

CARACTERÍSTICAS DE LOS CONDUCTOS HIDRÁULICOS EN LAS CUENCAS DE LOS RÍOS CURUNDÚ Y MARÍA SALAS

Ducto	Descripción		Símbolo	Valor	Unidad	Cuenca
Canal de cauce irregular	longitud			125.00	m	
	Cajón doble que cruza patio del ferrocarril y la calle Diablo					
	longitud			89.60	m	
				6.10x1.96	m	
	sección rectangular doble, de hormigón					
	Elevación de la solera de entrada			0.93	msnm	
				0.92	msnm	
	pendiente de la alcantarilla		S	0.00011		
	Elevación de la solera de salida			1.27		
				0.96		
	pendiente de la alcantarilla		S	-0.00379		
				-0.0004		
	Oscilaciones de la marea	mínima		-2.27	msnm	
		máxima		3.22	msnm	
Canal subterráneo	nivel mínimo de inundación ¹			4.50	msnm	
	Cuenca del río Curundú			01-1 a 01-4		
	Cuenca del río María Salas			02-1 a 02-3		
	Área sur del área de estudio			03		
	Aportes externos		01-3-2, 01-3-3 y 02-1-2			
	longitud		Lcms		m	
	Elevaciones	entrada			msnm	
		salida			msnm	
	pendiente del canal					
	sección mixta (trapezoidal y rectangular)					
	Coeficiente de talud		m		m	
	Ancho en el fondo, sección inferior					
	Ancho entre bordes final sección trapezoidal					
	Ancho entre bordes superiores sección rectangular					
	rugosidad canal con revestimiento de hormigón		n			2.30
	Profundidad, sección inferior					
Alcantarilla de cajón doble 2.44 x 1.83	longitud		Lcms	385.18	m	4-11
	Elevaciones	entrada		3.91	msnm	
		salida		2.18	msnm	
		cabezal		6.30	msnm	
	Pendiente			0.00449		
	Ancho en el fondo		2 x	2.44	m	
	Profundidad,			1.83		
	rugosidad canal con revestimiento de hormigón		n	0.01300		
Canal Sección X	longitud		Lcms	22.00	m	
	Elevaciones	entrada		2.18	msnm	
		salida		1.47	msnm	
	pendiente del canal			0.03227		
	sección trapezoidal					
	Coeficiente de talud		m	0.64		
	Ancho en el fondo			4.50	m	
	Profundidad			2.50	m	
	rugosidad canal con revestimiento de hormigón		n	0.01300		

CARACTERÍSTICAS DE LOS CONDUCTOS HIDRÁULICOS EN LAS CUENCAS DE LOS RÍOS CURUNDÚ Y MARÍA SALAS

Ducto	Descripción	Símbolo	Valor	Unidad	Cuenca
Canal Río Curundú /Salida de cajón B, patio de ferrocarriles	longitud	Lcms	10.50	m	
	Elevaciones		0.65	msnm	
				msnm	
	pendiente del canal		0.06190		
	sección trapezoidal				
	Coeficiente de talud	m			
	Ancho en el fondo		7.00	m	
	Profundidad			m	
	rugosidad canal con revestimiento de hormigón	n	0.01300		
Canal río María Salas /Salida de cajón B, patio de ferrocarriles	longitud	Lcms	7.50	m	
	Elevaciones		0.65	msnm	
				msnm	
	pendiente del canal		0.08667		
	sección trapezoidal				
	Coeficiente de talud	m			
	Ancho en el fondo		10.35	m	
	Profundidad			m	
	rugosidad canal con revestimiento de hormigón	n	0.01300		

¹ Guardia, F., Informe de Drenaje Pluvial II, Ciudad de Panamá

² no pudo ser obtenida la elevación exacta

CUADRO 1-2
CARACTERÍSTICAS GEOMÉTRICAS DE LOS CONDUCTOS HIDRÁULICOS Y
SISTEMAS ASUMIDOS DE ELEVACIONES DEL TERRENO

Item	Descripción	Conductos Hidráulicos			Observaciones
		viejo	viejo	nuevo	

1 ESTRUCTURA EXISTENTE

1.1 Elevaciones Originales

1.1.1	Elevaciones de la solera				
1.1.1a	entrada	2.750	2.500	1.610	msnm
1.1.1b	salida	1.000	-1.710	-0.914	msnm
1.1.2	Longitud de los conductos	1,465.000	2,103.000	2,103.490	m
1.1.3	Pendiente del fondo	0.001195	0.002002	0.001200	m
1.1.4	Nivel de marea máxima			3.327	msnm
1.1.5	Cota del terreno en la entrada de conductos			6.130	msnm

1.2 Elevaciones ajustadas (cota -1.71 = 0)

1.2.1	entrada	4.460	4.210	3.320	msnm
1.2.2	salida	2.710	0.000	0.796	msnm
1.2.3	Nivel de marea máxima			5.037	msnm
1.2.4	Cota del terreno en la etrada de conductos			7.840	msnm
1.3	Prolongación de conductos ⁽¹⁾	desde	1+940	1,940	m
1.3.1		longitud	563.700	564	m
1.3.2	Elevaciones de la solera			2,504	m
1.3.2a	entrada	-1.384	-0.718	msnm	
1.3.2b	salida	-2.512	-1.394	msnm	

1.4 Elevaciones ajustadas

1.4.1	entrada del conducto total	5.012	4.122	msnm
1.4.2	salida	0.000	1.118	msnm
1.4.3	Verificación			
1.4.3a	salida	-2.512	-1.394	msnm
1.4.3b		0.000	1.118	msnm
1.4.4	Nivel de marea máxima		5.839	msnm
1.4.5	Cota del terreno en la etrada de conductos		8.642	msnm

CUADRO 1-2
CARACTERÍSTICAS GEOMÉTRICAS DE LOS CONDUCTOS HIDRÁULICOS Y
SISTEMAS ASUMIDOS DE ELEVACIONES DEL TERRENO

Item	Descripción	Conductos Hidráulicos			Observaciones
		viejo viejo	viejo nuevo	nuevo	

3 CONDUCTO NUEVO RÍO CURUNDÚ + MARÍA SALAS

3.1.1	Inicio de conducto		563.700		
3.1.2	Final del conducto		1,067.000		
3.1.3	Longitud del conducto		503.300		
3.1.4	pendiente del fondo del canal		0.0005		
3.1.5	Elevaciones				
3.1.5a	Entrada		-2.512	msnm	0.252
3.1.5b	salida		-2.764	msnm	0.000
3.1.6	Nivel del terreno en la entrada de los ductos		6.130	msnm	8.894
3.1.7	Nivel máximo de mareas		3.327	msnm	5.644
3.1.8	Nivel del terreno en el área del puerto		6.970	msnm	9.734
3.1.9	Nivel del pavimento del patio de contenedores		7.310	msnm	10.074

nuevo sistema de elevaciones

⁽¹⁾ Estacionamiento con origen en la entrada de los conductos hidráulicos

⁽²⁾ Estacionamiento desde el inicio de la prolongación del conducto, 1 + 940

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q = 213 m³/s

1

CURRENT DATE: 10-15-2005
CURRENT TIME: 16:27:40

FILE DATE: 10-15-2005
FILE NAME: BALBOA

FHWA CULVERT ANALYSIS HY-8, VERSION 6.1

C U L V E R T N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (m)	OUTLET ELEV. (m)	CULVERT LENGTH (m)	BARRELS SHAPE MATERIAL	SPAN (mm)	RISE (mm)	MANNING n	INLET TYPE
1	4.21	0.00	2103.00	1 RCB	7400	3200	.014	CONVENTIONAL
2	3.32	0.80	2103.50	2 RCB	6000	3200	.015	CONVENTIONAL
3	4.46	2.71	1465.00	1 RCB	4050	2700	.014	CONVENTIONAL
4								
5								
6								

SUMMARY OF CULVERT FLOWS (m³/s)

FILE: BALBOA

DATE: 10-15-2005

ELEV (m)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
5.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
5.22	23.1	4.7	16.3	2.2	0.0	0.0	0.0	0.00	5
5.45	46.2	12.0	30.0	4.5	0.0	0.0	0.0	0.00	3
5.75	69.3	18.9	42.7	7.3	0.0	0.0	0.0	0.00	2
6.11	92.4	26.4	55.0	10.7	0.0	0.0	0.0	0.00	4
6.50	115.5	35.1	65.5	15.0	0.0	0.0	0.0	0.00	4
6.81	138.6	41.9	78.2	18.6	0.0	0.0	0.0	0.00	3
6.97	161.7	45.1	96.3	20.4	0.0	0.0	0.0	0.00	3
7.15	184.8	48.2	113.8	22.6	0.0	0.0	0.0	0.00	3
7.35	207.9	51.5	131.3	25.2	0.0	0.0	0.0	0.00	3
7.40	213.0	52.1	135.0	25.8	0.0	0.0	0.0	0.00	3
7.84	253.7	57.1	165.1	31.6	0.0	0.0	0.0	0.0	OVERTOPPING

