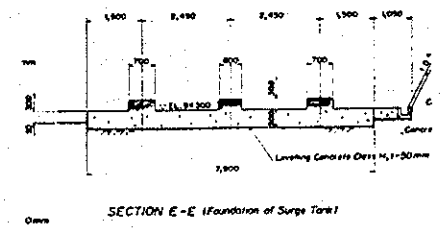
Description	Calculation Details	Unit	Quantity	Remarks
-	Foundation of butterfly valve			
	$\{(0.537 \times 1.5 - \frac{0.7+0.5}{2} \times 0.15) \times 0.45$			
	$+(1.063 \times 1.5 - \frac{0.7+0.5}{2} \times 0.15) \times 0.7\} \times 2$			
	$= 2.8\ m^3$			
-	Foundation of Non return valve			
	$\{(0.287 \times 2.5 - \frac{1.5+1.0}{2} \times 0.25)$			
	$+(0.813 \times 2.5 - \frac{1.5+1.0}{2} \times 0.25)\} \times 0.8 \times 2$			
	$= 3.4\ m^3$			
-	Foundation of surge tank			
	$0.3 \times (0.7 + 0.6 + 0.7) \times (0.6 + 0.6) \times 2$			
	$= 1.44\ m^3$			
	Total			
	$227 + 2.8 + 3.4 + 1.4 = 235\ m^3$			







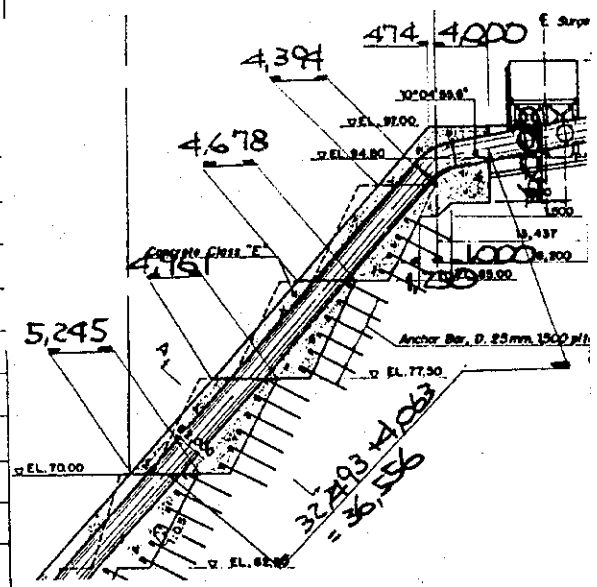


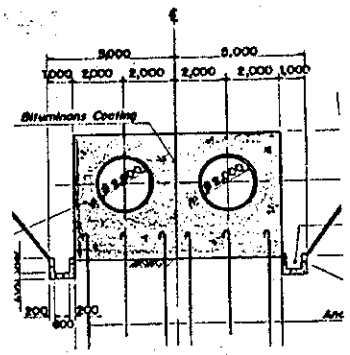


9-10

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
104	Concrete, class E, for encasing of penstock pipe			
	$\left(\frac{0.474+4.0}{2}\times4.5+4.0\times6.0+\frac{2.25+1.0}{2}\times1.0\right.$			
	$+\frac{4.394+7.178}{2}\times7.5+\frac{4.678+7.461}{2}\times7.5$			
	$\left.+\frac{4.961+7.745}{2}\times7.5\right)\times8.0-\frac{\pi}{4}\times2.0^2\times36.556\times2$			
	$=1,148m^3$			





