

1.3 Utilidad

Utility

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

Description	Calculation Details	Unit	Quantity	Remarks
Numero Circuitos Circuit Number				
	$2 \times 2.0 \text{ mm}^2 (16 \text{ AWG}) \text{ or } 2 \times 14 \text{ AWG} / \phi 1/2''$			
CN-1	$24 + 7 + 3 = 34$	m		
CN-2	$30 + 10 + 6 + 5 = 51$	m		
CN-3	$11.5 + 8.5 + 13 + 25 + 10 \times 2 = 76$	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	$23 + 60 + 45 + 9 + 14 + 7 + 5 = 163$	m		
CN-24				
CN-25	$57 + 16 + 10 + 8 = 85$	m		
CN-26	$35 + 12 = 47$	m		
	$3 \times 2.0 \text{ mm}^2 (16) \text{ or } 3 \times 14 \text{ AWG} / \phi 1/2''$		865	
CN-3	19	m		
CN-4	30	m		
CN-10	82	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	$4.5 + 6 + 4 = 14.5 \approx 15.0$	m		
	$5 \times 2.0 \text{ mm}^2 (16) \text{ or } 5 \times 14 \text{ AWG} / \phi 1/2''$		271	
CN-13	$5.5 + 5 + 5 + 4 = 24$	m		
CN-14	$5.75 + 5 + 5 = 20$	m		
			44	

Working Division: SEWERING PUMPING STATION (ELECTRICAL)

Description	Calculation Details	Unit	Quantity	Remarks
CN-5,6,7,8,9	$2 \times 5.5 \text{ mm}^2 (16) \text{ or } 2 \times 10 \text{ AWG} / \phi 1/2"$ $\rightarrow 60 + 30 + 27 + 9 + 11 + 30 + 41 + 48 + 20 + 5 = 281$	m		
CN-15	$2 \times 3.5 \text{ mm}^2 (16) \text{ or } 2 \times 12 \text{ AWG} / \phi 1/2"$ $= 82$	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		
	$2 \times 2.0 \text{ mm}^2 (16) \text{ or } 2 \times 14 \text{ AWG} / \phi 1/2"$			
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	$6 + 10.6 + 11.5 + 39 + 10.5 + 4 = 81.6 \approx 82$	m		
	786	m		
	$2 \times 5.5 \text{ mm}^2 (16) \text{ or } 2 \times 10 \text{ AWG} / \phi 1/2"$			
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		
CN-18	$4 \times 5.3 \text{ mm}^2 (22) \text{ or } 4 \times 10 \text{ AWG} / \phi 3/4"$ (LV CABLE) $= 55$	m		
TELEFONOS (TELEPHONE)				
	$2 \times 0.8 (16) \text{ or } 2 \times 20 \text{ AWG} / \phi 1/8"$			
	$45.0 + 24 + 31 + 28 + 28 + 85 + 24 + 14 + 10 + 13 = 302$	m		
	30	m		
$2 \times 0.8 (22)$	30	m		
$2 \times 0.8 (28 \times 2)$	47.5 \times 2 = 95	m		

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

Description	Calculation Details	Unit	Quantity	Remarks
2x(2x0.8) (16)	18	m		
4x(2x0.8) (22)	36	m		
6x(2x0.8) (16, 22)	6	m		
8x(2x0.8) (22x2)	6	m		
Resumen (Summary)				
Conductor (Wire + Cable)				
2x0.8 mm ²	(302 + 18x2 + 36x4 + 6x8 + 10x2) →	m	800	
2.0 mm ²	(865 + 286x2 + 27x3 + 4x5) x 1.05	m	4600	
3.5 mm ²	499x2 x 1.05	m	1050	
5.5 mm ²	(281x2 + 65x4) x 1.05	m	870	
CABLE 5.5x2	423 x 1.05	m	450	
" 4C-23mm ²	79 x 1.05	m	85	
" 4C-35mm ²	30 x 1.05	m	24	
" 4C-55mm ²	65 x 1.05	m	70	
Conduit Pipe				
16 mm pipe	(865 + 286 + 271 + 44 + 499 + 281) x 1.05	m	2900	
16 mm pipe (telephone)	(302 + 18 + 6) x 1.05	m	345	
22 mm pipe (")	(36 + 6 + 12) x 1.05	m	60	
28 mm pipe (")	95 x 1.05	m	100	
22 mm pipe (lighting)	65 x 1.05	m	70	
EL. 70°, 65°, 40°, 55°, 50°, 46° EWR, Dised				
Tumbler Switch	16 + 6 + 3 + 5 + 6 + 14 + 2 + 1 + 7 (spare) set	set	20	
Threeway	3 + 4 + 4 + 4 + 3 + 1 + 1 + 5 (spare) set	set	25	
Convenience Outlet. 12V-20A.	4.7 + 13 (spare)	set	50	
Safety Switch (3P x 230V x 50A)		set	3	

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

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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

1-3-7

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

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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

1-2-9

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 fan, 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

1-3-11

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	Louwer 400 x 200 Q = 300 CMH	No.	1
15	Louwer 450 x 200 Q= 650 CMH	No.	1

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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	24
	diam 19.05 mm	m	24
	diam 15.88 mm	m	24

1-2-13

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 screen, 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

1-1-3-1-A

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 Supply 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	250 x 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

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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

Severino Pumping Station Ventilation System

Summary : Weight of Sheets

Ventilation system 1

$$\text{Gage 22 (60+112.62)} = 172.62 \text{ m}^2$$

$$\text{Gage 24 ()} = 148.85 \text{ m}^2$$

Ventilation system 2

$$\text{Gage 22 (78+206.75)} = 284.75$$

$$\text{Gage 24} = 130.72$$

$$\text{Total Gage 22} = 457.4 \text{ m}^2$$

$$\text{Total Gage 24} = 279.57 \text{ m}^2$$

$$\text{Weights : Gage 22} = 6.52 \text{ Kg/m}^2 \times 457 \text{ m}^2$$

$$= 2979 \text{ Kg}$$

$$\text{Gage 24} = 5.22 \text{ Kg/m}^2 \times 279 \text{ m}^2$$

$$= 1456 \text{ Kg}$$

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 Ventilación de Severino

Resumen de Peso de Chapa para ductos

Sistema de ventilación 1

$$\text{Gage 22 (60+112.62)} = 172.62 \text{ m}^2$$

$$\text{Gage 24} = 148.85 \text{ m}^2$$

Sistema de ventilación 2

$$\text{Gage 22 (78+206.75)} = 284.75$$

$$\text{Gage 24} = 130.72$$

$$\text{Total Gage 22} = 457.4 \text{ m}^2$$

$$\text{Total Gage 24} = 279.57 \text{ m}^2$$

$$\text{Pesos : Gage 22} = 6.52 \text{ Kg/m}^2 \times 457 \text{ m}^2$$

$$= 2979 \text{ Kg}$$

$$\text{Gage 24} = 5.22 \text{ Kg/ m}^2 \times 279 \text{ m}^2$$

$$= 1456 \text{ Kg}$$

INSTALACIONES SANITARIAS
REPORTE DE CANTIDADES

SANITARY INSTALATIONS
QUANTITIES REPORT.

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 _____ of _____
 Hoja _____ de _____

INSALACIONES SANITARIAS / AGUA POTABLE SANITARY INSTALLATIONS / DOMESTIC WATER			TOTAL TOTAL	PREC PREC:
COBOS 90	20	□□□□□	22	22.14
BEND 90	25		2	32.40
	32	└		52.24
TEE	20	□	5	70.10
TEE PIPE	25	□	5	44.01
	32	└	2	84.48
REDUCER	32-25		1	14.66
	32-20		1	14.66
	25-20	□	3	5.96
	20-18		1	3.82
UNIFLEXES	22	□□□	14	21.24
UNIVERSAL JOINT	25	□	4	14.22
	30	□□□□□□□□□□	58	9.25
JOINT EXP.	32		1	161.16
EXPANSION JOINT				
SAFES	(12 mm)	□	4	
FAUCETS				
NEVO COU	32			
NIPLE	32			
	50	□□	10	8.66
VALVULA CHD	22		1.01	
GATE VALVE	25			
	30	□□	11.01	
FUSION	32		24.45	42.2
PIPE	25		5.0	42.1
	30		82.45	83.7

1-3-26

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

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

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Date: _____
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 Calculado por: _____
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INSTALACIONES SANITARIAS / AGUA POTABLE
 SANITARY INSTALLATIONS / DOMESTIC WATER
 CANTIDADES DE OBRA
 QUANTITIES.