SUMMARY OF ITERATIVE SOLUTION ERRORS

FILE: BALBOA

DATE: 10-15-2005

HEAD ELEV (m)	HEAD ERROR (m)	TOTAL FLOW (m ³ /s)	FLOW ERROR (m ³ /s)	% FLOW ERROR
5.04	0.000	0.00	0.00	0.00
5.22	0.000	23.10	-0.08	-0.34
5.45	0.003	46.20	-0.26	-0.57
5.75	-0.002	69.30	0.37	0.53
6.11	-0.002	92.40	0.23	0.24
6.50	0.002	115.50	-0.08	-0.07
6.81	0.001	138.60	-0.16	-0.11
6.97	0.001	161.70	-0.17	-0.11
7.15	-0.001	184.80	0.11	0.06
7.35	0.000	207.90	-0.03	-0.02
7.40	-0.001	213.00	0.14	0.07

<1> TOLERANCE (m) = 0.003

<2> TOLERANCE (%) = 1.000

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q = 213 m³/s

2

CURRENT DATE: 10-15-2005
CURRENT TIME: 16:27:40

FILE DATE: 10-15-2005
FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 1 - 1(7400 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	0.83	0-NF	0.00	0.00	0.00	5.04	0.00	0.00
4.69	5.22	0.59	1.01	3-M1f	0.38	0.34	3.20	5.04	0.20	0.00
11.96	5.45	1.10	1.24	3-M1f	0.71	0.65	3.20	5.04	0.51	0.00
18.95	5.75	1.50	1.54	3-M1f	0.96	0.87	3.20	5.04	0.80	0.00
26.40	6.11	1.86	1.90	3-M1f	1.19	1.09	3.20	5.04	1.12	0.00
35.07	6.50	2.23	2.29	3-M1f	1.44	1.32	3.20	5.04	1.48	0.00
41.94	6.82	2.51	2.61	3-M1f	1.63	1.49	3.20	5.04	1.77	0.00
45.12	6.97	2.63	2.76	3-M1f	1.71	1.56	3.20	5.04	1.90	0.00
48.23	7.15	2.75	2.94	3-M1f	1.79	1.63	3.20	5.04	2.04	0.00
51.46	7.35	2.88	3.14	3-M1f	1.87	1.70	3.20	5.04	2.17	0.00
52.06	7.40	2.90	3.19	3-M1f	1.89	1.72	3.20	5.04	2.20	0.00
El. inlet face invert					4.21 m	El. outlet invert		0.00 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

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***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.21 m
OUTLET STATION                     2103.00 m
OUTLET ELEVATION                   0.00 m
NUMBER OF BARRELS                  1
SLOPE (V/H)                        0.0020
CULVERT LENGTH ALONG SLOPE        2103.00 m

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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        7400 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                   NONE

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CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q = 213 m³/s

3

CURRENT DATE: 10-15-2005

FILE DATE: 10-15-2005

CURRENT TIME: 16:27:40

FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 2 - 2(6000 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	1.72	0-NF	0.00	0.00	0.00	4.24	0.00	0.00
16.29	5.22	0.88	1.90	3-M1f	0.79	0.57	3.20	4.24	0.42	0.00
29.96	5.44	1.32	2.12	3-M1f	1.19	0.86	3.20	4.24	0.78	0.00
42.68	5.75	1.67	2.43	3-M1f	1.52	1.09	3.20	4.24	1.11	0.00
55.04	6.11	1.99	2.79	3-M1f	1.82	1.29	3.20	4.24	1.43	0.00
65.51	6.50	2.24	3.17	3-M1f	2.06	1.45	3.20	4.24	1.71	0.00
78.22	6.82	2.52	3.50	3-M1f	2.34	1.63	3.20	4.24	2.04	0.00
96.32	6.97	2.90	3.65	3-M1f	2.73	1.88	3.20	4.24	2.51	0.00
113.83	7.15	3.27	3.83	3-M1f	3.20	2.10	3.20	4.24	2.97	0.00
131.26	7.35	3.66	4.03	3-M1f	3.20	2.31	3.20	4.24	3.42	0.00
135.03	7.40	3.75	4.08	3-M1f	3.20	2.35	3.20	4.24	3.52	0.00

El. inlet face invert

3.32 m

El. outlet invert

0.80 m

El. inlet throat invert

0.00 m

El. inlet crest

0.00 m

***** SITE DATA ***** CULVERT INVERT *****

INLET STATION	0.00 m
INLET ELEVATION	3.32 m
OUTLET STATION	2103.50 m
OUTLET ELEVATION	0.80 m
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0012
CULVERT LENGTH ALONG SLOPE	2103.50 m

***** CULVERT DATA SUMMARY *****

BARREL SHAPE	BOX
BARREL SPAN	6000 mm
BARREL RISE	3200 mm
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.015
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q = 213 m³/s

4

CURRENT DATE: 10-15-2005
CURRENT TIME: 16:27:40

FILE DATE: 10-15-2005
FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 3 - 1(4050 mm BY 2700 mm) RCB

DIS- CHARGE FLOW (m ³ /s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	0.58	0-NF	0.00	0.00	0.00	2.33	0.00	0.00
2.21	5.22	0.54	0.76	3-M1t	0.42	0.31	2.33	2.33	0.23	0.00
4.54	5.45	0.87	0.99	3-M1t	0.69	0.51	2.33	2.33	0.48	0.00
7.31	5.75	1.19	1.29	3-M1t	0.96	0.69	2.33	2.33	0.78	0.00
10.74	6.11	1.53	1.65	3-M1t	1.26	0.90	2.33	2.33	1.14	0.00
15.00	6.50	1.90	2.04	3-M1t	1.61	1.12	2.33	2.33	1.59	0.00
18.60	6.81	2.18	2.35	3-M1t	1.88	1.29	2.33	2.33	1.97	0.00
20.43	6.97	2.32	2.51	3-M1t	2.02	1.38	2.33	2.33	2.17	0.00
22.63	7.15	2.49	2.69	3-M1t	2.18	1.48	2.33	2.33	2.40	0.00
25.22	7.35	2.68	2.89	3-M2t	2.37	1.58	2.33	2.33	2.68	0.00
25.76	7.40	2.72	2.94	3-M2t	2.41	1.61	2.33	2.33	2.73	0.00
El. inlet face invert					4.46 m	El. outlet invert			2.71 m	
El. inlet throat invert					0.00 m	El. inlet crest			0.00 m	

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***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.46 m
OUTLET STATION                     1465.00 m
OUTLET ELEVATION                    2.71 m
NUMBER OF BARRELS                   1
SLOPE (V/H)                        0.0012
CULVERT LENGTH ALONG SLOPE         1465.00 m

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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        4050 mm
BARREL RISE                         2700 mm
BARREL MATERIAL                     CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                   NONE

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**CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y
NUEVO, Q = 213 m³/s**

5

CURRENT DATE: 10-15-2005
CURRENT TIME: 16:27:40

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FILE NAME: BALBOA

TAILWATER

CONSTANT WATER SURFACE ELEVATION
5.04

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	10.06 m
CREST LENGTH	10.00 m
OVERTOPPING CREST ELEVATION	7.84 m

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q=230 m³/s

1

CURRENT DATE: 10-15-2005
CURRENT TIME: 17:00:46

FILE DATE: 10-15-2005
FILE NAME: BALBOA

FHWA CULVERT ANALYSIS HY-8, VERSION 6.1

C U L V E R T N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (m)	OUTLET ELEV. (m)	CULVERT LENGTH (m)	BARRELS SHAPE MATERIAL	SPAN (mm)	RISE (mm)	MANNING n	INLET TYPE
1	4.21	0.00	2103.00	1 RCB	7400	3200	.014	CONVENTIONAL
2	3.32	0.80	2103.50	2 RCB	6000	3200	.015	CONVENTIONAL
3	4.46	2.71	1465.00	1 RCB	4050	2700	.014	CONVENTIONAL
4								
5								
6								

SUMMARY OF CULVERT FLOWS (m3/s)

FILE: BALBOA

DATE: 10-15-2005

ELEV (m)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
5.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
5.22	23.0	4.7	16.2	2.2	0.0	0.0	0.0	0.00	5
5.45	46.0	11.8	30.0	4.4	0.0	0.0	0.0	0.00	4
5.76	69.0	19.0	43.0	7.4	0.0	0.0	0.0	0.00	3
6.11	92.0	26.4	55.0	10.7	0.0	0.0	0.0	0.00	3
6.49	115.0	34.8	65.2	14.9	0.0	0.0	0.0	0.00	4
6.81	138.0	41.8	77.8	18.6	0.0	0.0	0.0	0.00	3
6.96	161.0	44.9	95.7	20.3	0.0	0.0	0.0	0.00	3
7.14	184.0	48.2	113.3	22.5	0.0	0.0	0.0	0.00	3
7.35	207.0	51.3	130.6	25.0	0.0	0.0	0.0	0.00	3
7.58	230.0	54.4	147.7	28.0	0.0	0.0	0.0	0.00	3
7.84	253.7	57.0	165.1	31.6	0.0	0.0	0.0	0.00	OVERTOPPING