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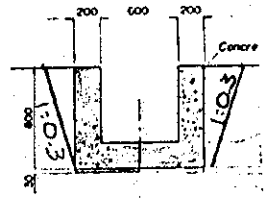
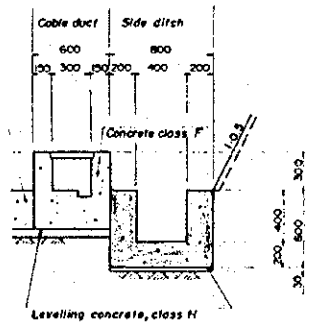
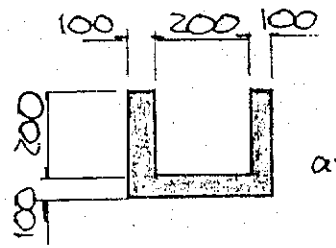
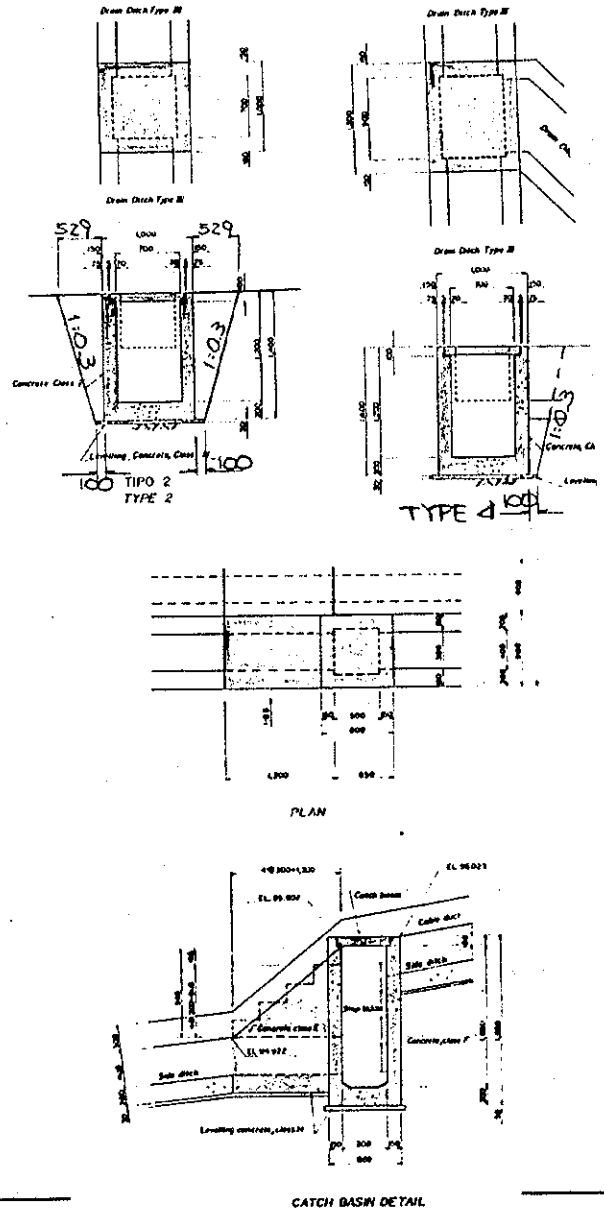
Working Division:

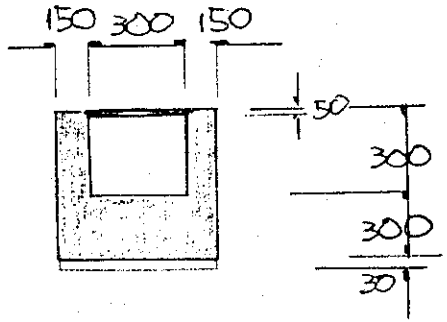
Description	Calculation Details	Unit	Quantity	Remarks
105	Concrete, class F, for side ditch and catch basin along penstock line			
				
–	for side ditch			
	Type III 72.773 m			
	$V = (0.2 \times 0.6 \times 2 + 1.0 \times 0.2) \times 72.773$			
	$= 32.0\ m^3$			
				