- TUBERIA / PIPE

ϕ 20 mm \rightarrow 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, 0.95, 0.95, 0.7, 0.3, 0.95 \rightarrow 82.45

ϕ 25 mm \rightarrow 0.8, 1.80, 1.20, 1.2 \rightarrow 5.0

ϕ 32 mm \rightarrow 0.80, 1.5, 2.1, 0.40, 19.65 \rightarrow 24.45

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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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INSALACIONES SANITARIAS / AGUA POTABLE
 SANITARY INSTALLATIONS / DOMESTIC WATER
 CONVERSION OF ACCESSORIES TO EQUIVALENT LENGTH PIPE
 CONVERSION OF ACCESSORIES TO EQUIVALENT LENGTH PIPE

COBOS 90° ----- 20 ----- 22 x 22.19/33.7 -----> 15.0'
 BEND 90° ----- 25 -----
 ----- 32 ----- 2 x 53.74/67.3 -----> 1.73'

TEE ----- 20 ----- 5 x 29.19/33.7 -----> 4.33'
 TEE PIPE ----- 25 ----- 5 x 49.91/42.12 -----> 5.02'
 ----- 32 ----- 2 x 84.45/67.3 -----> 2.71'

REDUCCIONES ----- 32 x 25 ----- 1 x 14.66/16.23 -----> 0.24
 REDUCER ----- 32 x 20 ----- 1 x 14.66/16.23 -----> 0.24
 ----- 25 x 20 ----- 3 x 5.00/42.12 -----> 0.42'
 ----- 20 x 13 ----- 1 x 3.52/32.7 -----> 0.11'

UNIVERSALES ----- 20 ----- 55' x 9.25/33.7 -----> 15.42'
 UNIVERSAL JOINT ----- 25 ----- 4 x 14.22/42.12 -----> 1.35'
 ----- 32 ----- 14 x 21.24/67.3 -----> 4.77'

NIPLES ----- 20 ----- 1 x 8.66/33.7 -----> 2.57'
 NIPLES.

EQUIVALENT PIPE

TUBERIA EQUIVALENTE

Sum ----- 20 ----- 25.36 + 55.0 + 82.45 = 117.45 = 118
 ----- 25 ----- 7.24 + 7.0 + 5.0 = 12.0 = 12.0
 ----- 32 ----- 9.67 + 10.0 + 2.45 = 24.45 = 35.0

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JAPAN INTERNATIONAL COOPERATION AGENCY - AGENCIA INTERNACIONAL DE COOPERACION DEL JAPON

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

Date: _____

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

Fecha: _____

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Calculated by: _____

Calculado por: _____

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INSTALACIONES SANITARIAS / EQUIPOS - TRATAMIENTO DE AGUAS SANITARY INSTALLATIONS / EQUIPMENT		CONEXION - BOMBAS TANQUE HIDRONEUMATICO CONNECTION - PUMPS / PRESSURE VESSEL	
CANTIDADES DE OBRA. QUANTITIES			
- TUBERIA ϕ 32 mm PIPE	0.8, 0.8, 1.6, 1.0, 0.6, 0.9, 0.4, 0.8, 0.30, 0.30, 0.20, 1.5, 0.30 9.2 m //		
- UNIVERSALES ϕ 32 mm UNIVERSAL JOINT	19.0 + 12 = 31.0 \rightarrow 10.57		
- Codos 90° ϕ 32 mm BEND 90°	3.0 \rightarrow 2.57		
- TEE ϕ 32 mm TEE PIPE	6.0 \rightarrow 1.36		
- VALVE GATE ϕ 32 mm	6.0 \rightarrow ✓		
- VALVE CHECK ϕ 32 mm CHECK VALVE	6.0 \rightarrow ✓		
- TRIN GATE ϕ 20 mm GATE VALVE	3.0 \rightarrow ✓		
- UNIVERSAL JOINT	0.82		
- FLEGO ϕ 1/2 FRUCCET	1.0 \rightarrow ✓		
- MANOMETROS PRESSURE GAUGE	2.0 \rightarrow ✓		
	14.52		
	+ 9.20		
	<u>23.72</u>		
	\approx 24.00 m	TOTAL LENGTH	
		LONGITUD TOTAL	
		ϕ 32 mm	
		0.8 m	ϕ 20 mm

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1-3-29

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

Date: _____

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

Fecha: _____

Calculated by: _____

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

Calculado por: _____

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of _____

Hoja _____

de _____

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

ACCESORIO ACCESSORY	DIAMETRO (mm)	UNID. UNIT	CANT. QUANTITY	ACCESORIO ACCESSORY	DIAMETRO (mm)	UNID. UNIT	CANTIDAD QUANTITY
CODOS 90° BEND 90°	20	U	23	(*) TUBERIA TOTAL TOTAL PIPE	20	M	145
	25	"			25	M	12
	32	"	5		32	M	59
TEE TEE PIPE	20	U	5				
	25	"	5				
	32	"	8				
REDUCTORES REDUCEK	32-25	U	1	(*) NOTA: LA TUBERIA TOTAL INCLUYE LA LONGITUD DE LA TUBERIA Y LA LONGITUD DE TUBERIA EQUIVALENTE POR ACCESORIOS.			
	32-20	"	1	NOTE: THE TOTAL PIPE INCLUDE THE PIPE LENGTH AND THE EQUIVALENT LENGTH PIPE FOR ACCESSORIES.			
	25-20	"	3				
	20-13	"	1				
UNIVERSALES UNIVERSAL JOINT	20	U	61				
	25	"	4				
	32	"	45				
JUNTA EXPANSION EXPANSION JOINT	32	U	1				
GRIFOS FAUCETS	13	U	5				
NEPLO NIPPLE	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				
PRESURE GAUGE HANDHETRO		U	1.0				

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RED DE INCENDIOS

FIRE FIGHTING NET

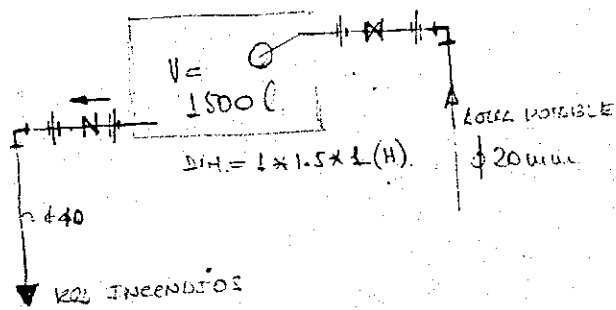
JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

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

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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



Pressure elevation: (T.S)

FIRE QUANTITIES

INCENDIOS:

Coo 40mm	1	0.33
UNIVOLVED 40mm	5	4.33
VOLVED	1	
TUB 40mm		1.90
		<u>6.56</u>

DOMESTIC WATER QUANTITIES

QUANT	POTABLE	REQ.
TRE	22	1.26
RCS	20 x 20	0.24
UNIV	20	1.14
VOL	20	0.13
TUB	20	1.17
TUB = 3.5, 5.65, 2.3, 4.95, 0.4		16.8
		<u>26.30</u>

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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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60-3 1/2
 50-2 1/2
 40-1 1/2

INSTALACIONES SANITARIAS / INCENDIOS.
 SANITARY INSTALLATIONS / FIRE
 CANTIDADES DE OBRAS.
 QUANTITIES

DESCRIPTION DESCRIPCION	NIVEL / ELEVATION							CHECKED TRANSLE 1204 JA RED.	TOTAL
	70	65	60	55	50	45	TOTAL		
CODOS 90° BEND 90°	65	1	1		1		1		8.0
	50	1		1					4.0
	40	1	1	1	1	1	1		31.0
TEE	65		1	1	1	1	1	1	9.0
TEE NIE	50		1			1			2.0
	40	1			1				2.0
UNIVERSAL	65	1	1	1	1	1	1	1	41.0
UNIVERSAL JOINT	50	1	1	1	1	1	1		10.0
	40	1	1	1	1	1	1		41.0
REDUCERS	65-50	1		1	1	1	1		5.0
REDUCER	50-40	1		1	1	1	1		8.0
	65-40	1		1					3.0
SONIA EXP	65		1						2.0
EXPANSION JOINT	50		1						1.0
	40				1	1			2.0
VAL. CHECK	65						1		2.0
VAL. CHECK	65						1		1.0
TUBERIA PIPE	65								48.61
	50								28.5
	40								193.3
EXTINGUIDORES EXTINGUISHER		1	1	1	1	1	1		20
CABINETS (BOX) HYDRANT BOX		1	1	1	1	1	1		13
MANHOLES / GAUGE							1		1.0
SOPORTES NIV. SUPPORTS	65								193
	50								29
	40								49