SUMMARY OF ITERATIVE SOLUTION ERRORS

FILE: BALBOA

DATE: 10-15-2005

HEAD ELEV (m)	HEAD ERROR (m)	TOTAL FLOW (m3/s)	FLOW ERROR (m3/s)	% FLOW ERROR
5.04	0.000	0.00	0.00	0.00
5.22	-0.002	23.00	-0.05	-0.21
5.45	0.002	46.00	-0.15	-0.33
5.76	0.002	69.00	-0.39	-0.56
6.11	0.002	92.00	-0.11	-0.12
6.49	-0.002	115.00	0.15	0.13
6.81	0.001	138.00	-0.19	-0.13
6.96	0.000	161.00	-0.01	-0.00
7.14	0.000	184.00	-0.01	-0.00
7.35	-0.000	207.00	0.05	0.03
7.58	0.001	230.00	-0.08	-0.04

<1> TOLERANCE (m) = 0.003

<2> TOLERANCE (%) = 1.000

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q=230 m³/s

2

CURRENT DATE: 10-15-2005
CURRENT TIME: 17:00:46

FILE DATE: 10-15-2005
FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 1 - 1(7400 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m ³ /s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	0.83	0-NF	0.00	0.00	0.00	5.04	0.00	0.00
4.66	5.22	0.59	1.01	3-M1f	0.38	0.34	3.20	5.04	0.20	0.00
11.77	5.45	1.09	1.24	3-M1f	0.70	0.64	3.20	5.04	0.50	0.00
19.02	5.75	1.51	1.55	3-M1f	0.96	0.88	3.20	5.04	0.80	0.00
26.37	6.11	1.86	1.90	3-M1f	1.19	1.09	3.20	5.04	1.11	0.00
34.80	6.49	2.22	2.28	3-M1f	1.43	1.31	3.20	5.04	1.47	0.00
41.83	6.81	2.51	2.60	3-M1f	1.63	1.48	3.20	5.04	1.77	0.00
44.92	6.96	2.63	2.75	3-M1f	1.71	1.56	3.20	5.04	1.90	0.00
48.20	7.14	2.75	2.94	3-M1f	1.79	1.63	3.20	5.04	2.04	0.00
51.32	7.35	2.87	3.14	3-M1f	1.87	1.70	3.20	5.04	2.17	0.00
54.36	7.58	2.98	3.37	3-M1f	1.95	1.77	3.20	5.04	2.30	0.00
El. inlet face invert					4.21 m	El. outlet invert		0.00 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```

***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.21 m
OUTLET STATION                     2103.00 m
OUTLET ELEVATION                    0.00 m
NUMBER OF BARRELS                   1
SLOPE (V/H)                        0.0020
CULVERT LENGTH ALONG SLOPE         2103.00 m

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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        7400 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                        CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                   NONE

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CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q=230 m³/s

3

CURRENT DATE: 10-15-2005
CURRENT TIME: 17:00:46

FILE DATE: 10-15-2005
FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 2 - 2(6000 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	1.72	0-NF	0.00	0.00	0.00	4.24	0.00	0.00
16.18	5.22	0.87	1.90	3-M1f	0.79	0.57	3.20	4.24	0.42	0.00
29.96	5.44	1.32	2.12	3-M1f	1.19	0.86	3.20	4.24	0.78	0.00
42.98	5.75	1.68	2.44	3-M1f	1.53	1.09	3.20	4.24	1.12	0.00
55.01	6.11	1.99	2.79	3-M1f	1.82	1.29	3.20	4.24	1.43	0.00
65.20	6.49	2.23	3.17	3-M1f	2.05	1.45	3.20	4.24	1.70	0.00
77.79	6.81	2.51	3.49	3-M1f	2.33	1.63	3.20	4.24	2.03	0.00
95.74	6.96	2.89	3.64	3-M1f	2.72	1.87	3.20	4.24	2.49	0.00
113.27	7.14	3.26	3.82	3-M1f	3.20	2.09	3.20	4.24	2.95	0.00
130.60	7.35	3.65	4.03	3-M1f	3.20	2.30	3.20	4.24	3.40	0.00
147.72	7.57	4.05	4.26	3-M1f	3.20	2.50	3.20	4.24	3.85	0.00
El. inlet face invert					3.32 m	El. outlet invert		0.80 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```

***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    3.32 m
OUTLET STATION                     2103.50 m
OUTLET ELEVATION                    0.80 m
NUMBER OF BARRELS                   2
SLOPE (V/H)                        0.0012
CULVERT LENGTH ALONG SLOPE         2103.50 m

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```

***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        6000 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.015
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION                   NONE

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CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y NUEVO, Q=230 m³/s

4

CURRENT DATE: 10-15-2005
CURRENT TIME: 17:00:46

FILE DATE: 10-15-2005
FILE NAME: BALBOA

PERFORMANCE CURVE FOR CULVERT 3 - 1(4050 mm BY 2700 mm) RCB

DIS- CHARGE FLOW (m ³ /s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.04	0.00	0.58	0-NF	0.00	0.00	0.00	2.33	0.00	0.00
2.21	5.22	0.54	0.76	3-M1t	0.42	0.31	2.33	2.33	0.23	0.00
4.42	5.45	0.85	0.98	3-M1t	0.68	0.50	2.33	2.33	0.47	0.00
7.38	5.76	1.20	1.30	3-M1t	0.97	0.70	2.33	2.33	0.78	0.00
10.74	6.11	1.53	1.65	3-M1t	1.26	0.90	2.33	2.33	1.14	0.00
14.86	6.49	1.88	2.03	3-M1t	1.59	1.11	2.33	2.33	1.58	0.00
18.57	6.81	2.18	2.35	3-M1t	1.88	1.29	2.33	2.33	1.97	0.00
20.34	6.96	2.32	2.50	3-M1t	2.01	1.37	2.33	2.33	2.16	0.00
22.54	7.14	2.48	2.68	3-M1t	2.17	1.47	2.33	2.33	2.39	0.00
25.02	7.34	2.67	2.88	3-M2t	2.35	1.58	2.33	2.33	2.65	0.00
28.00	7.57	2.89	3.11	3-M2t	2.70	1.70	2.33	2.33	2.97	0.00
El. inlet face invert					4.46 m	El. outlet invert		2.71 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```

***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.46 m
OUTLET STATION                     1465.00 m
OUTLET ELEVATION                    2.71 m
NUMBER OF BARRELS                   1
SLOPE (V/H)                        0.0012
CULVERT LENGTH ALONG SLOPE         1465.00 m

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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        4050 mm
BARREL RISE                        2700 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                   NONE

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**CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO VIEJO, VIEJO NUEVO Y
NUEVO, Q=230 m³/s**

5

CURRENT DATE: 10-15-2005
CURRENT TIME: 17:00:46

FILE DATE: 10-15-2005
FILE NAME: BALBOA

TAILWATER

CONSTANT WATER SURFACE ELEVATION
5.04

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	10.06 m
CREST LENGTH	10.00 m
OVERTOPPING CREST ELEVATION	7.84 m

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2 504 m), Q=187.2 m³/s

1

CURRENT DATE: 11-13-2005
CURRENT TIME: 17:55:43

FILE DATE: 11-13-2005
FILE NAME: BALBOA2D

FHWA CULVERT ANALYSIS HY-8, VERSION 6.1

C U L V N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (m)	OUTLET ELEV. (m)	CULVERT LENGTH (m)	BARRELS SHAPE MATERIAL	SPAN (mm)	RISE (mm)	MANNING n	INLET TYPE
1	5.01	0.00	2504.00	1 RCB	7400	3200	.014	CONVENTIONAL
2	4.12	1.12	2504.00	2 RCB	6000	3200	.014	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (m3/s)

FILE: BALBOA2D

DATE: 11-13-2005

ELEV (m)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
5.84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6.03	20.2	5.3	15.0	0.0	0.0	0.0	0.0	0.00	3
6.26	40.4	12.0	28.3	0.0	0.0	0.0	0.0	0.00	4
6.60	60.6	19.4	41.4	0.0	0.0	0.0	0.0	0.00	4
6.98	80.8	27.4	53.6	0.0	0.0	0.0	0.0	0.00	4
7.45	101.1	37.2	63.8	0.0	0.0	0.0	0.0	0.00	9
7.64	121.3	40.6	80.7	0.0	0.0	0.0	0.0	0.00	3
7.79	141.5	43.1	98.3	0.0	0.0	0.0	0.0	0.00	3
7.97	161.7	45.9	115.9	0.0	0.0	0.0	0.0	0.00	3
8.18	181.9	48.6	133.4	0.0	0.0	0.0	0.0	0.00	3
8.25	187.2	49.3	138.1	0.0	0.0	0.0	0.0	0.00	2
8.64	221.4	56.3	165.1	0.0	0.0	0.0	0.0	0.00	OVERTOPPING