	along penstock $l = 152$ m			
	$V = (0.2 \times 0.4 \times 2 + 0.8 \times 0.2) \times 152$			
	$= 48.6\ m^3$			
	around surge tank			
	$l = (9.0 + 19.437) \times 2 = 57$ m			
	$V = 0.1 \times (0.2 + 0.4 + 0.2) \times 57 = 4.6\ m^3$			
				 around surge tank
	sub total 85.2 m^3			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	for catch basin			
	Type 2 6nos			
	$\{0.15\times(1.0+0.7)\times2\times1.2+0.2\times1.0\times1.0$			
	$+0.84\times0.84\times0.1-0.6\times0.6\times0.15\times2\}\times6$			
	$=4.6\ m^3$			
	Type 4 2nos			
	$\{0.15\times(1.0+0.9)\times2\times1.2+0.2\times1.0\times1.2$			
	$+0.84\times1.04\times0.1-0.6\times0.6\times0.15\}\times2$			
	$=1.9\ m^3$			
	Penstock catch basin 2 nos.			
	$0.15\times(0.8+0.5)\times2\times1.65+0.2\times0.8\times0.8$			
	$+0.64\times0.64\times0.1 \quad = 0.8\ m^3$			
	$(0.8\times0.3+1.0\times0.3+1.2\times0.3+1.4\times1.05)$			
	$\times0.8-0.4\times0.4\times1.05 \quad =1.7\ m^3$			
	Sub total $9\ m^3$			
	Total $85.2+9.0=94.2\ m^3$			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
106	Concrete, class F, for cable duct along penstock line			
	$l = 49.296 + 9.906 = 59.202 \doteqdot 60m$			
	$V = (0.15 \times 0.3 \times 2 + 0.3 \times 0.6 + 0.05 \times 0.44) \times 60 = 18 m^3$			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
107	Concrete, class H, for levelling concrete of bottom slab, foundation of surge tank, side ditch, catch basin and cable duct along penstock line			see drawing
	-bottom slab t=50			
	l=64m, w=7.2 m			
	V = 0.05 × 64 × 7.2 = 23.0 m³			
	stair portion			
	V = 1.2 × 7.2 × 0.05 = 0.4 m³			
	sub total 23.4 m³			
	- foundation of surge tank			
	A = 82.16 + 184.40 = 266.56 m²			
	V = 0.05 × 266.56 = 13.3 m³			
	- side ditch			
	Type II 0.03 × 1.0 × 72.723 = 2.2 m³			
	Penstock line 0.03 × 0.8 × 152 = 3.6 m³			
	surge tank 0.03 × 0.4 × 57 = 0.7 m³			
	sub total 6.5 m³			
	- catch basin			
	Type 2 6 × 1.0 × 1.0 × 0.03 = 0.2 m³			
	Type 4 2 × 1.0 × 1.2 × 0.03 = 0.1 m³			
	penstock 2 × 0.8 × 0.8 × 0.03 = 0.04			
	2 × 1.05 × 0.8 × 0.03 = 0.05			
	sub total 0.4 m³			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	- cable duct			
	60 × 0.6 × 0.03 = 1.1 m³			see drawing
	Total 23.4 + 13.3 + 6.5 + 0.4 + 1.1			
	= 44.7 m³			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
108	Formwork, F1 finish, for concrete of item 101 and 105			
–	for 105			
–	for side ditch			see figures of concrete work
	Type III l = 72.773 m			
	(0.8 × 2) × 72.773 = 116.44 m²			
	Penstock line l = 152 m			
	(0.6 × 2) × 152 = 182.40			
	sub total 298.84 m²			
–	for catch basin			see figures of concrete work
	Type 2 6 nos			
	(1.0 × 1.4 × 4 − 0.6 × 0.6 × 2) × 6 = 29.28 m²			
	Type 4 2 nos			
	{(1.0 × 1.4 + 1.2 × 1.4) × 2 − 0.6 × 0.6 × 2			
	− 0.8 × 0.6} × 2 = 9.92 m²			
	penstock line 2 nos.			
	{1.85 × 0.8 × 4 + (0.8 × 0.3 + 1.0 × 0.3			
	+ 1.2 × 0.3 + 1.4 × 0.15) × 2} × 2 = 16.28 m²			
	sub total 55.48 m²			
	for 105 Total 298.84 + 55.48			
	= 354.32 m²			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	for /01			
	for contraction joint 4 portion			see figure of concrete work
	0.3 × 7.2 × 4 = 8.64 m²			
	Total 354.32 + 8.64 = 362.96 m²			

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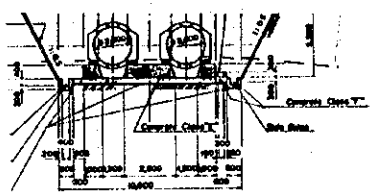
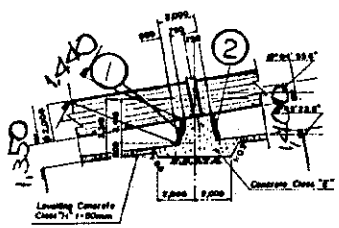
Working Division:

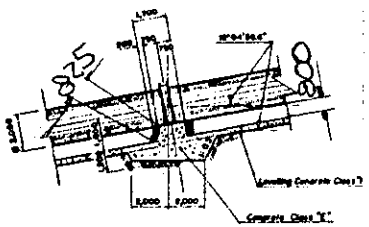
Description	Calculation Details	Unit	Quantity	Remarks
109	Formwork, F2 finish, for concrete of items 101, 102, 103, 104 and 106			
–	for 101			
	saddle block			
	Type 1 1 no.			
①	(0.9+2.6+0.9) × 1.44 = 6.34 m²			
②	(0.9+2.6+0.9) × 1.4 = 6.16 m²			
	Type 2 2 nos			
①	(0.9+2.6+0.9) × 0.825 × 2 = 1.65 m²			
②	(0.9+2.6+0.9) × 0.8 × 2 = 7.04 m²			
	Type 2′ 1 no			
①	(0.9+0.9) × 0.825 = 1.49 m²			
②	(0.9+0.9) × 0.8 = 1.44 m²			
	stair			
	4 × 0.2 × 7.2 = 5.76 m²			
	Total of for 101 29.88 m²			



TYPICAL CROSS SECTION



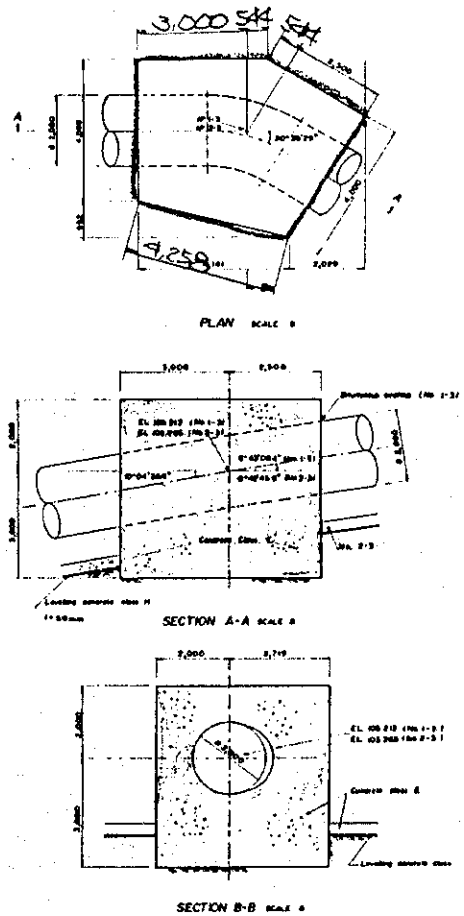
TYPE 1



TYPE 2

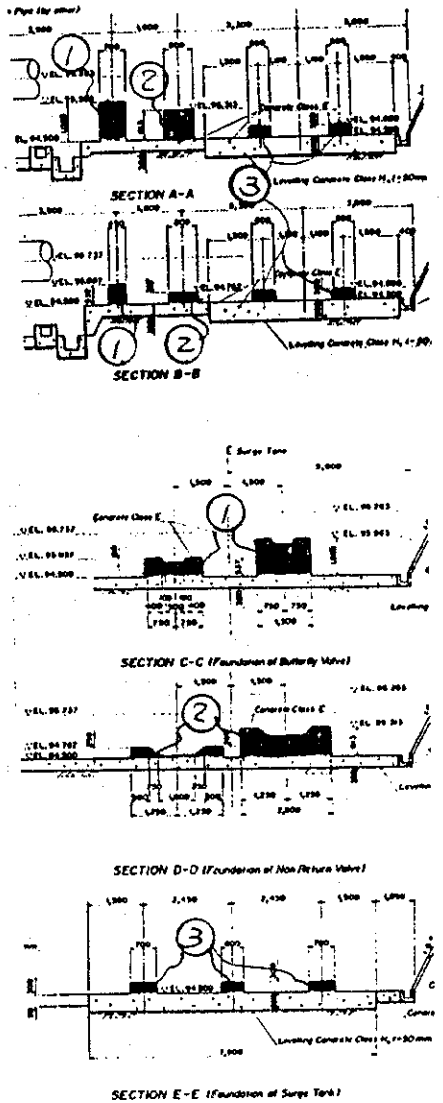
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	for 102			
	(3.544 + 3.044 + 4.0 + 4.0 + 4.258 − π/4 × 2.0² × 2)			
	× 3.0 × 2			
	= 75.38 m²			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for 103			
①	Foundation of butterfly valve			
	$\{(1.063\times1.5-\frac{0.5+0.7}{2}\times0.15)$			
	$+1.063\times0.7\}\times2$ = $4.50m^2$			
	$\{(0.537\times1.5-\frac{0.5+0.7}{2}\times0.15)$			
	$+0.537\times1.5\}\times2$ = $3.04m^2$			
②	Foundation of Non return valve			
	$\{(0.813\times2.5-\frac{1.5+1.0}{2}\times0.25)$			
	$+0.813\times0.8\}\times2$ = $4.74m^2$			
	$\{(0.287\times2.5-\frac{1.5+1.0}{2}\times0.25)$			
	$+0.287\times0.8\}\times2$ = $2.11m^2$			
③	Foundation of surge tank			
	$(0.7\times0.3\times2+0.3\times0.6\times2)\times4$			
	$+(0.6\times0.3\times2+0.3\times0.6\times2)\times2$			
	= $4.56m^2$			
	Total of for 103 $18.95m^2$			



