

# Diseño Hidráulico

**SISTEMA EXISTENTE**

## **Memoria de Calculo**



"Consultoría para la Elaboración del Estudio Definitivo y Expediente  
Técnico de Obra: Cambio de Redes de Alcantarillado Urb. Caja de Agua  
distrito de San Juan de Lurigancho"

SIMULACIÓN  
HIDRAÚLICA  
EXISTENTE

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## MEMORIA DESCRIPTIVA SIMULACIÓN HIDRÁULICA DEL SISTEMA EXISTENTE

### I. OBJETIVO

Evaluar las condiciones actuales de funcionamiento del sistema de alcantarillado de la Urbanización "Caja de Agua". Para identificar problemas de diseño y que estas puedan ser resueltas para la modelación en el sistema proyectado, que deberá cumplir todas las condiciones de diseño de sistemas de alcantarillado.

### II. TOPOLOGÍA

La topología considerada para la simulación para evitar confusiones es la siguiente:

**Cuadro 2-1: Topología**

ELEMENTO CONSIDERADO	TOPOLOGÍA EN LA SIMULACIÓN
<b>TUBERÍAS</b> Las tuberías para el sistema existente son tanto de PVC (cambiadas) como de concreto (a cambiar).	<b>Conduit</b> Representan los colectores y sus características físicas de funcionamiento.
<b>BUZONES</b> Los buzones que se encuentran dentro de la zona de estudio, para este caso tenemos los buzones rehabilitados y a rehabilitar.	<b>Manhole</b> Representadas por circunferencias en cada cambio de dirección o pendiente, es donde se asignan tanto las descargas domiciliarias como los aportes.
<b>BUZONES DE DESCARGA</b> Buzones en los que finaliza todo el recorrido de las tuberías que provienen de un sector definido.	<b>Out Fall</b> Se coloca la válvula reductora de Presión bajo las mismas condiciones de la simulación original.

### III. SOFTWARE

Para realizar el modelamiento hidráulico se ha utilizado el software Bentley® SewerCAD® V8i (SELECTseries 4)

### IV. DATOS DE INGRESO

#### Los aportes

Los aportes en la simulación original muestran los siguientes datos:

	Aporte total (L/s)
CAUDAL	32.04

El caudal proviene de la Demanda de Alcantarillado para el Año Base (2015) indicada en el Anexo 01: Demanda de Alcantarillado. El dato fue determinado tanto usando los consumos para cada

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tipo de usuario, como también el total de conexiones dentro de la zona de estudio con una proyección de 20 años, estos fueron evaluados y asignados a cada buzón dependiendo de la zona en la que se encuentre cada uno de estos. Estos caudales asignados se adjuntan al reporte de simulación hidráulica.

### Elevaciones

Las elevaciones son proporcionadas por el estudio topográfico y esportadas a través de las tablas flexibles que son herramientas de Sewercad, del mismo modo las profundidades de los buzones y las caídas para cada colector a la llegada a los buzones.

### **V. TRAMOS CRÍTICOS DE LA RED EXISTENTE**

Con la información recolectado de campo como datos topográficos, características de los buzones (profundidad), tipo de material y longitud de las tuberías, más la demanda calculado en gabinete se prosiguió a realizar la simulación hidráulica. Dando como resultado tramos con tensiones tractivas y velocidades inferiores a lo indicado en el RNE, resultando estos tramos como críticos por considerarse deficiente en el arrastre de sólidos.

Se tuvo en cuenta para determinar estos valores de tensiones tractivas que el caudal mínimo de aporte en los buzones de arranque, que son los que generalmente presenta mayores problemas, sea reemplazado por 1.5 l/s para poder generar condiciones apropiadas de funcionamiento, ya que al colocar la demanda real del sistema se obtuvo tensión tractiva menor a 1 Pa en el 45.5% de tuberías del sistema; para el cálculo de la tensión tractiva el programa Sewercad usa como fórmula la siguiente:

$$\tau = \gamma \cdot Rh \cdot S$$

donde:

$\tau$  = Fuerza tractiva ( Kg/m<sup>2</sup> )  
 $\gamma$  = Peso específico del agua ( Kg/m<sup>3</sup> ,  
 $Rh$  = Radio hidráulico ( m )  
 $S$  = Pendiente de la tubería ( m/m )

Por otra parte, la mayoría de las tuberías son de Concreto simple normalizado (CSN), tuberías que ya culminaron con su periodo de vida. Y algunas que fueron rehabilitadas tampoco cumplen con dicha condición. En la mayoría de los tramos las velocidades son inferiores a 0.6m/s, y presentan problemas de arrastre hidráulico, por lo que se plantea mejorar el sistema incrementando la pendiente para un mejor arrastre hidráulico.

A continuación se muestra las tablas con los tramos críticos indicadas por calles.

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**Cuadro 4- 1: Tramos críticos por calles del Sistema Existente**

CALLES	INICIO	FINAL	DIAMET RO (mm)	MATERIAL	VELOCIDAD (m/s)	TENSION TRACTIVA(Pa)
Jr. Piura	BE-58	BE-55	300	Concreto	0.34	0.431
Jr. Lambayeque	BE-69	BE-67	300	Concreto	0.50	0.941
Jr. Lambayeque	BE-AD-96 (A)	BE-AD-97	200	PVC	0.45	0.728
Jr. Pisco	BE-66	BE-63	200	Concreto	0.37	0.781
Av. Rimac	BE-147	BE-148	300	Concreto	0.46	0.861
Av. Rimac	BE-148	BE-149	300	Concreto	0.48	0.920
Av. Perú	BE-159	BE-166	350	Concreto	0.51	0.934
Jr. Zorritos	BE-AD-80	BE-AD-81	160	Concreto	0.31	0.524
Jr. Zorritos	BE-AD-75	BE-40	200	PVC	0.45	0.546
Jr. Tumbes	BE-AD-85	BE-AD-84	200	PVC	0.46	0.758
Jr. Chimbote	BE-AD-82	BE-AD-83	200	PVC	0.50	0.902
Jr. Chimbote	BE-AD-83 (A)	BE-AD-90(A)	200	PVC	0.41	0.566
Jr. Chimbote	BE-AD-90	BE-AD-93	200	PVC	0.44	0.704
Jr. Trujillo	BE-74	BE-75	200	Concreto	0.39	0.884
Jr. Trujillo	BE-82	BE-81	200	Concreto	0.39	0.919
Av. Rimac	BE-AD-16	BE-AD-18	250	Concreto	0.54	0.728
Av. Rimac	BE-58	BE-59	250	Concreto	0.25	0.244
Av. Perú	BE-AD-24	BE-AD-26	200	PVC	0.50	0.926
Jr. Tacna	BE-AD-39	BE-AD-31	250	Concreto	0.39	0.734
Av. Perú	BE-AD-30	BE-160	200	PVC	0.42	0.600
Av. Perú	BE-160	BE-161	200	Concreto	0.34	0.642
Av. Perú	BE-161	BE-162	300	Concreto	0.39	0.781
Av. Perú	BE-162	BE-163	300	Concreto	0.41	0.850
Av. Perú	BE-163	BE-164	300	Concreto	0.38	0.652
Jr. Iquitos	BE-AD-158	BE-AD-159	200	PVC	0.51	0.971
Jr. Iquitos	BE-AD-159	BE-AD-160	200	PVC	0.51	0.939
Jr. Iquitos	BE-AD-168	BE-AD-170	200	PVC	0.59	0.955
Jr. Loreto	BE-AD-139	BE-AD-140	200	PVC	0.46	0.752
Jr. Loreto	BE-AD-140 (A)	BE-AD-141	200	PVC	0.44	0.673
Jr. Lambayeque	BE-AD-151	BE-AD-153	200	PVC	0.48	0.821
Jr. Lambayeque	BE-AD-150	BE-AD-151	200	PVC	0.52	0.991
Jr. Lambayeque	BE-AD-149	BE-AD-150	200	PVC	0.43	0.666
Jr. Ica	BE-AD-134	BE-AD-135	200	PVC	0.45	0.682
Jr. Puerto Maldonado	BE-AD-126	BE-AD-127	200	PVC	0.34	0.396
Jr. Trujillo	BE-AD-135	BE-AD-137	200	PVC	0.49	0.695
Jr. Trujillo	BE-AD-131	BE-AD-132	200	PVC	0.47	0.618

## VI. CONCLUSIONES

- El 13.42% de las tuberías en total (tuberías de PVC y CSN) no cumplen con la condición que es Tensión Tractiva mayor o igual a 1 Pascal ( $T \geq 1\text{Pa}$ ). De estas tendremos especial atención en las de CSN, ya que las de PVC no serán cambiada según lo coordinado con el Equipo de Operación y Mantenimiento – SJL.
- El 45.84% de las tuberías en total (tuberías de PVC y CSN) cumplen la condición de velocidad mayor a 0.6 m/s ( $v > 0.6\text{ m/s}$ ).
- El 100% de los colectores trabaja a una capacidad hidráulica menor al 75%
- Se evaluará con la Simulación Hidráulica del Sistema a Cambiar si la capacidad hidráulica de los colectores es suficiente para la demanda al Año 20.