SUMMARY OF ITERATIVE SOLUTION ERRORS

FILE: BALBOA2D

DATE: 11-13-2005

HEAD ELEV (m)	HEAD ERROR (m)	TOTAL FLOW (m3/s)	FLOW ERROR (m3/s)	% FLOW ERROR
5.84	0.000	0.00	0.00	0.00
6.03	0.002	20.21	-0.16	-0.79
6.26	-0.001	40.42	0.16	0.41
6.60	0.002	60.63	-0.18	-0.29
6.98	0.003	80.84	-0.16	-0.20
7.45	-0.001	101.05	0.09	0.09
7.64	0.001	121.26	-0.06	-0.05
7.79	0.000	141.47	0.00	0.00
7.97	0.002	161.68	-0.17	-0.11
8.18	0.001	181.89	-0.12	-0.07
8.25	0.002	187.20	-0.16	-0.09

<1> TOLERANCE (m) = 0.003

<2> TOLERANCE (%) = 1.000

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2 504 m), Q=187.2 m³/s

2

CURRENT DATE: 11-13-2005
CURRENT TIME: 17:55:43

FILE DATE: 11-13-2005
FILE NAME: BALBOA2D

PERFORMANCE CURVE FOR CULVERT 1 - 1(7400 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.84	0.00	0.83	0-NF	0.00	0.00	0.00	5.84	0.00	0.00
5.32	6.03	0.65	1.02	3-M1f	0.41	0.37	3.20	5.84	0.23	0.00
11.98	6.25	1.10	1.24	3-M1f	0.71	0.65	3.20	5.84	0.51	0.00
19.44	6.60	1.53	1.59	3-M1f	0.98	0.89	3.20	5.84	0.82	0.00
27.44	6.98	1.91	1.97	3-M1f	1.22	1.12	3.20	5.84	1.16	0.00
37.16	7.46	2.32	2.44	3-M1f	1.50	1.37	3.20	5.84	1.57	0.00
40.59	7.64	2.46	2.62	3-M1f	1.59	1.46	3.20	5.84	1.71	0.00
43.15	7.79	2.56	2.78	3-M1f	1.66	1.51	3.20	5.84	1.82	0.00
45.95	7.96	2.67	2.95	3-M1f	1.73	1.58	3.20	5.84	1.94	0.00
48.65	8.17	2.77	3.16	3-M1f	1.80	1.64	3.20	5.84	2.05	0.00
49.29	8.25	2.80	3.23	3-M1f	1.82	1.66	3.20	5.84	2.08	0.00
El. inlet face invert					5.01 m	El. outlet invert		0.00 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```

***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    5.01 m
OUTLET STATION                     2504.00 m
OUTLET ELEVATION                   0.00 m
NUMBER OF BARRELS                  1
SLOPE (V/H)                        0.0020
CULVERT LENGTH ALONG SLOPE        2504.00 m

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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        7400 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                     CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                   NONE

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CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2 504 m), Q=187.2 m³/s

3

CURRENT DATE: 11-13-2005
CURRENT TIME: 17:55:43

FILE DATE: 11-13-2005
FILE NAME: BALBOA2D

PERFORMANCE CURVE FOR CULVERT 2 - 2(6000 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.84	0.00	1.72	0-NF	0.00	0.00	0.00	4.72	0.00	0.00
15.05	6.04	0.84	1.92	3-M1f	0.72	0.55	3.20	4.72	0.39	0.00
28.28	6.26	1.27	2.14	3-M1f	1.09	0.83	3.20	4.72	0.74	0.00
41.37	6.60	1.64	2.47	3-M1f	1.42	1.07	3.20	4.72	1.08	0.00
53.56	7.00	1.95	2.88	3-M1f	1.70	1.27	3.20	4.72	1.40	0.00
63.81	7.45	2.20	3.33	3-M1f	1.93	1.43	3.20	4.72	1.66	0.00
80.74	7.64	2.57	3.51	3-M1f	2.28	1.67	3.20	4.72	2.10	0.00
98.32	7.79	2.94	3.67	3-M1f	2.64	1.90	3.20	4.72	2.56	0.00
115.91	7.97	3.32	3.85	3-M1f	3.20	2.12	3.20	4.72	3.02	0.00
133.37	8.18	3.71	4.06	3-M1f	3.20	2.33	3.20	4.72	3.47	0.00
138.07	8.24	3.82	4.12	3-M1f	3.20	2.39	3.20	4.72	3.60	0.00
El. inlet face invert					4.12 m	El. outlet invert		1.12 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```
***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.12 m
OUTLET STATION                     2504.00 m
OUTLET ELEVATION                    1.12 m
NUMBER OF BARRELS                   2
SLOPE (V/H)                        0.0012
CULVERT LENGTH ALONG SLOPE         2504.00 m
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***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        6000 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION                   NONE
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**CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO
EXTENDIDOS (L = 2 504 m), Q=187.2 m³/s**

4

CURRENT DATE: 11-13-2005
CURRENT TIME: 17:55:43

FILE DATE: 11-13-2005
FILE NAME: BALBOA2D

TAILWATER

CONSTANT WATER SURFACE ELEVATION
5.84

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	10.06 m
CREST LENGTH	10.00 m
OVERTOPPING CREST ELEVATION	8.64 m

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2504 m), Q=202.1 m³/s

1

CURRENT DATE: 11-13-2005
CURRENT TIME: 18:07:35

FILE DATE: 11-13-2005
FILE NAME: BALBOA2E

FHWA CULVERT ANALYSIS HY-8, VERSION 6.1

C U L V N O.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (m)	OUTLET ELEV. (m)	CULVERT LENGTH (m)	BARRELS SHAPE MATERIAL	SPAN (mm)	RISE (mm)	MANNING n	INLET TYPE
1	5.01	0.00	2504.00	1 RCB	7400	3200	.014	CONVENTIONAL
2	4.12	1.12	2504.00	2 RCB	6000	3200	.014	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (m3/s)				FILE: BALBOA2E				DATE: 11-13-2005	
ELEV (m)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
5.84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6.03	20.2	5.4	15.0	0.0	0.0	0.0	0.0	0.00	3
6.26	40.4	12.1	28.3	0.0	0.0	0.0	0.0	0.00	3
6.60	60.6	19.3	41.3	0.0	0.0	0.0	0.0	0.00	4
6.98	80.8	27.4	53.3	0.0	0.0	0.0	0.0	0.00	5
7.45	101.1	37.1	63.8	0.0	0.0	0.0	0.0	0.00	7
7.64	121.3	40.6	80.7	0.0	0.0	0.0	0.0	0.00	3
7.79	141.5	43.1	98.3	0.0	0.0	0.0	0.0	0.00	3
7.86	150.0	44.4	105.8	0.0	0.0	0.0	0.0	0.00	3
8.18	181.9	48.6	133.4	0.0	0.0	0.0	0.0	0.00	3
8.43	202.1	51.2	151.1	0.0	0.0	0.0	0.0	0.00	2
8.64	221.4	56.3	165.1	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS			FILE: BALBOA2E	DATE: 11-13-2005
HEAD ELEV (m)	HEAD ERROR (m)	TOTAL FLOW (m3/s)	FLOW ERROR (m3/s)	% FLOW ERROR
5.84	0.000	0.00	0.00	0.00
6.03	0.001	20.21	-0.10	-0.48
6.26	-0.001	40.42	0.04	0.11
6.60	-0.001	60.63	0.03	0.04
6.98	-0.002	80.84	0.19	0.23
7.45	-0.001	101.05	0.11	0.11
7.64	0.000	121.26	-0.06	-0.05
7.79	0.000	141.47	0.00	0.00
7.86	0.002	150.00	-0.17	-0.11
8.18	0.002	181.89	-0.13	-0.07
8.43	0.002	202.10	-0.21	-0.11

<1> TOLERANCE (m) = 0.003

<2> TOLERANCE (%) = 1.000

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2504 m), Q=202.1 m³/s

2

CURRENT DATE: 11-13-2005
CURRENT TIME: 18:07:35

FILE DATE: 11-13-2005
FILE NAME: BALBOA2E

PERFORMANCE CURVE FOR CULVERT 1 - 1(7400 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.84	0.00	0.83	0-NF	0.00	0.00	0.00	5.84	0.00	0.00
5.35	6.03	0.65	1.02	3-M1f	0.41	0.38	3.20	5.84	0.23	0.00
12.12	6.26	1.11	1.25	3-M1f	0.71	0.65	3.20	5.84	0.51	0.00
19.27	6.59	1.52	1.58	3-M1f	0.97	0.89	3.20	5.84	0.81	0.00
27.40	6.97	1.90	1.96	3-M1f	1.22	1.12	3.20	5.84	1.16	0.00
37.09	7.45	2.32	2.44	3-M1f	1.50	1.37	3.20	5.84	1.57	0.00
40.59	7.64	2.46	2.62	3-M1f	1.59	1.46	3.20	5.84	1.71	0.00
43.15	7.79	2.56	2.78	3-M1f	1.66	1.51	3.20	5.84	1.82	0.00
44.39	7.86	2.61	2.85	3-M1f	1.69	1.55	3.20	5.84	1.87	0.00
48.63	8.17	2.77	3.16	3-M1f	1.80	1.64	3.20	5.84	2.05	0.00
51.20	8.43	2.87	3.42	3-M1f	1.87	1.70	3.20	5.84	2.16	0.00
El. inlet face invert					5.01 m	El. outlet invert		0.00 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```