1-3-33

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 (INCENDIAS)
 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, 0.3, 0.10, 2.4, 0.3, 21.8, 0.10, 2.40, 0.1, 2.4, 8.2, 0.5, 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, 1.6, 1.6, 4.40, 0.4, 4.40, 4.20 (21.5)

φ 65 mm 1.1, 4.4, 1.6, 4.40, 5.0, 5.0, 5.0, 5.0, 5.4, 2.4

CONNECTION / TANK - PUMP - NET
 CONECCION / TANQUE - BOMBA - RED. EN φ 65 mm 0.5, 0.2, 1.2, 1.0, 2.5, 0.4 3.5
 (49.5)

SUPPORTS OF PIPE

— SOPORTES DE TUBERIA DE COLEADERA ↓ SOPORTES POR CAUSA INCENDIO:

SOPORTES — φ 40 mm — 193
 NE SOPORTES 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 (TRAVASE LA ESPERANZA POZA HONDA)

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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INSTALACIONES SANITARIAS / EQUIPOS - TRATAMIENTO DE AGUAS.	
SANITARY INSTALLATIONS / EQUIPMENT -	
- CANTIDADES DE OBRA.	
- QUANTITIES OF WORKS	
CONEXION	HYDRANT PUMP - TANK - NET
CONEXION	BOMBA DE INCENDIOS - TANQUE - RED.
	M ² ----- LONG EQUIV
PIPE	
- TUBERIA ϕ 65mm	6.0 ----- 6.0
UNIVERSAL JOINT	
- UNIVERSALES ϕ 65mm	15 -----
BEND 90°	
- Codos ϕ 65mm	3.0 -----
TEE PIPE	
- TEE ϕ 65mm	3.0 -----
GATE VALVE ϕ 65mm	3.0 ✓ -----
VALVULA COMPUERTA	
- CHECK VALVE ϕ 65mm	2.0 ✓ -----
VALVULA CHECK	
- MANOMETRO	1.0 -----
PRESSURE GAUGE	

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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 (INCENDIOS) / SANITARY INSTALLATIONS (FIRE)
CANTIDADES DE OBRAS / QUANTITIES
CALCULATION OF EQUIVALENT PIPE
- CALCULO DE TUBERIA EQUIVALENTE

	#	SIZE	W.C.C.	W
ELBOWS	65	9	31.5/78.3	5.2
BENDS	50	4	23.82/58.6	1.5
	40	21	12.65/58.6	10.2
TEE	65	9	24.02/78.3	8.5
TEE PIPES	50	20	23/72.58	6.0
	40	20	22.14/58.6	1.0
UNIONS	65	4	112.64/78.3	59.5
UNIVERSAL JOINT	50	10	60.24/72.58	8.2
	40	4	50.12/58.6	26.2
REDUCER	65	5.0	52.27/78.3	3.2
	50	80	24.75/72.58	3.2
	40	30	22.02/58.6	4.6
SUPPORTS	65	192	1.92/78.3	6.7
SUPPORTS	50	24	2.11/72.58	0.44
	40	40	4.0/58.6	0.90

TUBERIA EQUIVALENTE	65 mm	50 mm	40 mm	TOTAL
EQUIVALENT PIPE	21.7	14.24	53.00	130.21
	48.6	28.20	193.3	42.84
				246.30

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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 / INCENDIOS / RESUMEN
 SANITARY INSTALLATIONS / FIRE / SUMMARY
 - CANTIDADES DE OBRA.
 QUANTITIES

ACCESSORY ACCESORIO	DIAMETER DIA mm	UNIT UNIDAD	QUANTITY CANTIDAD
CODS 90°	65	U	8.0
BEND 90°	50	"	4.0
	40	"	31.0
TEE	65	U	9.0
TEE PIPE	50	"	2.0
	40	"	2.0
UNIVERSAL	65	U	41.0
UNIVERSAL JOINT	50	"	10.0
	40	"	41.0
REDUCERS	65-50	U	5.0
REDUCER	50-40	"	8.0
	65-40	"	3.0
JUNTA DE EXPANSION	65	U	2.0
EXPANSION JOINT	50	"	1.0
	40	"	2.0
VALVULAS			
DE CANTONERA	65	U	3.0
GATE VALVE	40	U	1.0
VALVULA CHECK	65	U	2.0
CHECK VALVE	40	U	1.0
EXTINGUISHERS		U	2.0
EXTINGUISHER			
CAJETINES (BOX)		U	13.0
HYDRANT BOX			
HANOMETRO		U	1.0
PRESSURE GAUGE			
SOPORTES	65	U	193
SUPPORT	50	"	29
	40	"	49

ACCESSORY ACCESORIO	DIAMETER DIA	UNIT UNIDAD	QUANTITY CANTIDAD
TUBERIA	65	M	48.61
PIPE	50	M	28.51
	40	M	193.3
(*) TUBERIA	65	M	130.31
TOTAL	50	M	42.84
TOTAL PIPE	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

Revision	Checked by Revisado por	Date (Fecha)	Approved by: Aprobado por:	Date (Fecha)	Revision	Checked by: Revisado por	Date (fecha)	Approved by: Aprobado por:	Date (Fecha) Aprobado por:

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)

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

INSTALACIONES SANITARIAS. / DESAGUE		AMBIENTE / ENVIRONMENT					TOTAL	MTCO. PRICE
CANTIDADES DE OBRA. INTERIORES. INCLUYE HASTA LA OJTA DE REVISION		SHOWER ROOM	KITCHEN	RESTROOM	DATEENY ROOM			
QUANTITIES INTERIOR, INCLUDING UNTIL CATCH BASIN				SK	WENCETES	LAVAJOS		
ACCESORIO. ACCESSORY	φ mm							
- VUEJILLA. FLOOR TRAP	50 75	┌					6	2224
- SIFON SIFON U	50 75	┌					2	2228
- ADAPTADOR PARA SIFON ADAPTER FOR SIFON	φ 50mm & 1 1/2"				┌	┌	6	248
- CODO 45° BEND.	50 75 110						5	5810
- CODO 90° BEND	50 75 110	┌	┌		▣	▣	15	990
- REDUCER REDUCER	2" φ 50 & 50 110 & 50 110 & 75						4	1685
- JOINT UNION	50 75 110		┌		▣	▣	11	561
- YEE YEE	50 75 110	┌	┌		▣	▣	13	682
- REDUCER YEE YEE REDUCTORA	2" φ 75 & 50 110 & 50 110 & 75						6	1122
- CODO 90° CON RAMAL DE VENTILACION (B) BEND 90° WITH VENT BRANCH.							5	1304
- TUBERIA DE DRENAJE (A) DRAINAGE PIPE		2.40	3.60	1.80	3.2	3.5	14.5	8250
φ 50 mm		3.14	2.70	5.14	2.45	4.48	6.70	24.61
φ 75 mm					7.09		7.09	2035
φ 110 mm							2	2842
- SIFON SIFON	1 1/2"				┌			

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1-3-39

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

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

SEVERINO PUMPING STATION (ESTACION DE BOMBEO SEVERINO)

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 Calculado por: _____
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INSTALACIONES SANITARIAS / DESAGUE