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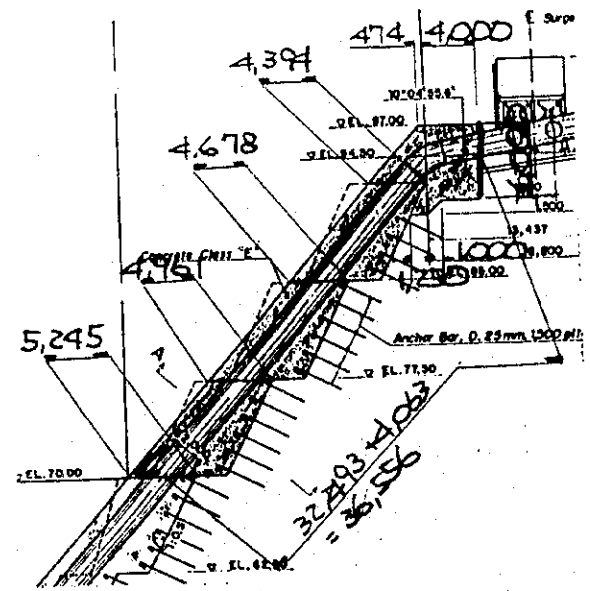
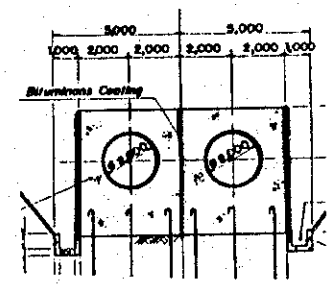
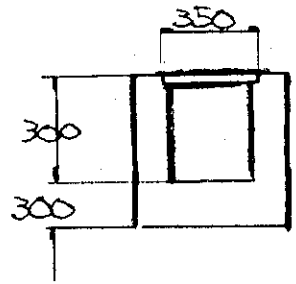
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for /04			
	$\left\{\frac{0.474+4.0}{2}\times4.5+4.0\times6.0+\frac{2.25+1.0}{2}\times1.0\right.$			
	$+\frac{4.394+7.178}{2}\times7.5+\frac{4.678+7.461}{2}\times7.5$			
	$\left.+\frac{4.961+7.745}{2}\times7.5\right\}\times3 = 516.77m^2$			
	$6.0\times8.0-\pi/4\times2.0^2\times2 = 41.72m^2$			
	Total of for/04 $558.49m^2$			



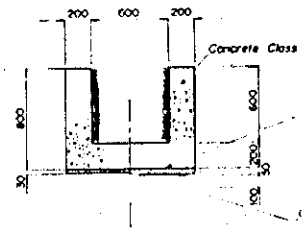


Working Division:

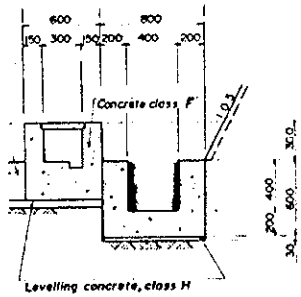
Description	Calculation Details	Unit	Quantity	Remarks
–	for 106			
	$l = 60m$			
	$(0.35 \times 2 + 0.3 \times 4 + 0.3 \times 2) \times 60$			
	$= 150\ m^2$			
	Total			
	101 29.88 m^2			
	102 75.38 m^2			
	103 18.95 "			
	104 558.49 "			
	106 150.00			
	832.70 m^2			

Working Division:

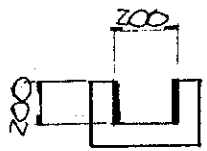
Description	Calculation Details	Unit	Quantity	Remarks
/10	Formwork, F3 finish, for concrete of item /05			
-	for side ditch			
	Type III l = 72.773 m			
	0.6×2×72.773 = 87.33 m²			
	Penstock line l = 152 m			
	0.4×2×152 = 121.60 m²			
	around surge tank l = 57 m			
	0.2×2×57 = 22.80 m²			
	sub total 231.73 m²			



TYPE III



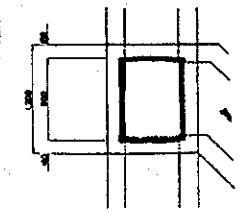
Penstock line

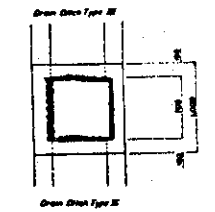


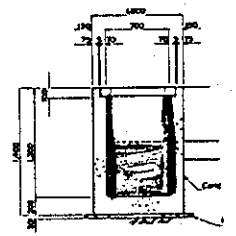
around surge tank

Working Division:

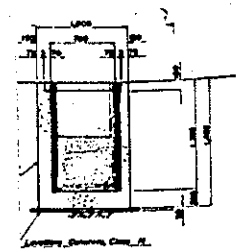
Description	Calculation Details	Unit	Quantity	Remarks
-	for catch basin			
	Type 2 6 nos			
	$(0.7 \times 1.2 \times 4 - 0.6 \times 0.6 \times 2) \times 6$			
	$= 15.84 m^2$			
	Type 4 2 nos			
	$(0.9 \times 2 + 0.7 \times 2) \times 1.2 \times 2$			
	$= 7.68 m^2$			
	Penstock line 2 nos			
	$(0.5 \times 1.65 \times 4 - 0.4 \times 0.4 \times 2) \times 2$			
	$= 5.96 m^2$			
	$1.05 \times 0.4 \times 3 \times 2$ $= 2.52 m^2$			
	sub total $32.00 m^2$			
	Total $263.73 m^2$			