***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    5.01 m
OUTLET STATION                     2504.00 m
OUTLET ELEVATION                    0.00 m
NUMBER OF BARRELS                   1
SLOPE (V/H)                        0.0020
CULVERT LENGTH ALONG SLOPE         2504.00 m

```

```

***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        7400 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                     CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                 SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION                     NONE

```

CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO EXTENDIDOS (L = 2504 m), Q=202.1 m³/s

3

CURRENT DATE: 11-13-2005
CURRENT TIME: 18:07:35

FILE DATE: 11-13-2005
FILE NAME: BALBOA2E

PERFORMANCE CURVE FOR CULVERT 2 - 2(6000 mm BY 3200 mm) RCB

DIS- CHARGE FLOW (m3/s)	HEAD- WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	5.84	0.00	1.72	0-NF	0.00	0.00	0.00	4.72	0.00	0.00
14.95	6.04	0.83	1.92	3-M1f	0.72	0.54	3.20	4.72	0.39	0.00
28.25	6.26	1.27	2.14	3-M1f	1.09	0.83	3.20	4.72	0.73	0.00
41.34	6.60	1.64	2.47	3-M1f	1.42	1.07	3.20	4.72	1.08	0.00
53.26	6.97	1.94	2.85	3-M1f	1.69	1.26	3.20	4.72	1.39	0.00
63.85	7.45	2.20	3.33	3-M1f	1.93	1.43	3.20	4.72	1.66	0.00
80.74	7.64	2.57	3.51	3-M1f	2.28	1.67	3.20	4.72	2.10	0.00
98.32	7.79	2.94	3.67	3-M1f	2.64	1.90	3.20	4.72	2.56	0.00
105.78	7.86	3.10	3.74	3-M1f	2.78	2.00	3.20	4.72	2.76	0.00
133.39	8.18	3.71	4.06	3-M1f	3.20	2.33	3.20	4.72	3.47	0.00
151.11	8.43	4.14	4.30	3-M1f	3.20	2.53	3.20	4.72	3.93	0.00
El. inlet face invert					4.12 m	El. outlet invert		1.12 m		
El. inlet throat invert					0.00 m	El. inlet crest		0.00 m		

```
***** SITE DATA ***** CULVERT INVERT *****
INLET STATION                      0.00 m
INLET ELEVATION                    4.12 m
OUTLET STATION                     2504.00 m
OUTLET ELEVATION                    1.12 m
NUMBER OF BARRELS                   2
SLOPE (V/H)                        0.0012
CULVERT LENGTH ALONG SLOPE         2504.00 m
```