Nota: Las conclusiones presentadas son una interpretación de lo expuesto en los reportes anexados.


## VII. OBSERVACIONES


- El tramo ubicado entre los BE-AD-83 y BE-AD- 84\* presenta en el cálculo hidráulico cero (0) aportes, por lo que se considera una tubería abandonada y reubicada a la pista. Sin embargo, se observó en campo que el tramo presenta aporte lo que indica que la conexiones no han sido conectadas a la nueva tubería. Según lo conversado con el Equipo de Operación y Mantenimiento – SJL, ellos se encargarán de clausurar el colector y reconectar las conexiones de desagüe.
- El tramo Tub-14, ubicado entre los buzones BE-123 y BE-122, se encuentran dentro de la zona lateral del ingreso al túnel Santa Rosa y por motivos de la construcción del mencionado túnel se hicieron expropiaciones teniendo este tramo totalmente abandonado (sin aportes). Se considerará como colector a anular en el Sistema de Alcantarillado a Cambiar según lo coordinado con el Equipo de Operación y Mantenimiento – SJL.
- El tramo Tub-207, ubicado entre los buzones BE-AD-122 y BE-AD-126, no figura dentro de los planos proporcionados por el equipo de Operación y Mantenimiento –SJL. De la inspección de campo se observa que sí recibe descargas ya que el buzón BE-AD-126 recibe cierto aporte, haciendo presumir que dentro de dicho colector se encuentran conexiones domiciliarias. Se considerará en el Sistema de Alcantarillado a Cambiar según lo coordinado con el Equipo de Operación y Mantenimiento – SJL.
- En el tramo PVC – 186, ubicado entre los buzones BE-AD-123 y BE-AD-124, circulan las descargas de todas las conexiones domiciliarias ubicadas en el Jr. Madre de Dios según la información brindada por el Equipo de Operación y Mantenimiento –SJL. Sin embargo, en la inspección de campo se pudo apreciar que las descargas de este jirón se dirigían hacia el colector Las Flores (BE-AD-172) y seguidamente al colector Próceres (BE-AD-174), dejando totalmente inoperativo este tramo y se considerará su anulación en el Sistema de Alcantarillado a Cambiar según lo coordinado con el Equipo de Operación y Mantenimiento – SJL

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## VIII. ANEXO

Anexo 01: Demanda de Alcantarillado

AÑO		POBLACION	COBERTURA		POBLACION SERVIDA	VIVIENDAS SERVIDAS	CONEXIONES					INDUSTRIAL	INDUSTRI
			CONEX.	OTROS MEDIOS			DOMES	COMER	MULTIFAM	ESTATAL			
Base	2,015	8,076	100.0%	0.0%	8,076	1,776	1,039	42	737	4	3	1,825	
0	2,016	8,279	100.0%	0.0%	8,279	1,821	1,065	42	756	4	3	1,870	
1	2,017	8,477	100.0%	0.0%	8,477	1,864	1,090	45	774	4	3	1,916	
2	2,018	8,670	100.0%	0.0%	8,670	1,907	1,114	47	791	4	3	1,960	
3	2,019	8,856	100.0%	0.0%	8,856	1,947	1,136	49	808	4	3	2,001	
4	2,020	9,037	100.0%	0.0%	9,037	1,987	1,158	51	825	4	3	2,041	
5	2,021	9,211	100.0%	0.0%	9,211	2,026	1,178	53	841	5	3	2,079	
6	2,022	9,379	100.0%	0.0%	9,379	2,062	1,196	55	856	5	3	2,115	
7	2,023	9,540	100.0%	0.0%	9,540	2,098	1,213	57	871	5	3	2,149	
8	2,024	9,695	100.0%	0.0%	9,695	2,132	1,229	59	885	5	3	2,181	
9	2,025	9,843	100.0%	0.0%	9,843	2,164	1,244	62	898	5	3	2,212	
10	2,026	9,986	100.0%	0.0%	9,986	2,196	1,257	64	911	5	3	2,241	
11	2,027	10,121	100.0%	0.0%	10,121	2,226	1,269	66	924	5	3	2,268	
12	2,028	10,250	100.0%	0.0%	10,250	2,254	1,280	69	935	5	4	2,293	
13	2,029	10,373	100.0%	0.0%	10,373	2,281	1,289	72	947	5	4	2,316	
14	2,030	10,489	100.0%	0.0%	10,489	2,307	1,297	75	957	5	4	2,338	
15	2,031	10,599	100.0%	0.0%	10,599	2,331	1,304	77	967	5	4	2,358	
16	2,032	10,703	100.0%	0.0%	10,703	2,354	1,310	80	977	5	4	2,376	
17	2,033	10,801	100.0%	0.0%	10,801	2,375	1,315	84	986	5	4	2,393	
18	2,034	10,893	100.0%	0.0%	10,893	2,395	1,318	87	994	5	4	2,408	
19	2,035	10,978	100.0%	0.0%	10,978	2,414	1,320	90	1,002	5	4	2,421	
20	2,036	11,059	100.0%	0.0%	11,059	2,432	1,321	94	1,009	5	4	2,434	



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Anexo 01: Demanda de Alcantarillado

AÑO	POBLACION	DEMANDA DESAGUE (80%)			Q <sub>md</sub> lt/seg	Q <sub>max h</sub> lt/seg
		lt/seg	lt/dia	m3/año		
Base	2,015	1780	1,537,819	561,304	23.14	32.04
0	2,016	1813	1,566,034	571,602	23.56	32.63
1	2,017	1849	1,597,824	583,206	24.04	33.29
2	2,018	1883	1,626,553	593,692	24.47	33.89
3	2,019	1915	1,654,200	603,783	24.89	34.46
4	2,020	1946	1,680,973	613,555	25.29	35.02
5	2,021	1975	1,706,659	622,930	25.68	35.56
6	2,022	2004	1,731,364	631,948	26.05	36.07
7	2,023	2031	1,754,986	640,570	26.41	36.56
8	2,024	2057	1,777,634	648,836	26.75	37.03
9	2,025	2082	1,799,208	656,711	27.07	37.48
10	2,026	2106	1,819,929	664,274	27.38	37.92
11	2,027	2129	1,839,487	671,413	27.68	38.32
12	2,028	2151	1,858,105	678,208	27.96	38.71
13	2,029	2171	1,875,796	684,666	28.22	39.08
14	2,030	2190	1,892,467	690,751	28.47	39.43
15	2,031	2209	1,908,238	696,507	28.71	39.75
16	2,032	2226	1,923,126	701,941	28.94	40.07
17	2,033	2242	1,937,146	707,058	29.15	40.36
18	2,034	2257	1,950,315	711,865	29.35	40.63
19	2,035	2271	1,962,547	716,330	29.53	40.89
20	2,036	2285	1,974,179	720,575	29.70	41.13