CANTIDADES DE OBRA
 QUANTITIES

LONGITUD DE TUBERIAS
 PIPE LENGTH

- SHOWER ROOM

$\phi 50 \text{ --- } 1.70 + 0.70 = 2.40$

$\phi 75 \text{ --- } 1.20, 0.194, 1.65 = 3.144$

$\phi 110 \text{ ---}$

- KITCHEN

$\phi 50 \text{ --- } 0.5, 1.4, 1.70 = 3.60$

$\phi 75 \text{ --- } 0.25, 0.20, 1.65 = 2.10$

- RESTROOM

SK $\phi 50 \text{ --- } 1.80, = 1.80$

$\phi 75 \text{ --- } 2.80, 0.50, 0.192, 1.65 = 5.14$

URINALS

$\phi 50 \text{ --- } 0.35, 0.5, 0.55, 0.75, 0.5, 0.55 = 3.2$

$\phi 75 \text{ --- } 0.5, 1.95, = 2.45$

$\phi 110 \text{ --- } 1.2, 1.65, 1.75, 0.20, 0.148, 2.10 = 7.04$

LOVATORY SINK

LAVALO. $\phi 50 \text{ --- } 0.50, 0.80, 0.5, 1.15, 0.55 = 3.5$

$\phi 75 \text{ --- } 0.75, 1.9, 0.18, 1.65 = 4.48$

- BATTERY ROOM

$\phi 75 \text{ mm --- } L = 6.20 + 0.50 = 6.70 \text{ m}$

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INSTALACIONES SANITARIAS / DRAINAGE
 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. $\phi 50 \text{ mm} - 2750 //$
 COST OF THE PIPE PER METER $\phi 75 \text{ mm} - 6123.3 //$
 $\phi 110 \text{ mm} - 6783.30 //$

CALCULO DE LA TUBERIA EQUIVALENTE
 CALCULATION OF EQUIVALENT PIPE

ACCESSORY ACCESORIO	NO	EQUIVALENT LENGTH LONGITUD EQUIVALENTE (m)
		16.0 ✓
REJILLA FLOOR TRAP $\phi 50$	6 x 7338 / 2750	2.4 ✓
$\phi 75$	7 x 7338 / 6123.3	5.4 ✓
SIFON SIPHON $\phi 50$	6 x 2486 / 2750	0.9 ✓
$\phi 75$	1 x 5810 / 6123.3	3.1 ✓
ADAPTADOR ADAPTER $\phi 50$	5 x 1683 / 2750	0.3 ✓
$\phi 75$	1 x 1551 / 6123.3	5.4 ✓
BEND 45° BEND 45° 50	15 x 990 / 2750	2.5 ✓
$\phi 75$	10 x 1551 / 6123.3	0.79 ✓
BEND 90° BEND 90° 110	2 x 2673 / 6783.3	2.4 ✓
REDUCIDOR 75-50 REDUCER 50	4 x 1683 / 2750	2.24 ✓
UNION JOINT 50	11 x 581 / 2750	1.40 ✓
$\phi 75$	13 x 682 / 6123.3	0.99 ✓
$\phi 110$	6 x 1122 / 6783.30	2.50 ✓
YEE 50	5 x 1369 / 2750	0.70 ✓
YEE PIPE 110	1 x 4578 / 6783.3	2.2 ✓
YEE REDUCIDOR 75/50 REDUCER YEE 50	2 x 2097 / 2750	
SIFON $\phi 1 1/2$ SIPHON 50	2 x $\frac{24420}{2750}$	2.67

$\phi 50 \rightarrow \boxed{59.94} + 14.5 = \boxed{74.44} //$
 $\phi 75 \rightarrow \boxed{17.50} + 24.61 = \boxed{32.11} //$
 $\phi 110 \rightarrow \boxed{2.48} + 7.00 = \boxed{9.57} //$

JICA STUDY TEAM - GRUPO DE ESTUDIOS JICA

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

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INSTALACIONES SANITARIAS / DRAINAGE
 SANITARY INSTALLATIONS / DRAINAGE

— REJILLAS DE PISO Y TRAMPAS DE LIMPIEZA.
 FLOOR TRAP AND FLOOR CLEANOUT

SE COLOCARAN 5 REJILLAS DE PISO } 3 → RESTROOM
 SHALL ARRANGE 5 FLOOR TRAP. } 1 → KITCHEN
 } 1 → SHOWER ROOM

+ TRAMPAS DE LIMPIEZA / FLOOR CLEANOUT

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

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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 / DECAQUE
 SANITARY INSTALLATIONS / DRAINAGE
 CANTIDADES DE OBRA / EXTERIOR
 QUANTITIES / EXTERIOR

LONGITUD DE TUBERIA PVC
 PVC PIPE LENGTH

FROM	TO	Ø 75mm	Ø 100mm
DE C-5	à C-4	5.7	
C-1	à C-2	2.70	
C-2	à C-3		9.0
C-3	à C-4		9.70
C-4	à C-6		6.70
C-6	à C-7		3.40
C-7	à TANQUE SEPTICO SEPTIC TANK		1.10
CH-1	à TANQUE SEPTICO SEPTIC TANK		0.60

8.4 ✓ 30.50 u ✓

CONNECTION OF SEPTIC TANK TO UNLOADING
 ENLACE DE TANQUE SEPTICO A DESCARGA. Ø 100mm

DE	TAU SEPT	TO	Ø	LENGTH
		C-8		1.0
FROM	C-8	à C-9		3.5
	C-9	à C-10		9.0
	C-10	à C-11		9.0
	C-11	à C-12		9.0
	C-12	à C-13		10.0
	C-13	à C-14		10.0
	C-14	à DESCARGA		0.0

61.50 u ✓

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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:

Sheet

Hoja

of

de

INSTALACIONES SANITARIAS / DRAJAGE Y VENTILACION / RESUMEN.
 SANITARY INSTALLATIONS. / DRAINAGE AND VENTILATION / **SUMMARY**
 CANTIDADES DE OBRA.
 QUANTITIES.

ACCESORIO ACCESSORY	DIA DIAMETER (MM)	UNID. UNIT	CANTIDAD. QUANTITIES	ACCESORIO ACCESSORY	DIA DIAMETER (MM)	UNID. UNIT	CANTIDAD. QUANTITIES
REJILLA FLOOR TRAP	50 75	U U	6 2	TUBERIA PIPE	50 75 110	M M M	27.0 24.6 7.1
SIFON SIPHON	50 75	U U	6 1	(*) TUBERIA TOTAL	50 75	M M	91.0 32.0
ADAPTADOR ADAPTER	50-1/2"	U	5	TOTAL PIPE	110	M	102.0
CODO 45° BEND 45°	75	U	1	TRAMPAS DE LIMPIEZA	50 75	M M	5.0 3.0
CODO 90° BEND 90°	50 75 110	U U U	21 10 2	FLOOR CLEANOUT	110	M	3.0
REDUCTOR REDUCER	75-50	U	4	SOMBRETE CAP.	80	U	1.0
UNION JOINT	50 75 110	U U U	11 13 6	(*) NOTA: LA TUBERIA TOTAL INCLUYE LA LONGITUD DE LA TUBERIA Y LA EQUIVALENTE POR ACCESORIOS, NO INCLUYE REJILLAS, TRAMPAS DE LIMPIEZA			
YEE YEE/PIPE	50 110	U U	5 1	NOTE: THE TOTAL PIPE INCLUDE THE PIPE LENGTH AND THE EQUIVALENT LENGTH FOR ACCESSORIES, NOT INCLUDE FLOOR TRAP AND FLOOR CLEANOUT.			
YEE REDUCTORA REDUCER YEE	75-50 110-75	U U	2 1				
SIFON SIPHON	1/2"	U	2				
CODO 90° ON RAMAL VENTILACION BEND 90° WITH VENT BRANCH	110 50	U U	2 5				
TEE PIPE							

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2. Tuberia de Carga

Penstock

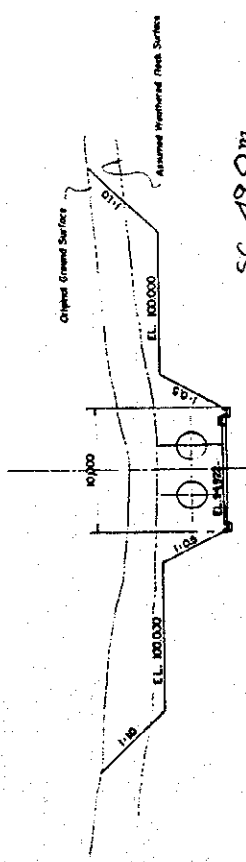
Working Division: 3. Severino Penstock

Description	Calculation Details	Unit	Quantity	Remarks
3.1 EARTHWORK				
101	Clearing the site	m ²	2416	see calculation paper and sections attached.
102	Open-cut excavation, in common, for penstock line	m ³	5.771	
103	Open-cut excavation, in weathered rock, for penstock line			
	weathered rock & rock	m ³	7.008	
	of which 95% for weathered rock			
	$7.008 \times 0.95 =$	m ³	6.658	
104	Open-cut excavation, in rock, for penstock line			
	5% for rock			
	$7.008 \times 0.05 =$	m ³	350	
106	Sod facing for cut slope protection	m ²	584	