```
***** CULVERT DATA SUMMARY *****
BARREL SHAPE                       BOX
BARREL SPAN                        6000 mm
BARREL RISE                        3200 mm
BARREL MATERIAL                    CONCRETE
BARREL MANNING'S n                 0.014
INLET TYPE                         CONVENTIONAL
INLET EDGE AND WALL                SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION                   NONE
```

**CÁLCULO DE LA CAPACIDAD DE LOS CONDUCTOS VIEJO NUEVO Y NUEVO
EXTENDIDOS (L = 2504 m), Q=202.1 m³/s**

4

CURRENT DATE: 11-13-2005
CURRENT TIME: 18:07:35

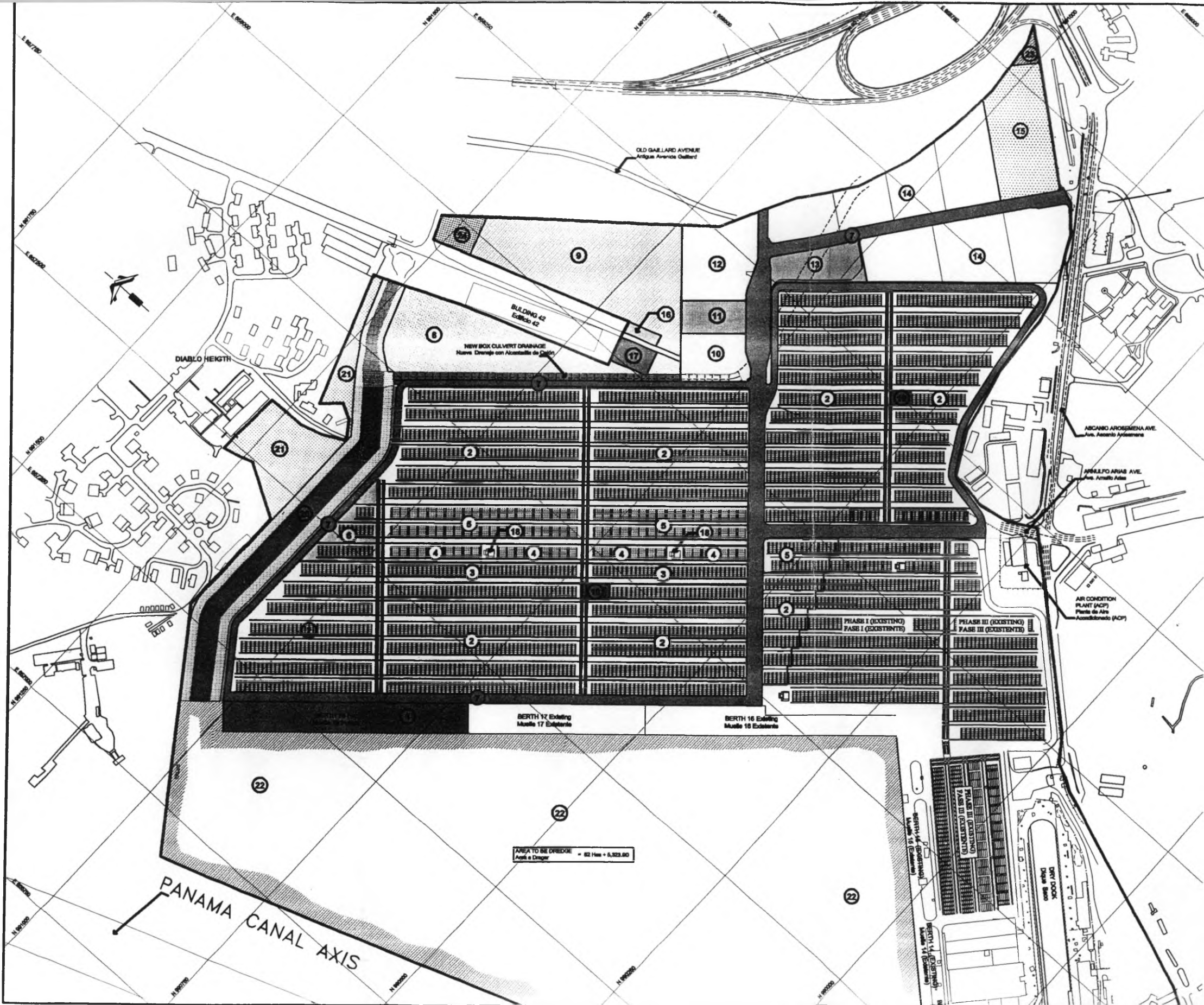
FILE DATE: 11-13-2005
FILE NAME: BALBOA2E

TAILWATER

CONSTANT WATER SURFACE ELEVATION
5.84

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	10.06 m
CREST LENGTH	10.00 m
OVERTOPPING CREST ELEVATION	8.64 m



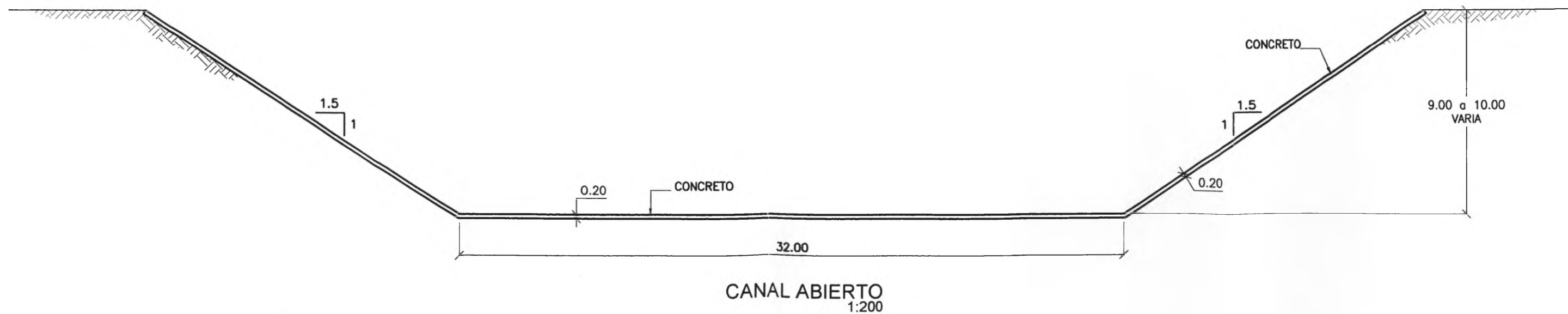
- 1 NEW BERTH 16 (PROJECTED)
Nuevo Muelle 16 (Proyecto en la)
- 2 FULL CONTAINER AREA
Área de Contenedores Llenos
- 3 HIGH RISK DRY CONTAINERS AREA
Área de Contenedores Secos de Alto Riesgo
- 4 HIGH RISK REEFERS CONTAINERS AREA
Área de Contenedores Refrigerados de Alto Riesgo
- 5 REEFERS CONTAINERS AREA
Área de Refrigeradores
- 6 EMPTY CONTAINERS AREA
Área de Contenedores Vacíos
- 7 SERVICE ROAD
Calles de Servicio
- 8 ENGINEERING AND MAINTENANCE AREA
Área de Ingeniería y Mantenimiento
- 9 CAR STORAGE OR EMPTY CONTAINERS AREA
Almacenamiento de Autos o Contenedores Vacíos
- 10 YARD WORKMEN FACILITIES
Facilidades para Trabajadores del Pórtico
- 11 CONTROL BUILDING AND PARKING
Edificio de Control y Estacionamiento
- 12 CARGO CHECKING AREA (IMPORT)
Área para Verificación de Carga (Importación)
- 13 CARGO CHECKING PARKING (EXPORT OR TRANSSHIPMENT)
Estacionamiento para Verificación de Carga (Exportación o Transbordo)
- 14 INDUSTRIAL AREA
Área Industrial
- 15 ADMINISTRATIVE AREA
Área Administrativa
- 16 SEWAGE TREATMENT PLANT
Planta de Tratamiento de Aguas Residuales
- 17 GAS STATION
Estación de Gasolina
- 18 ELECTRICAL SUBSTATION
Subestación Eléctrica
- 19 RTGC MAINTENANCE OR CONTAINERS STACKING AREA
Área de Mantenimiento de RTGC o Almacenamiento de Contenedores
- 20 OPEN CHANNEL
Canal Abierto
- 21 NATURAL PROTECTIVE BARRIER
Barrera de Protección Natural
- 22 AREA TO BE DREDGED
Área a Dragar
- 23 AREA OF NEW ELECTRICAL SUB-STATION
Área de Nueva Sub-Estación Eléctrica
- 24 NEW ELECTRICAL PLANT
Nueva Planta Eléctrica

CONTAINERS STACKING AREA
Área de Almacenamiento de Contenedores

TOTAL	AREA	SLOTS					TEU'S
		Full Llenos	Reefers 40' Refrigerados 40'	Reefers 20' Refrigerados 20'	Empty Vacíos	Total	
PHASE I (EXISTING) Fase I (Existente)	8 Has + 1,651.61	1,368	126	24		1,548	7,818
PHASE III (EXISTING) Fase III (Existente)	7 Has + 5,935.27	1,404	188	24		1,614	8,604
PHASE I (EXPANSION) Fase I (Expansión)	1 Ha + 8,327.23	366	90			456	2,370
MODULUS 2 Módulo 2	12 Has + 2,674.10	2,794	292			3,086	19,100
MODULUS 3 Módulo 3	15 Has + 1,445.04	3,396	363			3,759	23,280
MODULUS 4 Módulo 4	5 Has + 800.75	1,118			149	1,268	7,608
MODULUS 5 Módulo 5	7 Has + 663.70	1,734	78			1,812	11,028