## **Reportes**

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-1	BE-AD-10	196.800	BE-AD-09	196.693	PVC	144.60	1.500	12.19	8.776	0.63	1.512	22.1	12.21
Tub PVC-2	BE-AD-12	198.422	BE-AD-11	197.494	PVC	144.60	0.049	17.07	54.368	0.43	1.307	14.2	17.22
Tub PVC-3	BE-AD-133	189.150	BE-AD-130	189.570	PVC	144.60	1.500	53.64	7.829	0.61	1.383	22.4	53.60
Tub PVC-4	BE-AD-118	190.311	BE-AD-120	189.893	PVC	144.60	1.500	60.35	6.926	0.58	1.257	24.2	60.42
Tub PVC-5	BE-AD-11	197.494	BE-AD-10	196.800	PVC	144.60	1.500	68.88	10.075	0.66	1.687	21.8	68.78
Tub PVC-6	BE-AD-140	188.279	BE-AD-140*	188.153	PVC	180.80	0.179	1.83	68.898	0.67	2.697	4.8	1.69
Tub PVC-7	BE-AD-102	197.768	BE-AD-103	197.708	PVC	180.80	2.200	2.13	28.121	1.04	4.258	22.6	2.27
Tub PVC-9	BE-AD-85	198.257	BE-AD-86	198.343	PVC	180.80	0.300	3.96	21.704	0.52	1.416	13.3	4.06
Tub PVC-11	BE-AD-90*	197.565	BE-AD-90	197.410	PVC	180.80	0.717	4.57	33.902	0.79	2.978	15.7	4.59
Tub PVC-12	BE-AD-75	198.640	BE-AD-81	199.269	PVC	180.80	0.056	4.57	137.577	0.60	2.680	15.5	4.65
Tub PVC-13	BE-AD-27	194.647	BE-AD-28	191.401	PVC	180.80	0.347	4.88	665.600	1.79	21.075	29.4	5.85
Tub PVC-14	BE-AD-74	198.999	BE-AD-75	198.640	PVC	180.80	1.818	7.62	47.113	1.18	5.828	23.8	7.51
Tub PVC-15	BE-AD-26	196.136	BE-AD-28	191.401	PVC	180.80	0.383	8.23	575.362	1.74	19.834	29.7	9.48
Tub PVC-17	BE-AD-104	196.367	BE-AD-106	196.600	PVC	180.80	1.500	10.06	23.165	0.87	3.083	20.8	10.11
Tub PVC-18	BE-AD-129*	189.640	BE-AD-129	189.540	PVC	180.80	1.500	10.06	9.942	0.64	1.600	16.4	10.17
Tub PVC-19	BE-AD-152	189.287	BE-AD-153	188.930	PVC	180.80	0.776	10.36	34.449	0.82	3.097	15.0	10.35
Tub PVC-20	BE-AD-52	206.132	BE-AD-51	204.971	PVC	180.80	2.630	10.67	108.830	1.76	13.164	17.5	10.77
Tub PVC-21	BE-AD-114	189.498	BE-AD-113	190.285	PVC	180.80	0.055	10.67	73.772	0.48	1.659	7.7	10.82
Tub PVC-22	BE-AD-140*	188.153	BE-AD-144	187.660	PVC	180.80	0.179	11.58	42.565	0.56	1.876	8.1	11.44
Tub PVC-23	BE-AD-14	194.565	BE-92	196.467	PVC	180.80	0.307	13.41	141.822	1.00	6.079	21.4	13.68
Tub PVC-24	BE-40	198.610	BE-31	198.452	PVC	180.80	2.094	13.72	11.519	0.75	2.079	21.8	13.71
Tub PVC-25	BE-AD-104	196.367	BE-AD-107	195.914	PVC	180.80	2.511	15.24	29.724	1.10	4.724	19.0	15.25
Tub PVC-26	BE-AD-15	194.038	BE-AD-16	193.619	PVC	180.80	0.000	15.85	26.436	0.00	0.000	24.5	15.75
Tub PVC-28	BE-AD-127	189.125	BE-AD-124	188.967	PVC	180.80	2.429	17.37	9.094	0.72	1.847	21.1	17.39
Tub PVC-30	BE-AD-72	200.244	BE-AD-73	199.876	PVC	180.80	1.732	18.29	20.122	0.86	2.947	19.6	18.38
Tub PVC-31	BE-AD-67	204.130	BE-AD-66	206.938	PVC	180.80	0.365	18.90	148.590	1.07	6.830	9.9	19.19
Tub PVC-32	BE-AD-83*	197.612	BE-AD-90*	197.565	PVC	180.80	1.500	18.90	2.487	0.40	0.544	19.3	19.05
Tub PVC-33	BE-AD-126	189.159	BE-AD-127	189.125	PVC	180.80	1.572	19.20	1.771	0.35	0.426	23.1	19.33
Tub PVC-34	BE-AD-17	197.742	BE-AD-18	193.592	PVC	180.80	1.115	19.51	212.742	1.71	15.023	26.7	19.91
Tub PVC-35	BE-AD-108	195.129	BE-86	194.731	PVC	180.80	2.681	19.51	20.403	0.99	3.622	20.3	19.53
Tub PVC-36	BE-AD-146	186.470	BE-AD-148	186.040	PVC	180.80	0.533	19.81	21.704	0.62	1.841	20.8	19.67

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Bentley Systems, Inc. Haestad Methods Solution Center  
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-37	BE-27	197.313	BE-AD-76	197.595	PVC	180.80	1.940	21.64	13.031	0.76	2.213	18.1	21.72
Tub PVC-38	BE-AD-06	196.885	BE-AD-04	195.975	PVC	180.80	2.750	22.25	40.898	1.27	6.276	29.0	22.40
Tub PVC-39	BE-AD-90	197.410	BE-AD-83	197.574	PVC	180.80	1.500	22.56	7.271	0.58	1.254	18.5	22.71
Tub PVC-41	BE-AD-166	187.690	BE-AD-167	187.880	PVC	180.80	1.500	23.77	7.992	0.60	1.350	16.8	23.77
Tub PVC-43	BE-AD-168	187.410	BE-AD-170	187.360	PVC	180.80	2.029	24.08	2.076	0.40	0.539	23.7	24.23
Tub PVC-44	BE-AD-75	198.640	BE-40	198.610	PVC	180.80	1.874	24.99	1.200	0.33	0.338	24.5	25.13
Tub PVC-45	BE-AD-143	188.820	BE-AD-142	188.383	PVC	180.80	1.500	25.30	17.274	0.78	2.453	23.9	25.16
Tub PVC-46	BE-47	190.309	BE-AD-116	190.847	PVC	180.80	0.990	25.60	21.013	0.74	2.370	12.3	25.55
Tub PVC-47	BE-AD-73	199.876	BE-AD-74	198.999	PVC	180.80	1.772	25.60	34.254	1.04	4.500	19.9	25.69
Tub PVC-48	BE-AD-76	197.595	BE-16	198.615	PVC	180.80	1.894	25.91	39.370	1.12	5.166	20.6	25.95
Tub PVC-49	BE-AD-166	187.690	BE-AD-165	187.930	PVC	180.80	0.817	28.04	8.559	0.51	1.084	14.1	27.91
Tub PVC-50	BE-AD-112	189.986	BE-AD-111	190.290	PVC	180.80	1.500	28.04	10.841	0.67	1.706	16.2	28.14
Tub PVC-53	BE-16	198.615	BE-15	200.146	PVC	180.80	1.515	31.70	48.298	1.12	5.470	19.3	31.60
Tub PVC-54	BE-AD-142	188.383	BE-AD-141	188.036	PVC	180.80	3.907	32.61	10.640	0.88	2.570	30.1	32.53
Tub PVC-56	BE-AD-160	187.290	BE-AD-161	186.930	PVC	180.80	1.500	35.05	10.270	0.65	1.643	21.3	35.01
Tub PVC-57	BE-AD-170	187.360	BE-AD-169	188.120	PVC	180.80	0.152	35.97	21.131	0.43	1.004	14.1	36.03
Tub PVC-58	BE-AD-147	187.540	BE-AD-145	187.790	PVC	180.80	4.225	37.49	6.668	0.76	1.848	30.9	37.37
Tub PVC-59	BE-AD-109	194.345	BE-49	190.363	PVC	180.80	0.095	37.49	106.214	0.65	2.801	11.1	37.82
Tub PVC-60	BE-AD-08	197.976	BE-AD-06	196.885	PVC	180.80	2.750	38.10	28.635	1.12	4.767	19.9	38.07
Tub PVC-61	BE-AD-110	193.215	BE-AD-152	189.287	PVC	180.80	0.776	38.10	103.097	1.19	7.280	9.5	38.27
Tub PVC-62	BE-AD-107	195.914	BE-AD-108	195.129	PVC	180.80	2.511	38.40	20.440	0.97	3.523	24.0	38.29
Tub PVC-63	BE-AD-82	197.767	BE-AD-83	197.574	PVC	180.80	1.500	40.54	4.761	0.50	0.902	17.8	40.53
Tub PVC-64	BE-AD-132	188.560	BE-AD-133 (A)	189.150	PVC	180.80	1.500	40.54	14.554	0.74	2.149	23.7	40.69
Tub PVC-65	BE-143	192.329	BE-AD-44	188.653	PVC	180.80	0.381	41.15	89.336	0.92	4.689	6.8	41.28
Tub PVC-66	BE-AD-164	188.320	BE-AD-163	188.620	PVC	180.80	1.500	41.15	7.291	0.58	1.257	17.0	41.21
Tub PVC-67	BE-AD-71	200.726	BE-AD-72	200.244	PVC	180.80	1.668	41.45	11.628	0.70	1.894	19.3	41.60
Tub PVC-68	BE-AD-106	196.600	BE-AD-105	197.740	PVC	180.80	1.500	42.37	26.908	0.91	3.463	14.8	42.48
Tub PVC-69	BE-AD-89	198.317	BE-AD-90*	197.565	PVC	180.80	0.279	42.37	17.750	0.47	1.173	10.1	42.51
Tub PVC-70	BE-AD-129	189.540	BE-AD-128	189.790	PVC	180.80	1.495	43.28	5.776	0.53	1.046	17.4	43.26
Tub PVC-71	BE-AD-138	187.950	BE-AD-137	188.710	PVC	180.80	1.755	43.89	17.316	0.82	2.645	20.2	43.82