Penstock Earth Work

Sec. No.	Distance (m)	Site Clearance		Excavation, common		Excavation, w. rock & rock		Sod Facing	
		L (m)	A (m ²)	A (m ²)	V (m ³)	A (m ²)	V (m ³)	L (m)	A (m ²)
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	6.202	34.4	207.5	94.5	493.4	116.5	725.9	10.7	60.2
(Head Tank)									
Total			2,416		5,771		7,008		584

No. 3+1.250

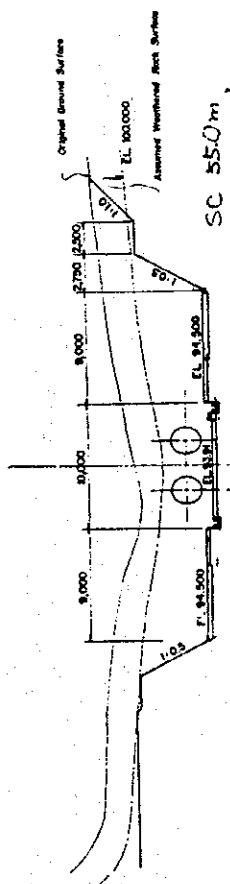


SC 49.0 m
 EC 125.4 m²
 ER 105.6 m²
 SF 14.8 m

DL 100,000

DL 90,000

No. 2+17.667

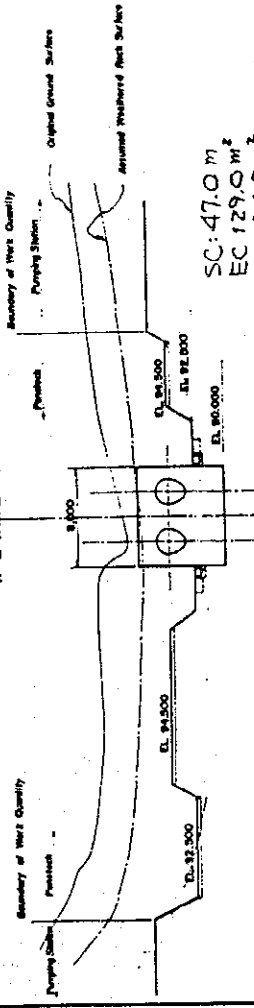


SC 55.0 m
 EC 124.4 m²
 ER 156.1 m²
 SF 5.0 m

DL 95,000

DL 90,000

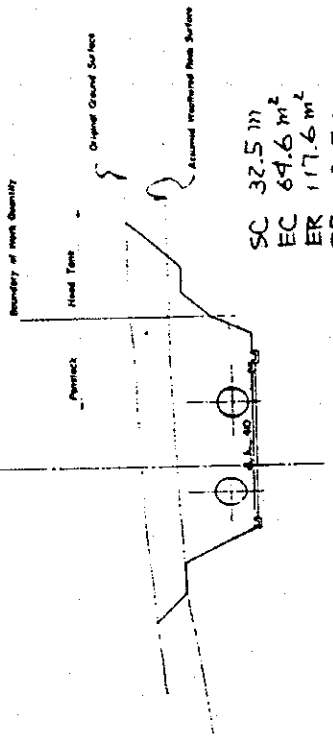
IP 2 (No. 2+9.250)



SC 47.0 m
 EC 129.0 m²
 ER 196.2 m²
 SF 0 m

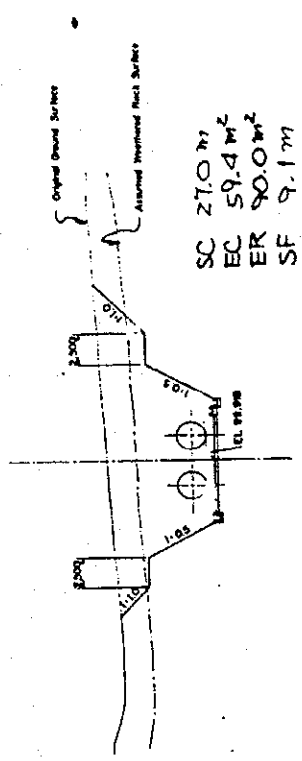
DL 85,000

IP 3



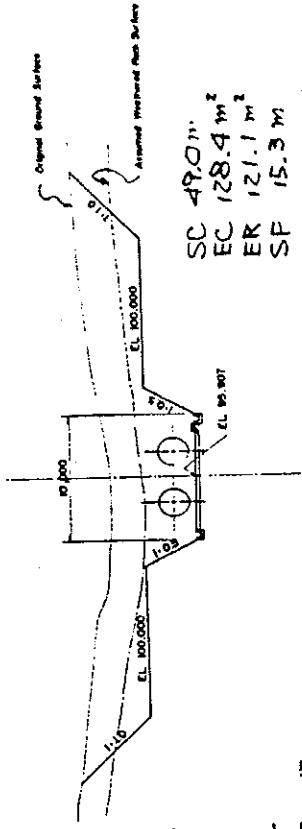
SC 32.5 m
 EC 69.6 m²
 ER 117.6 m²
 SF 8.7 m

No. 4



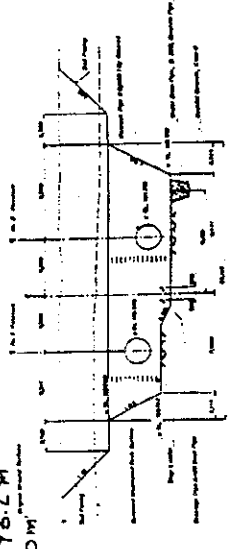
SC 27.0 m
 EC 59.4 m²
 ER 90.0 m²
 SF 9.1 m

No. 3+2.450



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



SCALE A
 SCALE B
 0 10 20 m

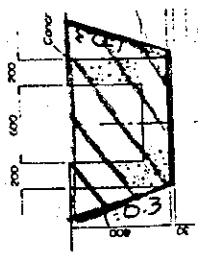
SECTION A-A

1:1000
 2: No. 4, 1:1000
 3: No. 3, 1:1000
 4: No. 2, 1:1000

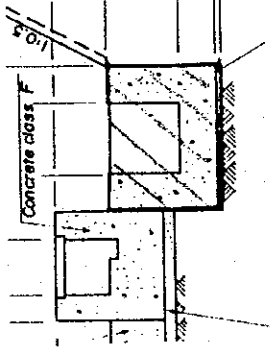
ATTORNEYS:
 TCM
 TCM
 TCM
 TCM

Working Division:

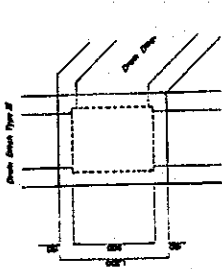
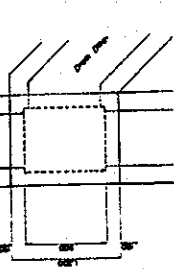
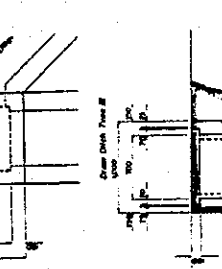
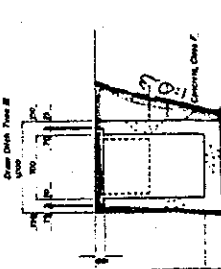
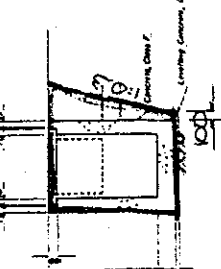
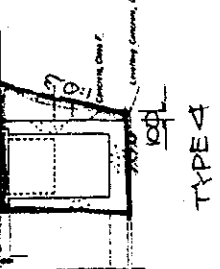
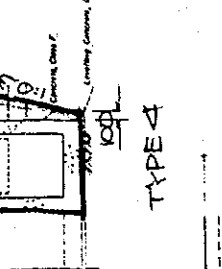
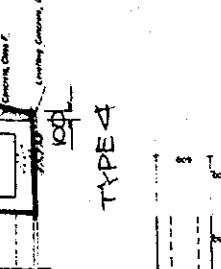
Description	Calculation Details	Unit	Quantity	Remarks
105	Trench excavation, in all classes, for side ditch and catch basin			
-	for side ditch			
	• Type III (drain ditch)			
	$l = \sqrt{7.745^2 + (2.5 + \sqrt{7.5^2 + 3.75^2})^2} \times 3$			
	$+ \sqrt{0.88^2 + 0.441^2} \times 5 \times 1.09 \times 2$			
	$= 72.773 \text{ m}$			
	$A = 0.83 \times 1.0 = 0.83 \text{ m}^2$			
	$V = 0.83 \times 72.773 =$	60.4 m^3		
	• along (penstock line)			
	$l = 60.243 + 3.0 + 78.626 + 10.0$			
	IP1-2, IP1-3 IP2-2, IP2-3 152 m			
	$A = 0.63 \times 0.8 = 0.504 \text{ m}^2$			
	$V = 0.504 \times 152 =$	76.6 m^3		
	Subtotal		137 m^3	