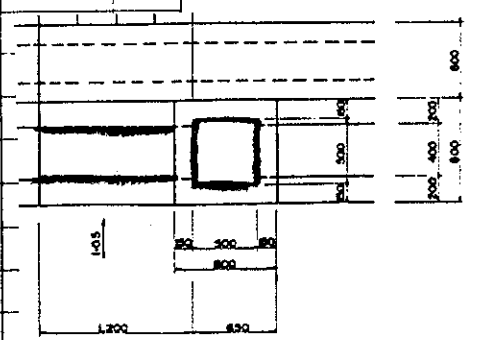


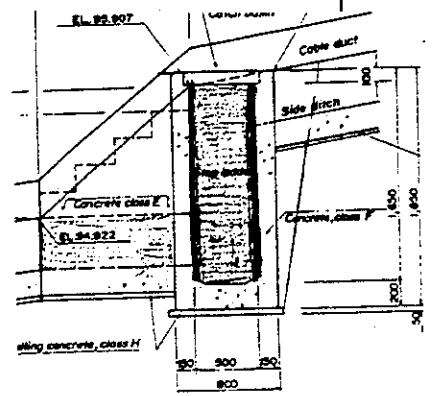


TYPE 4



TIPO 2
TYPE 2

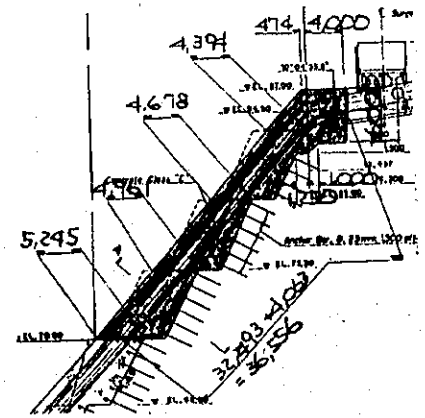


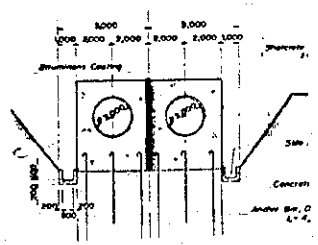


PENSTOCK LINE

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/11	Bitumminous coating for contraction joint of bottom slab and encasing concrete along penstock pipe			
-	for bottom slab			
	$t = 300,\ W = 7,200$			
	$0.3 \times 7.2 \times 4 = 8.64\ m^2$			
-	for encasing concrete			
	$\frac{0.474+4.0}{2} \times 4.5 + 4.0 \times 6.0$			
	$+ \frac{2.25+1.0}{2} \times 1.0 + \frac{4.395+7.178}{2} \times 7.5$			
	$+ \frac{4.678+7.461}{2} \times 7.5 + \frac{4.961+7.745}{2} \times 7.5$			
	$= 187.26\ m^2$			
	Total $195.9\ m^2$			





Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for side ditch			
	C 85 m^3			
	R 30 kg/m^3			
	W = 85×30 = 2.6 t			
	for catch basin			
	C: 9 m^3			
	R: 50 kg/m^3			
	W = 9×50 = 0.5 t			
	for cable duct			
	C: 18 m^3			
	R: 30 kg/m^3			
	W = 18×30 = 0.5 t			
	Total 90.9 t			

Working Division:

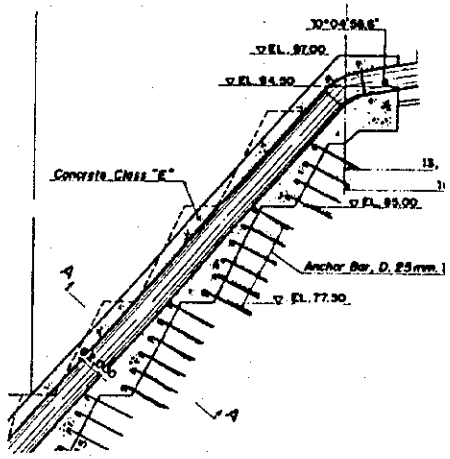
Description	Calculation Details	Unit	Quantity	Remarks
/12	Reinforcing bars for concrete works			
-	for bottom slab			
	Concrete 143 m^3			
	Re-bar 70 kg/m^3			
	W = 143 × 70 = 10.0 ton			
-	for saddle block			
	Concrete 108 m^3			
	Re-bar 10 kg/m^3			
	W = 108 × 10 = 1.1 ton			
-	for anchor block			
	C 232 m^3			
	R 10 kg/m^3			
	W = 232 × 10 = 2.3 ton			
-	for foundation of surge tank and valves			
	C 235 m^3			
	R 70 kg/m^3			
	W = 235 × 70 = 16.5 ton			
-	for encasing concrete			
	C 1,148 m^3			
	R 50 kg/m^3			
	W = 1,148 × 50 = 57.4 ton			

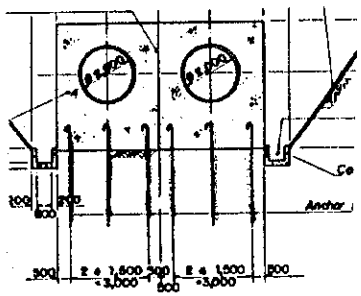
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/13	Dowel bar, 22 mm dia. (round bar), for bottom slab of penstock line			$l = 1,000$ 500 pitch
	Nos. 7,200/500 + 1 = 15 nos/joint			
	4 contraction joints			
	$l = 15 \times 1.0 \times 4 = 60$ m			
	$w = 2.98$ kg/m			
	$W = 2.98 \times 60 = 178.8$ kg			