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-72	BE-AD-83*	197.612	BE-AD-84	198.031	PVC	180.80	1.500	44.50	9.416	0.63	1.533	19.3	44.39
Tub PVC-73	BE-AD-165	187.930	BE-AD-164	188.320	PVC	180.80	0.740	44.81	8.704	0.50	1.050	13.0	44.71
Tub PVC-74	BE-AD-83	197.574	BE-AD-84*	198.193	PVC	180.80	0.000	46.02	13.449	0.00	0.000	9.1	45.95
Tub PVC-76	BE-AD-132	188.560	BE-AD-142	188.383	PVC	180.80	3.724	46.63	3.795	0.60	1.125	29.4	46.70
Tub PVC-77	BE-AD-30	186.407	BE-160	186.279	PVC	180.80	1.500	46.63	2.745	0.41	0.587	21.2	46.72
Tub PVC-78	BE-AD-145	187.790	BE-AD-141	188.036	PVC	180.80	4.161	46.63	5.275	0.69	1.525	30.7	46.73
Tub PVC-79	BE-AD-88	198.733	BE-AD-89	198.317	PVC	180.80	1.500	46.63	8.920	0.62	1.470	16.6	46.74
Tub PVC-80	BE-AD-150	189.400	BE-AD-149	189.550	PVC	180.80	1.500	46.63	3.217	0.43	0.666	18.7	46.77
Tub PVC-81	BE-AD-93	197.240	BE-AD-92	197.677	PVC	180.80	1.500	47.24	9.250	0.63	1.512	18.2	47.29
Tub PVC-82	BE-AD-163	188.620	BE-AD-162	188.970	PVC	180.80	1.500	47.55	7.361	0.58	1.266	16.9	47.54
Tub PVC-83	BE-AD-170	187.360	BE-163	186.280	PVC	180.80	2.276	47.85	22.569	0.97	3.643	18.6	47.82
Tub PVC-84	BE-AD-70	198.225	BE-21	198.717	PVC	180.80	0.895	47.85	10.281	0.56	1.302	16.8	47.88
Tub PVC-85	BE-AD-153	188.930	BE-AD-151	189.120	PVC	180.80	1.500	47.85	3.970	0.47	0.784	18.2	47.91
Tub PVC-87	BE-AD-103	197.708	BE-AD-104	196.367	PVC	180.80	2.425	47.85	28.023	1.07	4.420	23.4	47.97
Tub PVC-88	BE-AD-128	189.790	BE-47	190.309	PVC	180.80	0.530	48.16	10.777	0.49	1.064	14.4	48.08
Tub PVC-89	BE-AD-148	186.040	BE-AD-147	187.540	PVC	180.80	4.240	48.16	31.147	1.31	6.180	30.9	48.10
Tub PVC-90	BE-AD-69	199.833	BE-21	198.717	PVC	180.80	0.143	48.16	23.174	0.42	1.061	9.7	48.18
Tub PVC-91	BE-AD-158	187.812	BE-AD-159	187.560	PVC	180.80	1.500	48.16	5.233	0.51	0.971	17.6	48.17
Tub PVC-92	BE-68	196.457	BE-AD-96	197.260	PVC	180.80	1.500	48.16	16.674	0.77	2.387	15.5	48.34
Tub PVC-93	BE-AD-131	188.630	BE-AD-132	188.560	PVC	180.80	2.557	48.46	1.444	0.38	0.448	30.0	48.45
Tub PVC-94	BE-AD-166	187.690	BE-AD-161	186.930	PVC	180.80	1.004	48.46	15.682	0.67	1.902	19.6	48.51
Tub PVC-96	BE-AD-90	197.410	BE-AD-93	197.240	PVC	180.80	1.500	49.07	3.464	0.44	0.704	18.6	48.96
Tub PVC-98	BE-AD-93	197.240	BE-AD-94	195.919	PVC	180.80	1.536	49.68	26.589	0.91	3.468	19.0	49.81
Tub PVC-100	BE-29	197.809	BE-AD-70	198.225	PVC	180.80	1.764	50.29	8.272	0.63	1.490	18.1	50.20
Tub PVC-101	BE-AD-117	190.878	BE-AD-125	190.290	PVC	180.80	1.273	50.29	11.692	0.65	1.684	17.4	50.28
Tub PVC-102	BE-05	205.142	BE-AD-65	212.603	PVC	180.80	1.070	50.60	147.460	1.48	11.116	16.6	51.17
Tub PVC-103	BE-AD-92	197.677	BE-AD-91	198.477	PVC	180.80	0.290	51.51	15.531	0.46	1.078	13.0	51.47
Tub PVC-104	BE-AD-129	189.540	BE-AD-127	189.125	PVC	180.80	0.826	51.51	8.057	0.50	1.040	18.3	51.57
Tub PVC-105	BE-AD-125	190.290	BE-AD-126	189.159	PVC	180.80	1.502	51.82	21.827	0.85	2.941	20.5	51.78
Tub PVC-106	BE-AD-151	189.120	BE-AD-150	189.400	PVC	180.80	1.500	52.12	5.372	0.52	0.991	18.2	52.10
Tub PVC-107	BE-65 (A)	197.319	BE-66	196.486	PVC	180.80	1.500	52.43	15.889	0.76	2.300	19.5	52.44

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-108	BE-AD-144	187.660	BE-AD-146	186.470	PVC	180.80	0.454	52.43	22.699	0.60	1.773	10.3	52.48
Tub PVC-109	BE-AD-68	201.170	BE-AD-67	204.130	PVC	180.80	0.567	52.73	56.135	0.87	3.946	12.1	52.78
Tub PVC-110	BE-AD-134	189.026	BE-AD-114	189.498	PVC	180.80	0.670	53.04	8.900	0.49	1.022	15.9	53.13
Tub PVC-112	BE-AD-124	188.967	BE-AD-131	188.630	PVC	180.80	2.429	53.95	6.247	0.63	1.379	27.0	54.01
Tub PVC-113	BE-AD-50	201.898	BE-AD-49	198.607	PVC	180.80	2.823	54.56	60.320	1.47	8.594	18.9	54.70
Tub PVC-114	BE-AD-159	187.560	BE-AD-160	187.290	PVC	180.80	1.500	55.17	4.894	0.50	0.921	17.8	55.11
Tub PVC-115	BE-43	197.036	BE-AD-110	193.215	PVC	180.80	0.761	55.78	68.503	1.02	5.265	12.9	55.88
Tub PVC-116	BE-AD-70	198.225	BE-AD-68	201.170	PVC	180.80	0.799	57.61	51.122	0.94	4.292	16.4	57.62
Tub PVC-117	BE-AD-153	188.930	BE-AD-154	188.160	PVC	180.80	1.334	60.05	12.824	0.68	1.848	15.0	60.12
Tub PVC-118	BE-31	198.452	BE-AD-102	197.768	PVC	180.80	2.200	60.66	11.277	0.75	2.091	19.6	60.71
Tub PVC-119	BE-AD-84	198.031	BE-AD-85	198.257	PVC	180.80	1.500	60.66	3.726	0.46	0.745	18.3	60.74
Tub PVC-120	BE-AD-27*	195.520	BE-AD-27	194.647	PVC	180.80	0.323	61.87	14.109	0.46	1.052	8.5	61.79
Tub PVC-121	BE-AD-137	188.710	BE-AD-135	188.820	PVC	180.80	1.500	62.18	1.769	0.35	0.417	21.0	62.10
Tub PVC-122	BE-AD-29	187.500	BE-AD-30	186.407	PVC	180.80	1.500	62.18	17.578	0.79	2.487	19.1	62.15
Tub PVC-123	BE-AD-136	189.540	BE-AD-137	188.710	PVC	180.80	1.500	65.53	12.666	0.70	1.934	18.9	65.65
Tub PVC-124	BE-AD-138	187.950	BE-AD-168	187.410	PVC	180.80	1.941	65.84	8.202	0.65	1.544	22.8	65.72
Tub PVC-125	BE-AD-139	188.530	BE-AD-140	188.279	PVC	180.80	1.500	66.45	3.777	0.46	0.752	18.3	66.60
Tub PVC-127	BE-AD-97	197.198	BE-71	196.800	PVC	180.80	1.500	69.49	5.727	0.53	1.041	17.4	69.59
Tub PVC-128	BE-AD-135	188.820	BE-AD-134	189.026	PVC	180.80	1.500	69.80	2.951	0.42	0.622	21.0	69.85
Tub PVC-129	BE-AD-94	195.919	BE-64	196.338	PVC	180.80	1.500	71.32	5.875	0.54	1.062	18.8	71.41
Tub PVC-130	BE-AD-114	189.498	BE-AD-112	189.986	PVC	180.80	1.500	73.46	6.643	0.56	1.169	17.1	73.46
Tub PVC-131	BE-AD-98	197.090	BE-93	196.567	PVC	180.80	1.500	74.37	7.032	0.57	1.222	17.0	74.34
Tub PVC-132	BE-AD-24	196.774	BE-AD-26	196.136	PVC	180.80	1.500	129.54	4.925	0.50	0.926	17.7	129.58
Tub PVC-133	BE-171	190.808	BE-142	190.708	PVC	226.20	2.899	3.05	32.808	1.16	5.194	15.2	3.03
Tub PVC-134	BE-AD-154	188.160	BE-AD-155	188.000	PVC	226.20	1.334	7.92	20.190	0.77	2.508	13.5	7.96
Tub PVC-135	BE-79	195.675	BE-AD-99	195.564	PVC	226.20	2.594	16.15	6.871	0.65	1.469	16.8	16.08
Tub PVC-136	BE-AD-156	189.137	BE-AD-155	188.000	PVC	226.20	0.116	19.51	58.286	0.52	1.888	9.0	19.59
Tub PVC-137	BE-AD-02	197.053	BE-AD-01	199.021	PVC	226.20	1.591	25.30	77.791	1.30	7.745	14.4	25.35
Tub PVC-138	BE-AD-62	196.530	BE-AD-63	195.282	PVC	226.20	0.144	27.13	46.005	0.53	1.704	5.1	27.07
Tub PVC-139	BE-AD-148	186.040	BE-164	185.833	PVC	226.20	4.828	28.04	7.382	0.80	2.045	29.8	27.99
Tub PVC-140	BE-AD-16	193.619	BE-AD-18	193.592	PVC	226.20	6.000	30.18	0.895	0.40	0.426	34.7	30.16