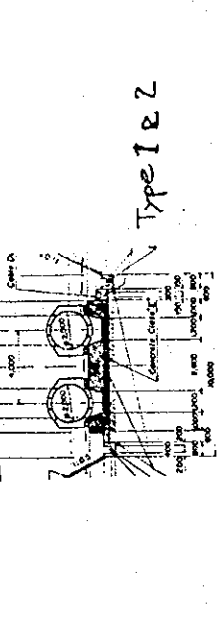
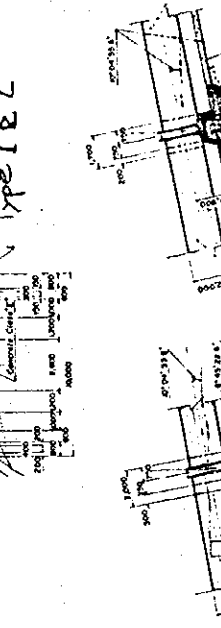
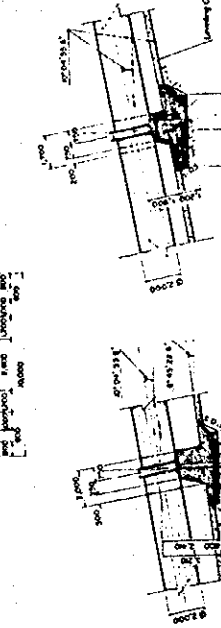
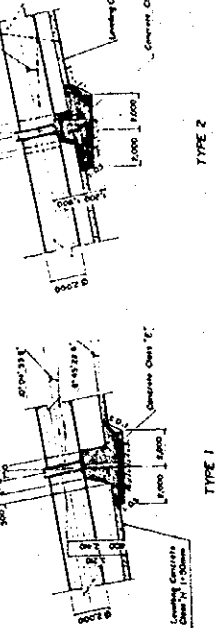

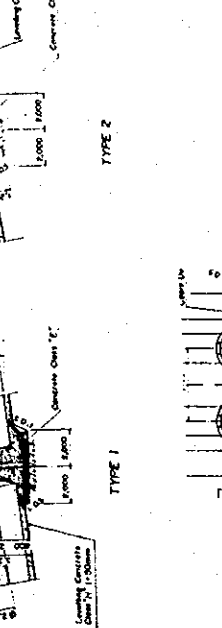
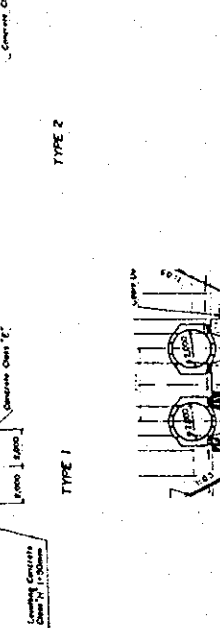
Location is shown on the drawings.



Working Division:

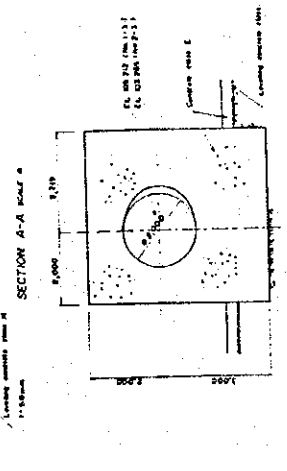
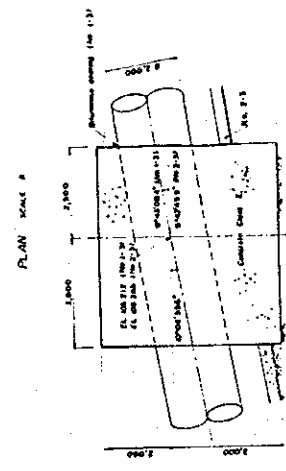
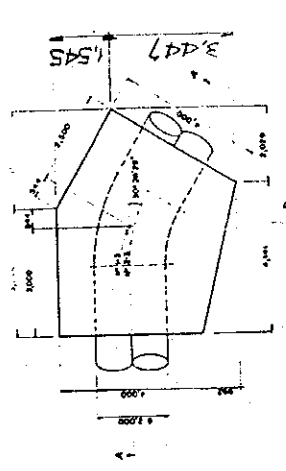
Description	Calculation Details	Unit	Quantity	Remarks
-	for catch basin			
Type 2	6 nos			
	$1.0 \times 1.0 \times 1.43 \times 6$		= 9 m ³	
Type 4	2 nos.			
	$1.0 \times 1.2 \times 1.43 \times 2$		= 3.5 m ³	
	Catch basin of Penstock Line : 2 nos.			
	$0.8 \times 0.8 \times 1.85 \times 2$		= 2.4 m ³	
	$\frac{1.4106}{2} \times 1.0 \times 2$		= 2.0	
	Sub total		17 m ³	
	Total		137 + 17 = 154 m ³	

Working Division: 3.2 Concrete Works

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

Working Division:

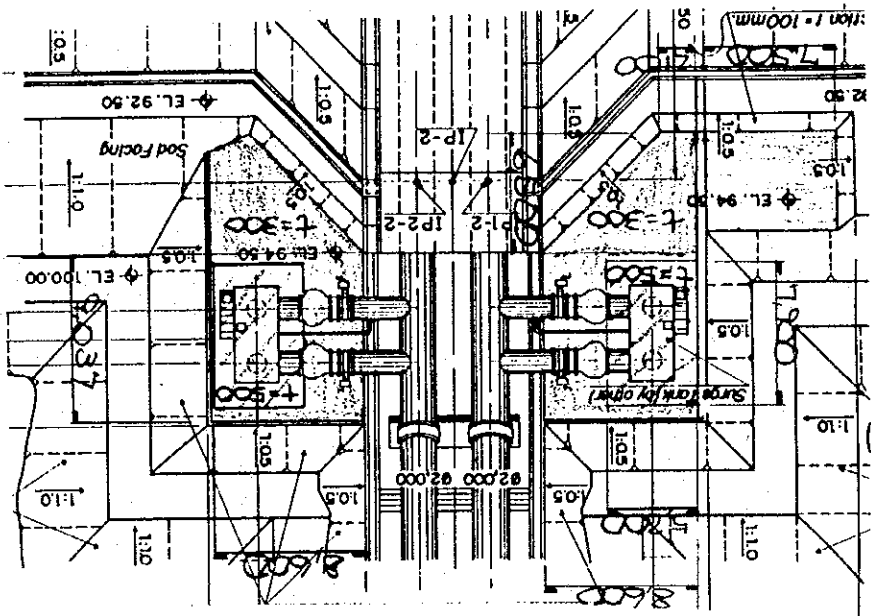
Description	Calculation Details	Unit	Quantity	Remarks
102	Concrete, class E, for anchor block			
	$V = 4.992 \times 6.170$			
	$- \frac{1}{2} \times (0.992 \times 4.14) + 2.029 \times 3.447 + (2.626 \times 1.545)$			
	$\times 5.0 \times 2 \text{ nos.}$			
	$= 232 \text{ m}^3$			