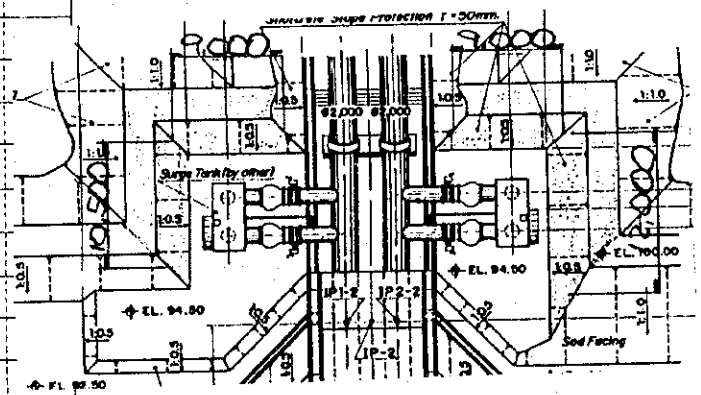
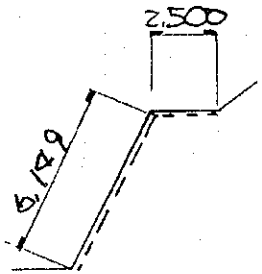
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/14	Anchor bar, 25 mm dia., for encasing concrete			
	$l = 4,500$ / no.			
	no. = 16 × 6 = 96 nos.			
	L = 4.5 × 96 = 432 m			





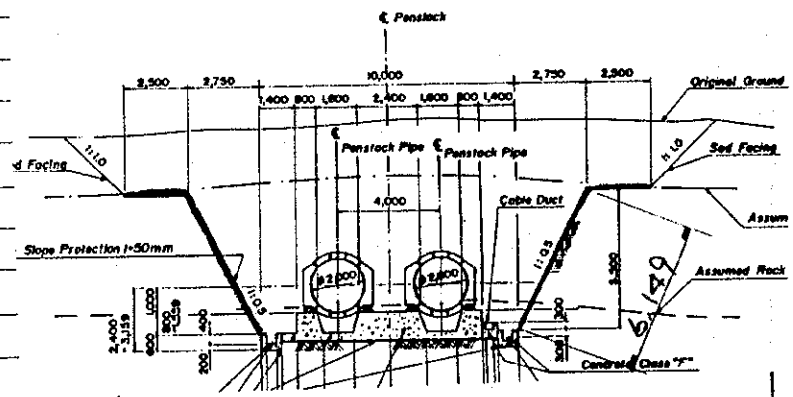
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/15	Shotcrete with wire mesh for cut slope protection along penstock line, t=100 mm			
	(6.149+2.5)×(10.5+9.0+9.0+12.0)			
	= 350 m²			

2-3/

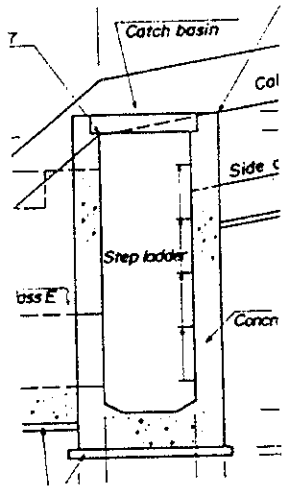
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/16	Shotcrete with wire mesh for cut slope protection along penstock line, t = 50mm			
	l = 134 m			
	A = (6.139 + 2.5) × 134 = 1,158 m²			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/17	P.V.C. pipe, 50mm dia., for weephole			
	l = 200 mm / no.			
	no. = 1 / 4 m² of projected area			
-	for t = 100mm shotcrete			
	Projected area			
	5.5 × (10.5+9.0+9.0+12.0) = 222.75 m²			
	l = 0.2 × 222.75/4 = 11.2 m			
-	for t = 50 mm shotcrete			
	Projected area			
	5.5 × 134 = 737 m²			
	l = 0.2 × 737/4 = 36.8 m			
	Total 48 m			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
3.3	Miscellaneous Metal Work			
101	Round bar, for step ladder			
	for catch basin (penstock line)			
	D.22 round bar w = 2.98 kg/m			
	l = 1.26 m/no. ladder 5 nos			
	W = 1.26 × 5 × 2.98 = 18.8 kg