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FlexTable: Conduit Table

Label	Start Node	Invert (m)	Stop Node	Invert (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-141	BE-AD-13	195.116	BE-AD-14	194.565	PVC	226.20	5.693	48.16	11.441	0.98	3.094	27.3	48.17
Tub PVC-142	BE-142	190.308	BE-145	188.678	PVC	226.20	3.483	48.16	33.847	1.24	5.769	21.7	48.30
Tub PVC-143	BE-AD-161	186.930	BE-161	186.628	PVC	226.20	3.053	48.46	6.232	0.66	1.463	18.4	48.32
Tub PVC-144	BE-145	188.678	BE-AD-40	187.105	PVC	226.20	3.971	48.46	32.458	1.27	5.928	17.8	48.36
Tub PVC-145	BE-AD-94	195.919	BE-79	195.675	PVC	226.20	1.968	48.77	5.003	0.53	1.015	16.8	48.65
Tub PVC-146	BE-139	191.767	BE-171	190.808	PVC	226.20	2.899	49.68	19.303	0.96	3.439	15.9	49.64
Tub PVC-147	BE-AD-157	187.570	BE-AD-161	186.930	PVC	226.20	1.737	50.60	12.649	0.71	1.970	17.1	50.70
Tub PVC-148	BE-AD-04	195.975	BE-AD-13	195.116	PVC	226.20	5.574	51.82	16.578	1.11	4.094	26.8	51.75
Tub PVC-149	BE-AD-63	195.282	BE-AD-64	193.200	PVC	226.20	0.303	58.83	35.392	0.60	1.970	11.8	58.96
Tub PVC-150	BE-AD-18	193.592	BE-AD-23	193.012	PVC	226.20	7.115	61.87	9.374	0.97	2.917	34.4	61.88
Tub PVC-151	BE-AD-155	188.000	BE-AD-157	187.570	PVC	226.20	1.627	64.62	6.655	0.56	1.161	14.5	64.63
Tub PVC-152	BE-AD-03	196.607	BE-AD-02	197.053	PVC	226.20	1.732	67.36	6.621	0.57	1.190	15.0	67.36
Tub PVC-153	BE-AD-14	194.565	BE-AD-16	193.619	PVC	226.20	6.000	67.36	14.044	1.07	3.715	33.4	67.41
Tub PVC-154	BE-AD-04	195.975	BE-AD-03	196.607	PVC	226.20	1.888	69.80	9.055	0.65	1.577	21.0	69.90
Tub PVC-155	BE-AD-64	193.200	BE-139	192.267	PVC	226.20	2.458	72.85	12.808	0.79	2.324	15.3	72.99
Tub PVC-156	BE-AD-37	184.930	BE-170	183.848	PVC	285.00	23.781	12.50	86.582	2.96	27.032	70.9	12.69
Tub PVC-157	BE-106	194.697	BE-108	194.598	PVC	285.00	4.140	24.08	4.111	0.60	1.162	17.3	24.22
Tub PVC-158	BE-AD-99	195.564	BE-AD-100	195.325	PVC	285.00	2.649	27.74	8.617	0.68	1.689	13.8	27.87
Tub PVC-159	BE-156	189.413	BE-AD-31	186.863	PVC	285.00	19.348	32.31	78.926	2.69	22.941	39.7	32.52
Tub PVC-160	BE-AD-35	185.723	BE-AD-36	185.575	PVC	285.00	23.781	36.58	4.046	0.99	2.433	41.1	36.64
Tub PVC-161	BE-AD-31	186.863	BE-AD-32	186.455	PVC	285.00	23.781	39.93	10.218	1.38	5.071	36.6	39.78
Tub PVC-162	BE-155	189.710	BE-156	189.413	PVC	285.00	15.517	40.23	7.382	1.09	3.274	35.5	40.09
Tub PVC-163	BE-AD-36	185.575	BE-AD-37	184.930	PVC	285.00	23.781	40.54	15.911	1.62	7.185	34.9	40.58
Tub PVC-164	BE-AD-100	195.325	BE-AD-101	195.121	PVC	285.00	2.777	44.20	4.616	0.56	1.063	14.0	44.33
Tub PVC-165	BE-AD-101	195.121	BE-104	194.912	PVC	285.00	2.863	47.85	4.367	0.55	1.033	15.4	47.76
Tub PVC-166	BE-154	190.968	BE-155	189.710	PVC	285.00	14.777	48.16	26.122	1.68	8.611	33.1	48.03
Tub PVC-167	BE-AD-28	191.401	BE-154	190.968	PVC	285.00	14.060	48.16	8.991	1.14	3.662	32.3	48.22
Tub PVC-168	BE-104	194.912	BE-106	194.697	PVC	285.00	3.999	49.99	4.301	0.61	1.185	16.9	49.89
Tub PVC-169	BE-108	194.598	BE-AD-28	191.401	PVC	285.00	4.397	55.47	57.631	1.55	9.240	24.7	55.49
Tub PVC-170	BE-AD-33	185.991	BE-AD-34	185.834	PVC	285.00	23.781	66.14	2.374	0.81	1.586	49.3	66.21
Tub PVC-171	BE-AD-34	185.834	BE-AD-35	185.723	PVC	285.00	23.781	66.45	1.671	0.71	1.193	46.8	66.34