MODULUS 6 Módulo 6	5 Has + 5,669.08	1,296	48			1,344	8,160
TOTAL	80 Has + 8190.70	13,607	1,163	48	149	14,867	87,968

FACILITIES AND SERVICES AREAS
Áreas de Facilidades y Servicios

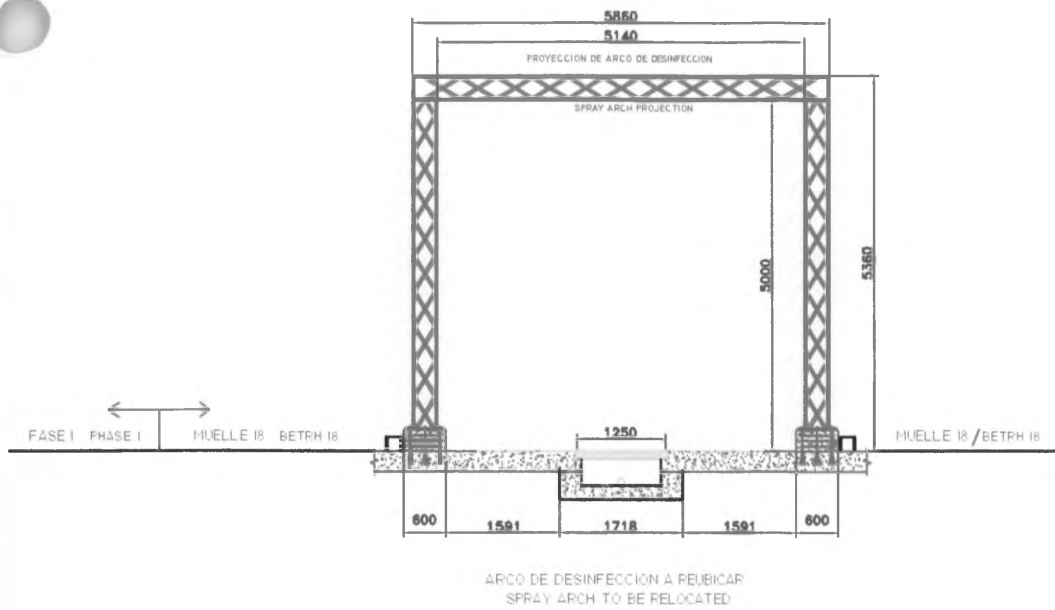
	DESCRIPTION / Descripción	AREA
7	SERVICE ROAD Calles de Servicio	6 Has + 9,894.42
8	ENGINEERING AND MAINTENANCE AREA Área de Mantenimiento e Ingeniería	3 Has + 4519.62
9	CAR STORAGE OR EMPTY CONTAINERS Almacenamiento de Autos o Contenedores Vacíos	4 Has + 720.96
10	YARD WORKMEN FACILITIES Facilidades para Trabajadores del Pórtico	0 Has + 7,995.62
11	CONTROL BUILDING AND PARKING Edificio de Control y Estacionamiento	0 Has + 5,259.92
12	CARGO CHECKING AREA (IMPORT) Área para Verificación de Carga (Importación)	1 Has + 3,999.19
13	CARGO CHECKING PARKING (EXPORT OR TRANSSHIPMENT) Estacionamiento para Verificación de Carga (Exportación o Transbordo)	0 Has + 8,019.93
14	INDUSTRIAL AREA Área Industrial	6 Has + 4,468.96
15	ADMINISTRATIVE AREA Área Administrativa	1 Has + 9,149.71
16	SEWAGE TREATMENT PLANT Planta de Tratamiento de Aguas Residuales	0 Has + 1,007.13
17	GAS STATION Estación de Gasolina	0 Has + 2,422.75
18	ELECTRICAL SUBSTATION (OPERATIVE AREA) Subestación Eléctrica (Área de Operación)	0 Has + 1,547.88
19	RTGC MAINTENANCE OR CONTAINERS STACKING AREA Área de Mantenimiento de RTGC o Almacenamiento de Contenedores	0 Has + 1,423.66
20	OPEN CHANNEL Canal Abierto	4 Has + 8,396.58
21	NATURAL PROTECTIVE BARRIER Barrera de Protección Natural	2 Has + 2,161.00
23	ELECTRICAL SUB-STATION (ADMINISTRATIVE AREA) Sub-Estación Eléctrica (Área Administrativa)	0 Has + 1,165.76
24	NEW ELECTRICAL PLANT Nueva Planta Eléctrica	0 Has + 3,313.40
	TOTAL	34 Has + 0021.48



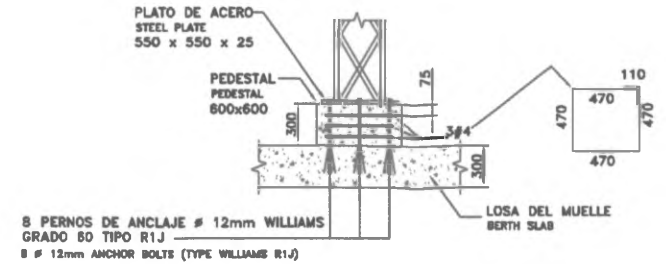
ANEXO 8

DIAGRAMA - ARCO DE FUMIGACIÓN

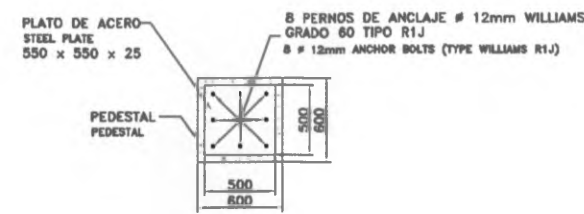
ELEVACION FRONTAL/FRONTAL ELEVATION
ESCALA/SCALE 1:50



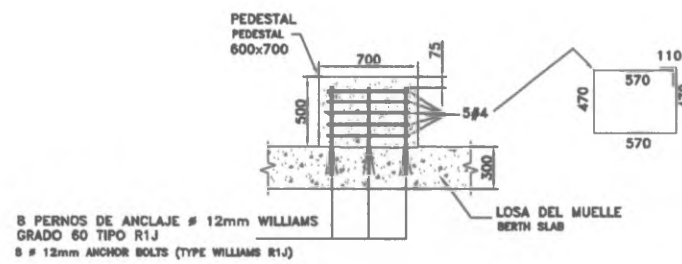
SECCION/SECTION A - A
ESCALA/SCALE 1:25



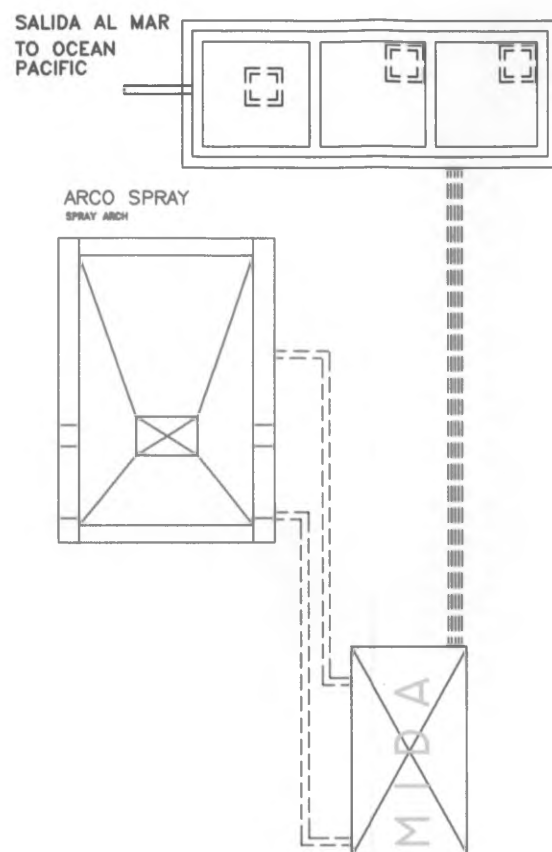
PLANTA / PLAN VIEW
ESCALA/SCALE 1:25



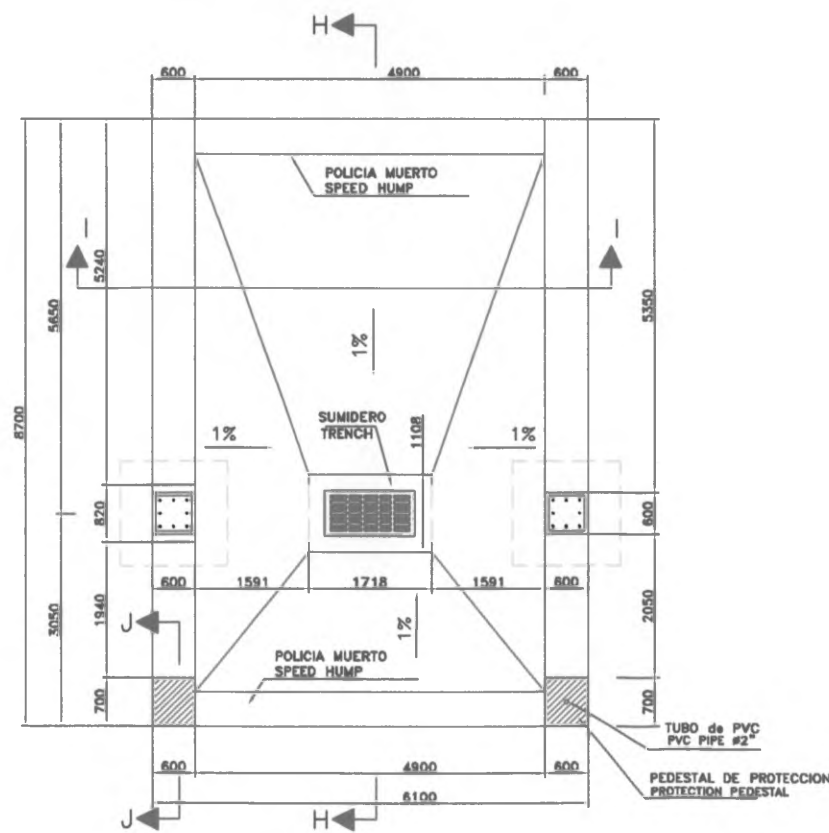
SECCION/SECTION J - J
ESCALA/SCALE 1:25



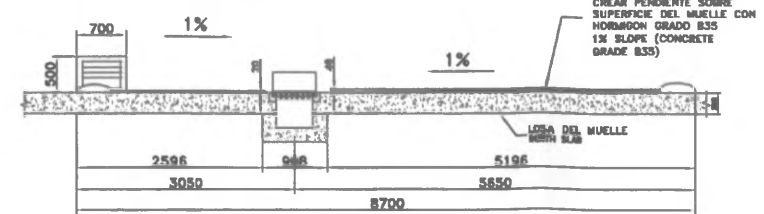
VISTA DE PLANTA DE ESTRUCTURAS
DEL ARCO DE DESINFECCION
SPRAY ARCH STRUCTURES - PLAN VIEW
ESCALA/SCALE 1:50



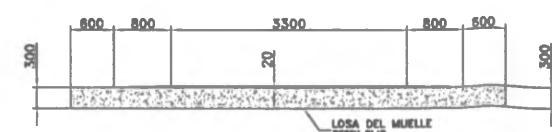
VISTA DE PLANTA/PLAN VIEW
ESCALA/SCALE 1:50



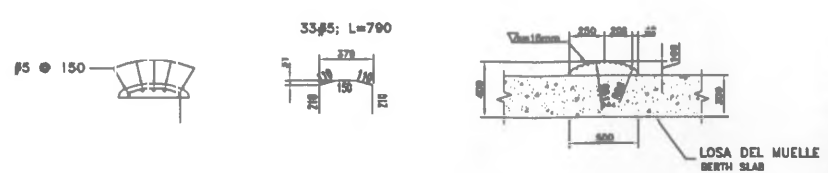
SECCION/SECTION H - H
ESCALA/SCALE 1:50



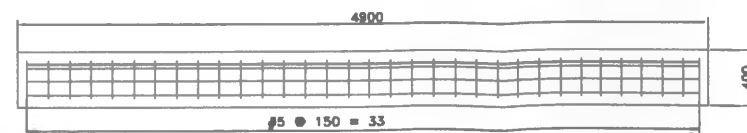
SECCION/SECTION I - I
ESCALA/SCALE 1:50



RESALTO / SPEED HUMP
ESCALA/SCALE 1:25



ELEVACION/ELEVATION
ESCALA/SCALE 1:25



PANAMA PORTS
COMPANY S.A.

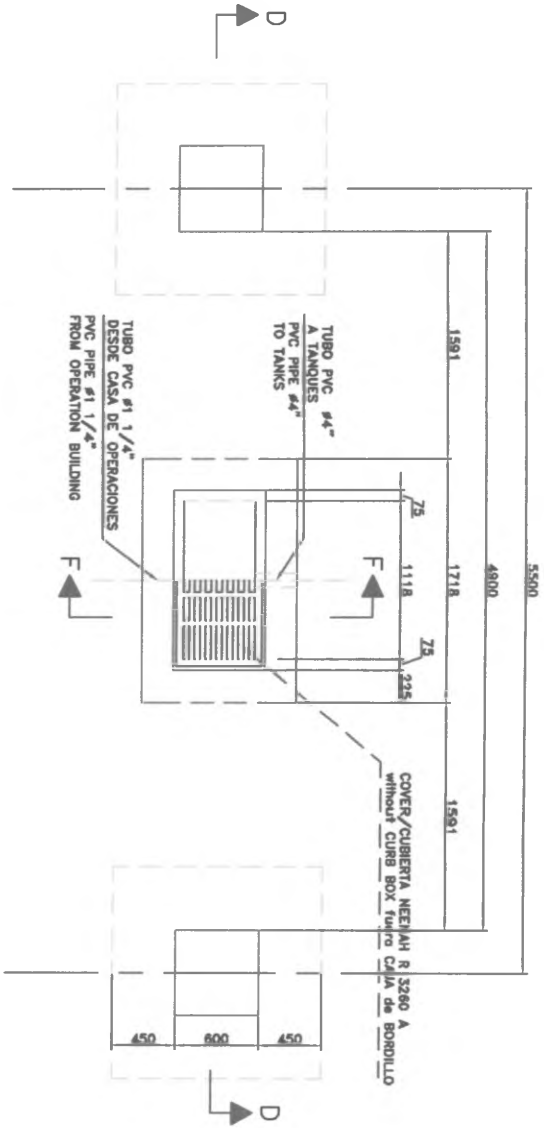
PORT OF BALBOA
GARITA Y PAVIMENTOS
GATE HOUSE AND SUNDRY PAVEMENTS

DETALLES DE LA ESTRUCTURA DEL ARCO DE DESINFECCION
SPRAY ARCH STRUCTURE DETAILS

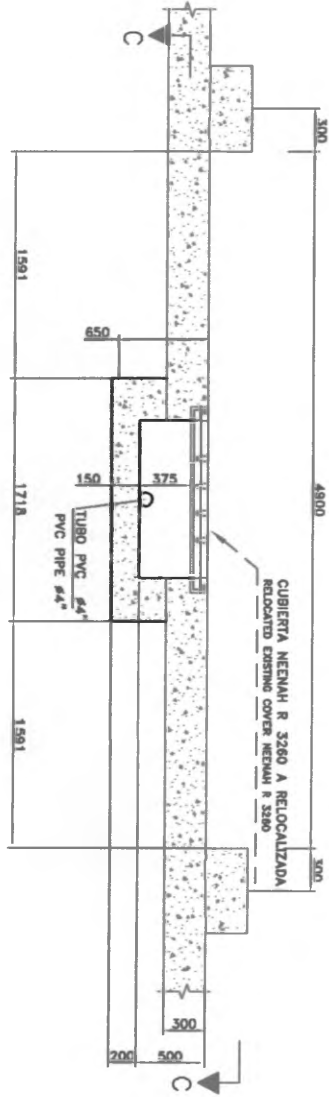
INGENIEROS GEOTECNICOS, S.A.
DISEÑO: GSA
DISEÑO: GSA
SOMETIDO POR: G. BERMAN
FECHA: DICIEMBRE / 2002
ESCALAS INDICADAS

ACEPTADO POR:
POR PANAMA PORTS COMPANY
AUTORIDAD