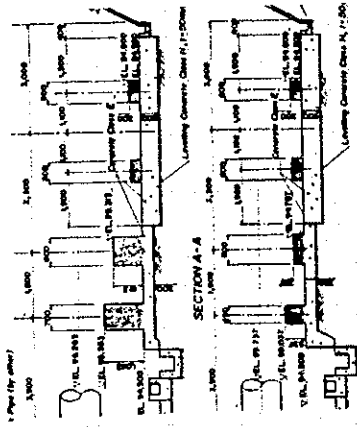
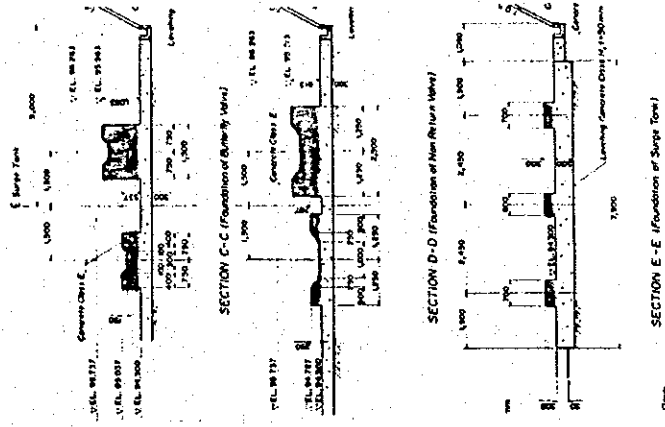


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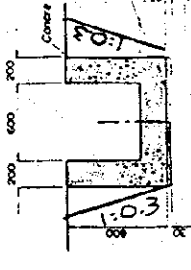
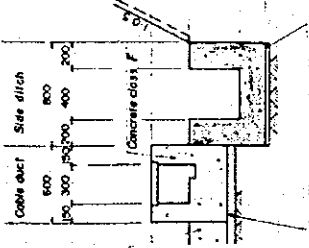
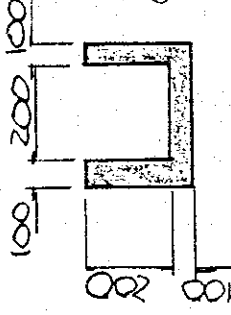
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
103 Concrete, class F, for foundation of surge tank and valves				
- slab	$t = 300$ $A = 5.2 \times 7.9 \times 2 = 82.16 \text{ m}^2$ $V = 0.5 \times 82.16 = 41.08 \text{ m}^3$			
①	$A = 8.6 \times 9.037 \times 2 + 7.5 \times 5.5$ $+ \frac{8.6 + 2.1}{2} \times 6.5 + \frac{1}{2} \times 8.6 \times 6.5$ $+ \frac{1}{2} \times 5.5 \times 2.6 - 82.16$ $= 184.40 \text{ m}^2$ $V = 184.40 \times 0.3 = 55.32 \text{ m}^3$			
②	$\frac{0.250 + 0.659}{2} \times 0.818 \times 9.037 \times \frac{1}{2}$ $= 1.68 \text{ m}^3$			
	Sub total		227 m ³	

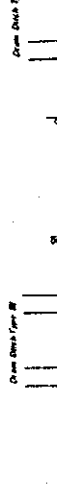
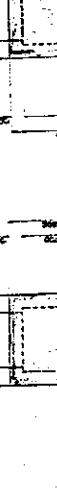

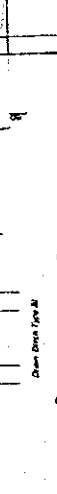
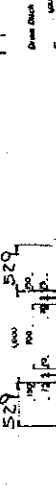







Description	Calculation Details	Unit	Quantity	Remarks
-	Foundation of butterfly valve $\left\{ \frac{0.537 \times 1.5 - \frac{0.7+0.5}{2} \times 0.15}{1} \times 0.45 \right. \\ \left. + \frac{1.063 \times 1.5 - \frac{0.7+0.5}{2} \times 0.15}{1} \times 0.7 \right\} \times 2 \\ = 2.8 \text{ m}^3$			
-	Foundation of Non return valve $\left\{ \frac{0.287 \times 2.5 - \frac{1.5+1.0}{2} \times 0.25}{1} \right. \\ \left. + \frac{0.813 \times 2.5 - \frac{1.5+1.0}{2} \times 0.25}{1} \right\} \times 0.8 \times 2 \\ = 3.4 \text{ m}^3$			
-	Foundation of surge tank $0.3 \times (0.7 + 0.6 + 0.7) \times (0.6 + 0.6) \times 2 \\ = 1.44 \text{ m}^3$			
Total	$227 + 2.8 + 3.4 + 1.4 = 235 \text{ m}^3$			

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			
	$V = (0.2 \times 0.6 \times 2 + 1.0 \times 0.2) \times 72.773$ $= 32.0 \text{ m}^3$			
	along penstock D=152 m			
	$V = (0.2 \times 0.4 \times 2 + 0.8 \times 0.2) \times 152$ $= 48.6 \text{ m}^3$			
	around surge tank D = (9.0 + 19.437) x 2 = 57 m			
	$V = 0.1 \times (0.2 + 0.4 + 0.2) \times 57 = 4.6 \text{ m}^3$			
	sub total		85.2 m ³	

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for catch basin			
Type 2	6 nos			
	$\{0.15 \times (1.0 + 0.7) \times 2 \times 1.2 + 0.2 \times 1.0 \times 1.0 + 0.84 \times 0.84 \times 0.1 - 0.6 \times 0.6 \times 0.15 \times 2\} \times 6$ $= 4.6 \text{ m}^3$			
Type 4	2 nos			
	$\{0.15 \times (1.0 + 0.9) \times 2 \times 1.2 + 0.2 \times 1.0 \times 1.2 + 0.84 \times 1.04 \times 0.1 - 0.6 \times 0.6 \times 0.15\} \times 2$ $= 1.9 \text{ m}^3$			
	Penstock catch basin	2 nos.		
	$0.15 \times (0.8 + 0.5) \times 2 \times 1.65 + 0.2 \times 0.8 \times 0.8$ $+ 0.64 \times 0.64 \times 0.1 = 0.8 \text{ m}^3$			
	$(0.8 \times 0.3 + 1.0 \times 0.3 + 1.2 \times 0.3 + 1.4 \times 1.05) \times 0.8 - 0.4 \times 0.4 \times 1.05 = 1.7 \text{ m}^3$			
	Sub total		9 m ³	
	Total		85.2 + 9.0 = 94.2 m ³	

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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 $t=50$			
	$l=64m, w=7.2m$			
	$V = 0.05 \times 64 \times 7.2 =$		23.0 m ³	
	stair portion			
	$V = 1.2 \times 7.2 \times 0.05 =$		0.4 m ³	
	sub total		23.4 m ³	
	- foundation of surge tank			
	$A = 82.16 + 184.40 = 266.56 m^2$			
	$V = 0.05 \times 266.56 =$		13.3 m ³	
	- side ditch			
	Type II $0.03 \times 1.0 \times 72.773 =$		2.2 m ³	
	Penstock line $0.03 \times 0.8 \times 152 =$		3.6 m ³	
	Surge tank $0.03 \times 0.4 \times 57 =$		0.7 m ³	
	sub total		6.5 m ³	
	- catch basin			
	Type 2 $6 \times 1.0 \times 1.0 \times 0.03 =$		0.2 m ³	
	Type 4 $2 \times 1.0 \times 1.2 \times 0.03 =$		0.1 m ³	
	penstock $2 \times 0.8 \times 0.8 \times 0.03 =$		0.04	
	$2 \times 1.05 \times 0.8 \times 0.03 =$		0.05	
	sub total		0.4 m ³	

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
108	Formwork F1 finish for concrete of item 101 and 105			
-	for 105			
-	for side ditch			
	Type III $l = 72.773 \text{ m}$			
	$(0.8 \times 2) \times 72.773 = 116.44 \text{ m}^2$			
	Penstock Line $l = 152 \text{ m}$			
	$(0.6 \times 2) \times 152 = 182.40$			
	sub total 298.84 m^2			
-	for catch basin			
	Type 2 6 nos			
	$(1.6 \times 1.4 \times 4 - 0.6 \times 0.6 \times 2) \times 6 = 29.28 \text{ m}^2$			
	Type 4 2 nos			
	$\{(1.0 \times 1.4 + 1.2 \times 1.4) \times 2 - 0.6 \times 0.6 \times 2 - 0.8 \times 0.6\} \times 2 = 9.92 \text{ m}^2$			
	Penstock Line 2 nos			
	$\{1.85 \times 0.8 \times 4 + (0.8 \times 0.3 + 1.0 \times 0.3 + 1.2 \times 0.3 + 1.4 \times 0.15) \times 2\} \times 2 = 16.28 \text{ m}^2$			
	sub total 55.48 m^2			
	for 105 Total $298.84 + 55.48$			
	$= 354.32 \text{ m}^2$			

see figures of concrete work

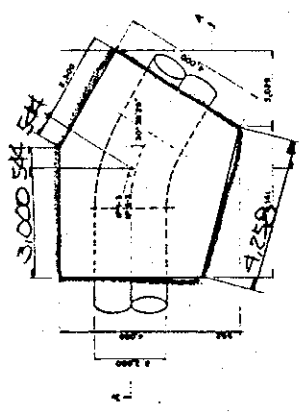
see figures of concrete work

Working Division:

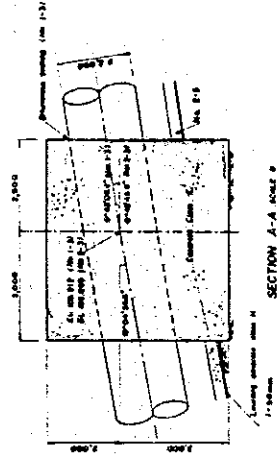
Description	Calculation Details	Unit	Quantity	Remarks
-	for 101			see figure of concrete work
	for contraction joint 4 portion			
	$0.3 \times 7.2 \times 4 =$		8.64m ²	
	Total		$354.32 + 8.64 = 362.96 \text{ m}^2$	

Working Division:

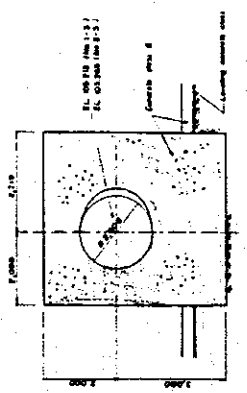
Description	Calculation Details	Unit	Quantity	Remarks
-	for /oz			
	$(3.544 + 3.044 + 4.0 + 4.0 + 4.258 - \frac{1}{4} \times 2.0^2 \times 2)$ $\times 3.0 \times 2$			
	$= 75.38 \text{ m}^2$			



PLAN SCALE 1/4"

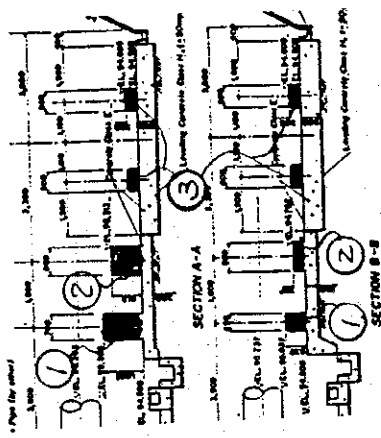
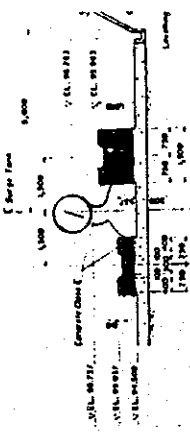
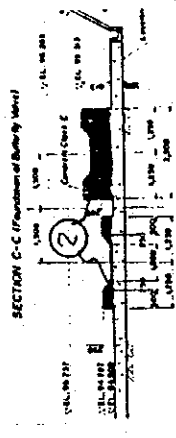
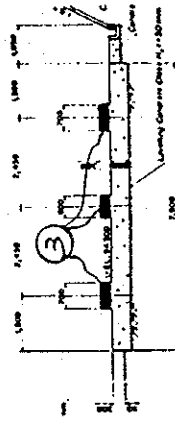


SECTION A-A SCALE 1/4"

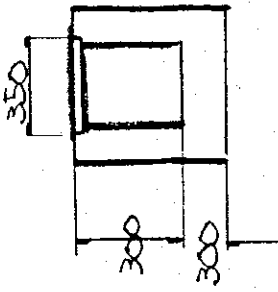


SECTION B-B SCALE 1/4"

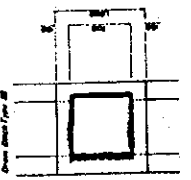
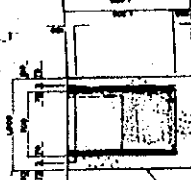
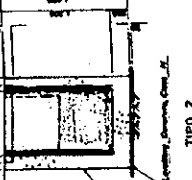
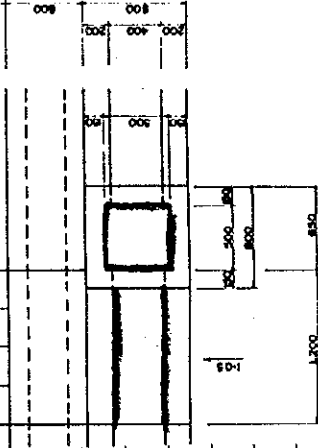
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for 103			
①	Foundation of butterfly valve $\left\{ \frac{1.063 \times 1.5 - \frac{0.5 \times 0.7}{2} \times 0.15}{2} + 1.063 \times 0.7 \right\} \times 2 = 4.50 \text{ m}^2$			
	$\left\{ \frac{0.537 \times 1.5 - \frac{0.5 \times 0.7}{2} \times 0.15}{2} + 0.537 \times 1.5 \right\} \times 2 = 3.04 \text{ m}^2$			
②	Foundation of Non return valve			
	$\left\{ 0.813 \times 2.5 - \frac{1.5 + 1.0}{2} \times 0.25 \right\} + 0.813 \times 0.8 \times 2 = 4.74 \text{ m}^2$			
	$\left\{ 0.287 \times 2.5 - \frac{1.5 + 1.0}{2} \times 0.25 \right\} + 0.287 \times 0.8 \times 2 = 2.11 \text{ m}^2$			
③	Foundation of surge tank $(0.7 \times 0.3 \times 2 + 0.3 \times 0.6 \times 2) \times 4 + (0.6 \times 0.3 \times 2 + 0.3 \times 0.6 \times 2) \times 2 = 4.56 \text{ m}^2$			
	Total of for 103		18.95 m ²	

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
- for 106	R = 60m			
	$(0.35 \times 2 + 0.3 \times 4 + 0.3 \times 2) \times 60$ $= 150 \text{ m}^2$			
	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
-	for catch basin			
	Type 2 6 nos			
	$(0.7 \times 1.2 \times 4 - 0.6 \times 0.6 \times 2) \times 6$			
			$= 15.84 \text{ m}^2$	TIPO 2 TIPO 2
	Type 4 2 nos			
	$(0.9 \times 2 + 0.7 \times 2) \times 1.2 \times 2$			
	Penstock Line 2 nos		$= 7.68 \text{ m}^2$	
	$(0.5 \times 1.65 \times 4 - 0.4 \times 0.4 \times 2) \times 2$			TYPE 4
			$= 5.96 \text{ m}^2$	
	$1.05 \times 0.4 \times 3 \times 2$		$= 2.52 \text{ m}^2$	
	sub total		32.00 m^2	
	Total		263.73 m^2	PENSTOCK LINE

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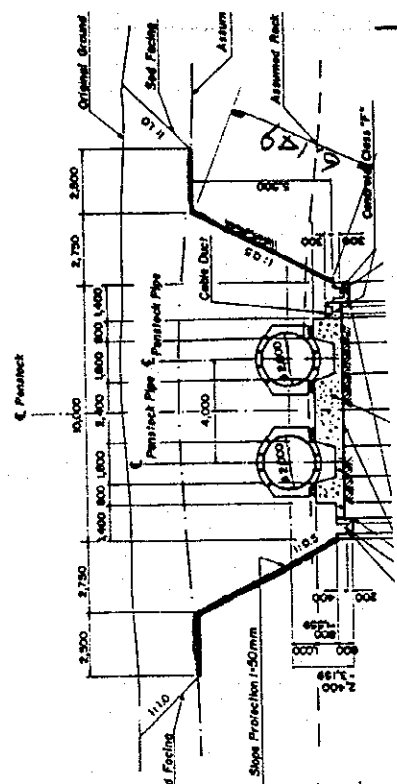
Working Division:

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

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
116	Shotcrete with wire mesh for cut slope protection along penstock line, t = 50 mm			
	$l = 134 \text{ m}$			
	$A = (6.139 + 2.5) \times 134 = 1,158 \text{ m}^2$			



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 $w = 2.98 \text{ kg/m}$			
	$l = 1.26 \text{ m/no.}$ ladder 5 nos			
	$W = 1.26 \times 5 \times 2.98 = 18.8 \text{ kg}$			