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FlexTable: Conduit Table

Label	Start Node	Invert (m)	Stop Node	Invert (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC-172	BE-AD-32	186.455	BE-AD-33	185.991	PVC	285.00	23.781	86.26	5.379	1.10	3.051	44.3	86.34
Tub PVC-173	BE-AD-172	188.609	BE-AD-174	188.409	PVC	407.00	87.537	7.62	26.247	2.72	17.689	53.6	7.70
Tub PVC-174	BE-AD-121	189.072	BE-AD-172	188.609	PVC	407.00	87.100	42.67	10.850	1.98	8.778	51.9	42.72
Tub PVC-175	BE-AD-119	189.421	BE-AD-121	189.072	PVC	407.00	87.100	79.25	4.404	1.42	4.264	49.8	79.40
Tub PVC-176	BE-AD-65 (A)	212.603	BE-17	205.260	PVC	180.80	0.150	54.00	135.981	0.80	4.216	6.4	53.52
Tub PVC-177	BE-15 (A)	200.146	BE-AD-69	199.833	PVC	180.80	1.500	18.20	17.198	0.78	2.445	15.5	16.95
Tub PVC-178	BE-64	196.338	BE-36 (A)	197.106	PVC	180.80	1.500	48.90	15.706	0.76	2.279	15.6	48.09
Tub PVC-179	BE-AD-96* (A)	197.377	BE-AD-97	197.198	PVC	180.80	1.500	49.60	3.609	0.45	0.728	18.4	48.72
Tub PVC-180	BE-AD-22 (A)	196.218	BE-AD-27*	195.520	PVC	180.80	1.057	68.50	10.190	0.59	1.391	13.7	67.27
Tub PVC-181	BE-131	200.711	BE-AD-47	199.208	PVC	180.80	0.143	46.30	32.462	0.48	1.375	11.6	45.36
Tub PVC-182	BE-AD-83 (A)	197.574	BE-AD-83*	197.612	PVC	180.80	0.000	4.50	-8.444	0.00	0.000	31.0	3.30
Tub PVC-183	BE-AD-140* (A)	188.193	BE-AD-141	188.036	PVC	180.80	1.500	47.90	3.278	0.44	0.673	24.9	46.67
Tub PVC-184	BE-AD-167 (A)	187.880	BE-AD-168	187.410	PVC	180.80	1.500	24.00	19.583	0.82	2.703	21.6	22.58
Tub PVC-185	BE-AD-135	188.820	BE-AD-133	189.150	PVC	180.80	1.500	49.90	6.613	0.56	1.165	20.2	48.84
Tub PVC-186	BE-AD-124	188.967	BE-AD-123 (A)	189.249	PVC	180.80	0.000	30.00	9.400	0.00	0.000	11.6	28.82
Tub-1	BE-60	195.572	BE-59	195.621	Concrete	150.00	0.177	2.13	22.966	0.38	1.366	7.0	2.06
Tub-2	BE-AD-78	200.818	BE-AD-77	200.977	Concrete	150.00	0.024	2.74	57.962	0.30	1.094	12.9	3.07
Tub-3	BE-AD-123	189.249	BE-AD-172	188.609	Concrete	150.00	0.437	4.57	139.983	0.95	8.327	56.1	4.58
Tub-4	BE-AD-05	196.081	BE-AD-04	195.975	Concrete	150.00	0.808	4.88	21.736	0.60	2.592	28.5	4.73
Tub-5	BE-120	197.541	BE-AD-09	196.693	Concrete	150.00	0.551	4.88	173.885	1.10	10.946	15.3	4.85
Tub-6	BE-119	197.723	BE-120	197.541	Concrete	150.00	0.319	9.75	18.660	0.43	1.513	12.1	9.76
Tub-7	BE-04	206.575	BE-03	206.782	Concrete	150.00	0.177	9.75	21.223	0.37	1.286	7.1	9.86
Tub-8	BE-AD-55	194.604	BE-AD-55*	195.228	Concrete	150.00	0.165	13.11	47.610	0.49	2.315	9.5	12.98
Tub-9	BE-AD-79	200.439	BE-AD-78	200.818	Concrete	150.00	1.500	13.11	28.917	0.80	4.269	19.6	13.23
Tub-10	BE-AD-09	196.693	BE-AD-07	196.346	Concrete	150.00	0.808	16.46	21.082	0.59	2.532	16.9	16.44
Tub-11	BE-18	203.648	BE-19	202.807	Concrete	150.00	0.352	16.76	50.167	0.62	3.417	12.4	16.74
Tub-12	BE-AD-122	189.536	BE-AD-123	189.249	Concrete	150.00	0.397	18.29	15.693	0.43	1.463	12.0	18.38

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FlexTable: Conduit Table

Label	Start Node	Invert (m)	Stop Node	Invert (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-13	BE-13	204.324	BE-05	205.142	Concrete	150.00	1.320	20.12	40.663	0.86	5.268	22.0	19.99
Tub-14	BE-122	198.071	BE-123	201.473	Concrete	150.00	0.000	21.34	159.449	0.00	0.000	12.7	21.67
Tub-15	BE-118	198.491	BE-119	197.723	Concrete	150.00	0.319	23.77	32.304	0.53	2.302	9.0	23.86
Tub-16	BE-AD-80	199.385	BE-AD-79	200.439	Concrete	150.00	0.146	28.96	36.400	0.43	1.779	19.5	29.03
Tub-17	BE-15	200.146	BE-14	201.641	Concrete	150.00	1.491	30.78	48.563	0.96	6.353	18.7	30.84
Tub-18	BE-74	197.045	BE-87	196.894	Concrete	150.00	1.500	32.00	4.718	0.42	1.038	24.8	32.06
Tub-19	BE-17	205.260	BE-18	203.648	Concrete	150.00	0.211	33.22	48.520	0.53	2.633	9.8	33.12
Tub-20	BE-61	195.803	BE-62	196.058	Concrete	150.00	1.213	33.83	7.537	0.47	1.364	21.2	33.98
Tub-21	BE-60	195.572	BE-61	195.803	Concrete	150.00	1.301	34.14	6.767	0.46	1.293	21.6	34.11
Tub-22	BE-AD-86	198.343	BE-AD-87	198.791	Concrete	150.00	1.500	35.05	12.781	0.60	2.261	21.5	35.03
Tub-23	BE-AD-07	196.346	BE-AD-05	196.081	Concrete	150.00	0.808	37.80	7.011	0.40	1.077	16.9	37.91
Tub-24	BE-51	196.962	BE-50	197.224	Concrete	150.00	1.500	38.10	6.877	0.48	1.392	23.1	38.23
Tub-25	BE-AD-58	193.667	BE-AD-56	193.944	Concrete	150.00	1.500	38.40	7.213	0.49	1.444	31.5	38.43
Tub-26	BE-AD-55*	195.228	BE-AD-54	196.991	Concrete	150.00	0.119	38.71	45.544	0.44	1.920	7.0	38.75
Tub-27	BE-117	198.969	BE-118	198.491	Concrete	150.00	1.500	39.62	12.063	0.59	2.161	21.6	39.53
Tub-28	BE-116	199.353	BE-117	198.969	Concrete	150.00	1.500	39.93	9.617	0.54	1.810	22.2	39.84
Tub-29	BE-73	196.698	BE-72	196.315	Concrete	150.00	1.500	39.93	9.592	0.54	1.807	22.2	39.98
Tub-30	BE-72	196.315	BE-68	195.837	Concrete	150.00	1.500	40.23	11.881	0.58	2.135	21.6	40.23
Tub-31	BE-74	197.045	BE-70	197.341	Concrete	150.00	1.500	41.15	7.194	0.49	1.441	24.3	41.20
Tub-32	BE-120	197.541	BE-121	197.868	Concrete	150.00	1.500	42.06	7.774	0.50	1.535	22.8	41.92
Tub-33	BE-121	197.868	BE-122	198.071	Concrete	150.00	1.500	42.06	4.826	0.42	1.056	24.2	41.98
Tub-34	BE-AD-56	193.944	BE-AD-55	194.604	Concrete	150.00	0.385	43.59	15.142	0.42	1.404	17.2	43.44
Tub-37	BE-05	205.142	BE-04	206.575	Concrete	150.00	0.177	47.85	29.946	0.42	1.675	14.6	47.86
Tub-38	BE-57	195.417	BE-56	195.054	Concrete	150.00	1.500	48.16	7.538	0.50	1.499	40.2	48.27
Tub-39	BE-14	201.641	BE-13	204.324	Concrete	150.00	1.430	49.38	54.336	0.98	6.834	22.7	49.56
Tub-40	BE-19	202.807	BE-20	200.699	Concrete	150.00	0.554	49.99	42.171	0.68	3.638	14.4	49.92
Tub-41	BE-AD-120	189.893	BE-AD-122	189.536	Concrete	150.00	1.500	53.64	6.655	0.48	1.357	23.2	53.59
Tub-42	BE-AD-81	199.269	BE-AD-80	199.385	Concrete	150.00	1.500	58.52	1.982	0.31	0.524	27.4	58.65
Tub-43	BE-56	196.104	BE-51	196.962	Concrete	150.00	0.311	59.44	14.436	0.39	1.228	9.7	59.34
Tub-44	BE-87	196.894	BE-92	196.467	Concrete	150.00	1.500	71.93	5.936	0.46	1.240	23.5	71.87
Tub-46	BE-AD-130	189.570	BE-AD-115	190.186	Concrete	150.00	1.500	76.81	8.020	0.51	1.572	23.1	76.86