NÚMERO DE HOJA: 5-08

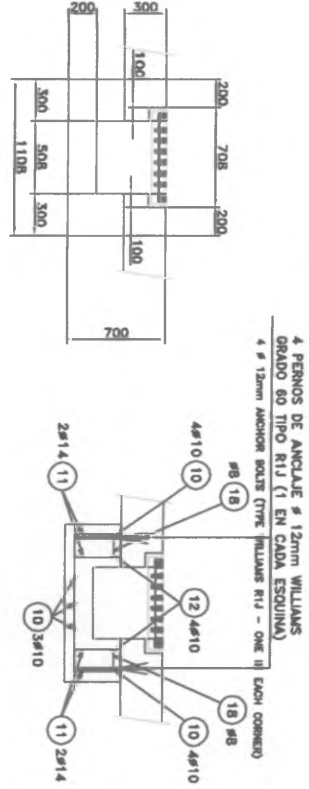
SECCION/SECTION C - C
ESCALA/SCALE 1:25



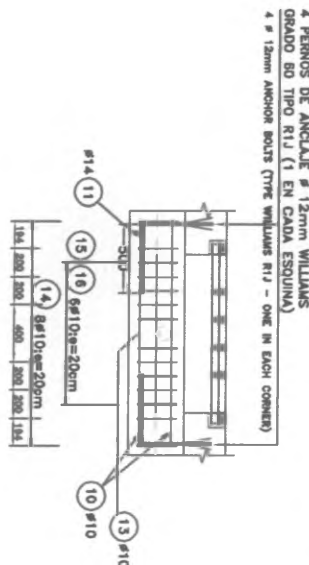
SECCION/SECTION D - D
ESCALA/SCALE 1:25



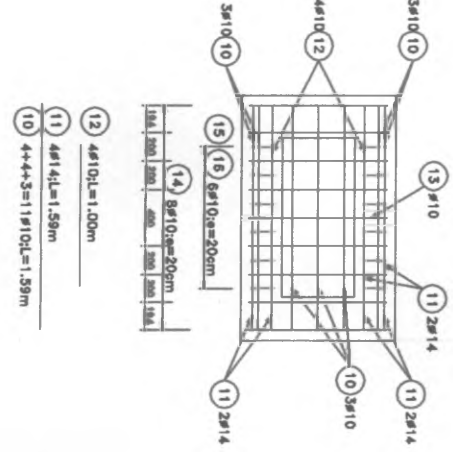
SECCION/SECTION F - F
ESCALA/SCALE 1:25



ELEVACION/ELEVATION
ESCALA/SCALE 1:25



VISTA DE PLANTA/PLAN VIEW
ESCALA/SCALE 1:25



PANAMA PORTS
COMPANY S.A.

REPUBLICA DE PANAMA	PANAMA
PORT OF BALBOA GARITA Y PAVIMENTOS GATE HOUSE AND SUNDRY PAVEMENTS	
DETALLES DEL LA ESTRUCTURA DEL ARCO DE DESINFECCION SPRAY ARCH STRUCTURE DETAILS	
INGENIEROS GEOTECNICOS, S.A.	ACEPTADO POR:
DIBUJO: IGSA	PROPIETARIO
DISEÑO: IGSA	POR PANAMA PORTS COMPANY
SOMETIDO POR: G. BERMAN	APROBADO POR:
FECHA: DICIEMBRE / 2002	AUTORIDAD
ESCALAS: INDICADAS	NUMERO DE HOJA: 3-09

ANEXO 9

TABLA DE SEGREGACIÓN DE CONTENEDORES

INTRODUCCIÓN GENERAL

Tabla de segregación

La siguiente tabla muestra los requerimientos generales para la segregación entre las distintas clases de mercancías peligrosas.

DADO QUE LAS PROPIEDADES DE LAS SUSTANCIAS O ARTÍCULOS DENTRO DE CADA CLASE PUEDEN VARIAR GRANDEMENTE, SIEMPRE SE DEBEN CONSULTAR LOS HORARIOS INDIVIDUALES PARA REQUERIMIENTOS ESPECÍFICOS DE SEGREGACIÓN, YA QUE ESTOS TOMAN PRECEDENCIA SOBRE LOS REQUERIMIENTOS GENERALES.

LA SEGREGACIÓN TAMBIÉN DEBE TOMAR EN CUENTA UNA SOLA ETIQUETA DE RIESGOS AUXILIAR.

CLASE	1.1 1.2 1.5	1.3 1.6	1.4	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9
Explosivos 1.1, 1.2, 1.5	*	*	*	4	2	2	4	4	4	4	4	4	2	4	2	4	X
Explosivos 1.3, 1.6	*	*	*	4	2	2	4	3	3	4	4	4	2	4	2	2	X
Explosivos 1.4	*	*	*	2	1	1	2	2	2	2	2	2	X	4	2	2	X
Gases inflamables 2.1	4	4	2	X	X	X	2	1	2	X	2	2	X	4	2	1	X
Gases no tóxicos, no inflamables 2.2	2	2	1	X	X	X	1	X	1	X	X	1	X	2	1	X	X
Gases tóxicos 2.3	2	2	1	X	X	X	2	X	2	X	X	2	X	2	1	X	X
Líquidos inflamables 3	4	4	2	2	1	2	X	X	2	1	2	2	X	3	2	X	X
Sólidos inflamables (incluyen auto-reactivos y sustancias relacionadas y explosivos desensibilizados) 4.1	4	3	2	1	X	X	X	X	1	X	1	2	X	3	2	1	X
Sustancias susceptibles de combustión espontánea 4.2	4	3	2	2	1	2	2	1	X	1	2	2	1	3	2	1	X
Sustancias que, en contacto con agua, emiten gases inflamables 4.3	4	4	2	X	X	X	1	X	1	X	2	2	X	2	2	1	X
Sustancias oxidantes (agentes) 5.1	4	4	2	2	X	X	2	1	2	2	X	2	1	3	1	2	X
Peróxidos orgánicos 5.2	4	4	2	2	1	2	2	2	2	2	2	X	1	3	2	2	X
Sustancias tóxicas 6.1	2	2	X	X	X	X	X	X	1	X	1	1	X	1	X	X	X
Sustancias infecciosas 6.2	4	4	4	4	2	2	3	3	3	2	3	3	1	X	3	3	X
Materiales radiactivos 7	2	2	2	2	1	1	2	2	2	2	1	2	X	3	X	2	X
Corrosivos 8	4	2	2	1	X	X	X	1	1	1	2	2	X	3	2	X	X
Sustancias y artículos peligrosos misceláneos 9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Los números y símbolos se relacionan a los siguientes términos como se define en esta sección:

- 1 - "Lejos de"
- 2 - "Separado de"
- 3 - "Separado por un compartimiento completo"
- 4 - "Separar longitudinalmente por un compartimiento completo"
- X - La segregación, si existe, se muestra en los horarios individuales
- Ver subsección 6.2 de la introducción a la clase 1 para la segregación dentro de la clase 1

ANEXO 10

FLORA TERRESTRE