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-47	BE-AD-21	196.284	BE-AD-22	196.218	Concrete	200.00	1.730	2.13	30.934	0.82	4.537	14.5	2.16
Tub-48	BE-AD-20	196.358	BE-AD-21	196.284	Concrete	200.00	1.730	2.74	26.976	0.78	4.073	14.7	2.66
Tub-49	BE-54	194.521	BE-67	194.338	Concrete	200.00	0.706	3.35	54.581	0.76	4.708	27.6	3.40
Tub-50	BE-AD-22	196.218	BE-AD-23	193.012	Concrete	200.00	1.730	5.18	618.728	2.32	46.119	30.5	6.04
Tub-51	BE-07	209.002	BE-06	205.970	Concrete	200.00	0.128	24.99	121.311	0.60	3.951	3.6	25.21
Tub-52	BE-08	202.628	BE-09	202.124	Concrete	200.00	3.872	7.01	71.893	1.41	12.496	26.1	7.08
Tub-53	BE-49	190.363	BE-AD-111	190.290	Concrete	200.00	1.500	8.84	8.259	0.50	1.527	16.2	8.75
Tub-54	BE-128	196.249	BE-127	196.340	Concrete	200.00	1.500	8.84	10.295	0.53	1.815	15.2	8.93
Tub-55	BE-138	193.615	BE-140	192.916	Concrete	200.00	0.218	10.36	67.450	0.57	3.230	6.7	10.50
Tub-56	BE-124	197.112	BE-AD-60	196.650	Concrete	200.00	0.422	12.50	36.969	0.57	2.753	7.1	12.64
Tub-57	BE-AD-49	198.607	BE-AD-53	197.934	Concrete	200.00	2.854	13.72	49.067	1.12	8.119	24.8	13.68
Tub-58	BE-91	193.682	BE-86	194.581	Concrete	200.00	2.961	14.94	60.193	1.22	9.670	23.7	15.07
Tub-59	BE-101	196.432	BE-93	196.567	Concrete	200.00	1.500	17.07	7.909	0.49	1.477	16.5	17.12
Tub-60	BE-46	190.429	BE-47	190.309	Concrete	200.00	1.500	18.29	6.562	0.46	1.277	16.0	18.30
Tub-61	BE-01	210.577	BE-02	209.305	Concrete	200.00	0.049	5.49	231.846	0.55	4.259	3.7	5.50
Tub-62	BE-AD-48	198.651	BE-AD-53	197.934	Concrete	200.00	1.521	19.81	36.190	0.83	4.834	21.8	19.95
Tub-63	BE-07	209.002	BE-02	209.305	Concrete	200.00	0.128	3.05	99.409	0.56	3.395	3.6	2.99
Tub-64	BE-63	196.401	BE-66	196.486	Concrete	200.00	1.500	24.38	3.486	0.37	0.781	17.4	24.38
Tub-65	BE-AD-19	197.228	BE-AD-20	196.358	Concrete	200.00	1.730	26.21	33.190	0.84	4.791	14.4	26.26
Tub-66	BE-98	197.072	BE-97	197.715	Concrete	200.00	1.500	28.96	22.206	0.70	3.284	16.5	29.03
Tub-67	BE-137 (A)	194.008	BE-138	193.615	Concrete	200.00	1.500	30.78	12.766	0.58	2.143	14.8	30.79
Tub-68	BE-155	189.710	BE-114	193.884	Concrete	200.00	0.624	31.09	134.257	1.00	8.885	29.0	31.23
Tub-69	BE-102	196.270	BE-101	196.432	Concrete	200.00	1.500	31.09	5.211	0.42	1.067	16.5	30.99
Tub-70	BE-99	196.914	BE-98	197.072	Concrete	200.00	1.500	31.09	5.082	0.42	1.046	16.5	31.02
Tub-71	BE-160	186.279	BE-161	186.198	Concrete	200.00	1.500	31.09	2.605	0.33	0.622	24.0	31.03
Tub-73	BE-154	190.968	BE-113	196.205	Concrete	200.00	0.607	31.39	166.813	1.07	10.395	28.3	31.89
Tub-74	BE-48	190.729	BE-49	190.363	Concrete	200.00	1.500	32.31	11.328	0.55	1.953	15.0	32.19
Tub-75	BE-115	189.664	BE-156	189.413	Concrete	200.00	3.776	32.61	7.696	0.63	2.172	39.6	32.57
Tub-76	BE-06	205.870	BE-08	202.628	Concrete	200.00	2.438	33.83	95.824	1.35	12.713	23.2	33.89
Tub-77	BE-93	196.567	BE-94	196.889	Concrete	200.00	1.500	34.44	9.349	0.52	1.681	15.4	34.57
Tub-78	BE-77	197.574	BE-71	196.800	Concrete	200.00	0.143	34.75	22.275	0.34	1.133	10.5	34.86

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**FlexTable: Conduit Table**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-79	BE-AD-53	197.934	BE-130	196.690	Concrete	200.00	4.375	35.36	35.184	1.13	7.585	22.8	35.35
Tub-80	BE-133	194.799	BE-138	193.615	Concrete	200.00	0.134	35.36	33.487	0.39	1.510	5.4	35.44
Tub-81	BE-AD-60	196.650	BE-AD-61	196.113	Concrete	200.00	0.422	35.97	14.931	0.41	1.368	8.9	35.82
Tub-82	BE-52	197.095	BE-53	196.695	Concrete	200.00	1.500	39.01	10.253	0.53	1.809	15.2	38.90
Tub-83	BE-94	196.889	BE-95	197.311	Concrete	200.00	1.500	39.62	10.650	0.54	1.856	15.1	39.65
Tub-84	BE-32	199.158	BE-33	198.633	Concrete	200.00	1.500	39.93	13.148	0.58	2.191	14.8	39.81
Tub-85	BE-78	196.351	BE-76	196.594	Concrete	200.00	1.500	39.93	6.086	0.44	1.204	16.2	39.99
Tub-86	BE-76	196.594	BE-75	196.849	Concrete	200.00	1.500	40.23	6.338	0.45	1.243	16.3	40.19
Tub-87	BE-82	197.973	BE-81	197.800	Concrete	200.00	1.500	40.23	4.300	0.39	0.919	16.9	40.25
Tub-88	BE-141	190.830	BE-142	190.308	Concrete	200.00	0.359	40.54	12.877	0.37	1.134	15.7	40.51
Tub-89	BE-136	192.515	BE-135	193.099	Concrete	200.00	1.500	41.15	14.193	0.60	2.324	14.7	41.21
Tub-90	BE-135	193.099	BE-134	194.166	Concrete	200.00	0.119	41.45	25.740	0.34	1.167	10.2	41.54
Tub-91	BE-53	196.695	BE-54	196.361	Concrete	200.00	1.500	41.76	7.999	0.49	1.489	15.7	41.74
Tub-92	BE-110	196.726	BE-109	197.467	Concrete	200.00	0.202	42.06	17.617	0.35	1.107	7.7	42.16
Tub-93	BE-20	200.699	BE-21	198.717	Concrete	200.00	0.752	42.37	46.781	0.73	4.300	11.9	42.27
Tub-94	BE-113	196.205	BE-110	196.726	Concrete	200.00	0.558	42.37	12.297	0.42	1.330	9.9	42.25
Tub-95	BE-95	197.311	BE-96	197.677	Concrete	200.00	1.500	42.37	8.639	0.50	1.581	15.5	42.39
Tub-96	BE-90	195.251	BE-91	193.682	Concrete	200.00	0.415	43.28	36.251	0.56	2.691	16.6	43.33
Tub-97	BE-09	202.124	BE-10	198.454	Concrete	200.00	3.976	44.50	82.470	1.49	14.079	63.1	44.55
Tub-98	BE-40	198.610	BE-41	198.941	Concrete	200.00	1.500	45.42	7.288	0.47	1.386	17.7	45.28
Tub-99	BE-22	198.316	BE-23	197.443	Concrete	200.00	1.245	48.46	18.014	0.62	2.573	14.7	48.41
Tub-100	BE-130	195.790	BE-128	196.249	Concrete	200.00	1.500	45.72	10.039	0.53	1.779	15.3	45.86
Tub-101	BE-AD-47	199.208	BE-AD-48	198.651	Concrete	200.00	1.500	47.55	11.714	0.56	2.000	16.0	47.44
Tub-102	BE-71	196.800	BE-66	196.486	Concrete	200.00	1.500	47.55	6.604	0.46	1.283	17.5	47.67
Tub-103	BE-85	197.822	BE-86	194.581	Concrete	200.00	0.280	47.55	68.162	0.63	3.617	14.7	47.78
Tub-105	BE-68	194.767	BE-54	194.521	Concrete	200.00	1.500	47.85	5.141	0.42	1.056	16.5	47.97
Tub-107	BE-100	196.503	BE-99	196.914	Concrete	200.00	1.500	48.16	8.534	0.50	1.566	15.5	48.08
Tub-108	BE-114	193.884	BE-111	195.167	Concrete	200.00	0.624	48.16	26.641	0.57	2.556	8.9	48.23
Tub-109	BE-111	195.167	BE-100	196.503	Concrete	200.00	0.520	48.46	27.567	0.55	2.417	9.8	48.36
Tub-110	BE-89	196.259	BE-90	195.251	Concrete	200.00	0.415	48.46	20.799	0.46	1.755	7.5	48.47
Tub-111	BE-140	192.916	BE-141	190.830	Concrete	200.00	0.319	48.46	43.043	0.55	2.717	7.5	48.58

Bentley SewerCAD V8i (SELECTseries 4)  
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Bentley Systems, Inc. Haestad Methods Solution Center  
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**Alejandro Rojas Galluffi**  
INGENIERO SANITARIO  
REG. CIP N° 21666

**NAZARIO CACERES OLIVERA**

INGENIERO CIVIL  
Reg. Cip. No. 21895



**JAVIER PAJARES RIVERA**  
JEFE ETC

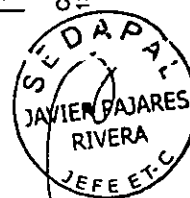
FlexTable: Conduit Table

Label	Start Node	Invert (m)	Stop Node	Invert (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-112	BE-36	197.106	BE-37	196.787	Concrete	200.00	1.500	49.07	6.501	0.46	1.268	16.1	49.05
Tub-113	BE-80	197.419	BE-79	197.155	Concrete	200.00	1.500	49.68	5.314	0.42	1.083	16.5	49.69
Tub-115	BE-79	195.975	BE-78	196.351	Concrete	200.00	1.500	49.99	7.522	0.48	1.420	15.8	49.98
Tub-116	BE-126	203.710	BE-125	200.569	Concrete	200.00	0.220	50.29	62.455	0.56	3.056	7.2	50.32
Tub-117	BE-81	197.800	BE-80	197.419	Concrete	200.00	1.500	50.29	7.576	0.48	1.428	16.5	50.27
Tub-118	BE-33	198.633	BE-34	198.108	Concrete	200.00	1.500	52.43	10.014	0.53	1.775	15.3	52.38
Tub-119	BE-125	200.569	BE-124	197.112	Concrete	200.00	0.422	52.43	65.941	0.70	4.292	6.7	52.67
Tub-120	BE-34	198.108	BE-35	197.651	Concrete	200.00	1.500	52.73	8.667	0.50	1.585	15.5	52.65
Tub-121	BE-12	201.965	BE-11	204.986	Concrete	200.00	0.159	53.64	56.315	0.50	2.409	6.1	53.67
Tub-122	BE-85	197.822	BE-84	198.252	Concrete	200.00	1.500	53.95	7.970	0.49	1.485	15.7	54.06
Tub-123	BE-16	198.615	BE-12	201.965	Concrete	200.00	0.293	54.86	61.060	0.61	3.411	12.7	54.87
Tub-124	BE-AD-59	193.647	BE-AD-61	196.113	Concrete	200.00	0.532	55.17	44.699	0.65	3.546	13.4	55.09
Tub-126	BE-106	196.347	BE-105	197.971	Concrete	200.00	0.110	56.08	28.957	0.35	1.217	3.8	56.21
Tub-127	BE-84	198.252	BE-83	198.540	Concrete	200.00	1.500	56.39	5.107	0.42	1.050	16.5	56.28
Tub-128	BE-10	198.864	BE-26	197.096	Concrete	200.00	4.128	56.39	31.354	1.07	6.758	22.4	56.44
Tub-129	BE-145	188.678	BE-144	188.987	Concrete	200.00	1.500	56.69	5.450	0.43	1.105	21.1	56.57
Tub-130	BE-139	191.767	BE-136	192.515	Concrete	200.00	0.325	57.91	12.916	0.36	1.087	14.4	58.00
Tub-131	BE-62	196.058	BE-63	196.401	Concrete	200.00	1.100	57.91	5.923	0.40	1.025	14.9	58.04
Tub-132	BE-41	198.941	BE-42	199.395	Concrete	200.00	1.500	59.13	7.678	0.48	1.443	15.7	59.00
Tub-133	BE-112	191.691	BE-115	189.664	Concrete	200.00	3.776	59.44	34.104	1.07	6.933	21.2	59.33
Tub-134	BE-38	196.169	BE-39	195.720	Concrete	200.00	0.902	59.44	7.554	0.41	1.133	25.8	59.33
Tub-135	BE-104	195.412	BE-103	195.761	Concrete	200.00	1.495	59.44	5.872	0.44	1.170	16.2	59.54
Tub-136	BE-108	196.268	BE-107	197.432	Concrete	200.00	0.165	60.05	19.385	0.34	1.083	4.8	60.22
Tub-137	BE-35	197.651	BE-36	197.106	Concrete	200.00	1.500	60.05	9.076	0.51	1.643	16.1	60.16
Tub-138	BE-132	197.336	BE-131(A)	201.621	Concrete	200.00	0.128	63.40	67.588	0.49	2.528	6.3	63.68
Tub-139	BE-23	197.443	BE-24	196.689	Concrete	200.00	1.315	48.16	15.657	0.60	2.362	13.6	48.30
Tub-141	BE-AD-41	187.332	BE-AD-39	186.967	Concrete	200.00	1.500	65.23	5.596	0.43	1.128	26.0	65.29
Tub-142	BE-44	193.298	BE-45	192.405	Concrete	200.00	0.262	67.67	13.197	0.34	1.000	7.6	67.68
Tub-143	BE-37	196.787	BE-38	196.169	Concrete	200.00	0.750	67.97	9.092	0.42	1.206	11.8	67.85
Tub-145	BE-127	196.340	BE-129	201.002	Concrete	200.00	0.192	68.58	67.979	0.55	3.072	10.8	68.77
Tub-146	BE-103	195.761	BE-102	196.270	Concrete	200.00	0.793	70.71	7.198	0.39	1.032	14.1	70.63

Bentley SewerCAD V8i (SELECTseries 4)  
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Page 10 of 13Bentley Systems, Inc. Haestad Methods Solution Center  
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13/11/2015

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ALEJANDRO ROJAS GALLUFFI  
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REG. CIP. N° 21656

*Nazario Pacheco Olivera*  
NAZARIO PACHECO OLIVERA  
INGENIERO CIVIL  
Reg. CIP. N° 21825



FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-147	BE-143	192.329	BE-132	197.336	Concrete	200.00	0.381	72.85	68.733	0.68	4.254	8.1	73.04
Tub-148	BE-45	192.405	BE-46	190.429	Concrete	200.00	0.445	81.99	24.100	0.50	2.030	12.4	81.92
Tub-149	BE-91	193.682	BE-112	191.691	Concrete	200.00	3.590	84.12	23.667	0.93	5.103	25.2	84.19
Tub-150	BE-AD-39	186.967	BE-AD-40	187.105	Concrete	250.00	3.971	2.13	64.679	1.32	11.168	23.9	2.14
Tub-151	BE-AD-96	197.260	BE-AD-96*	197.377	Concrete	250.00	1.500	9.14	12.795	0.56	2.052	12.6	9.17
Tub-152	BE-AD-57	193.905	BE-AD-58	193.667	Concrete	250.00	0.652	11.28	21.104	0.52	2.077	16.0	11.40
Tub-153	BE-39	195.720	BE-24	195.939	Concrete	250.00	9.867	13.72	15.967	1.06	5.632	31.4	13.69
Tub-154	BE-130	195.790	BE-AD-57	193.905	Concrete	250.00	0.652	22.56	83.573	0.84	5.975	6.2	22.66
Tub-155	BE-AD-51	204.971	BE-AD-50	201.898	Concrete	250.00	2.716	43.59	70.504	1.22	10.050	17.2	43.76
Tub-156	BE-29	197.809	BE-30	198.111	Concrete	250.00	1.500	44.81	6.740	0.45	1.247	13.1	44.93
Tub-158	BE-26	196.566	BE-27	196.963	Concrete	250.00	4.192	49.38	8.040	0.65	2.263	26.4	49.46
Tub-159	BE-AD-39	186.967	BE-AD-31	186.863	Concrete	250.00	4.433	56.39	1.844	0.39	0.734	37.9	56.27
Tub-160	BE-AD-59	193.647	BE-AD-64	193.200	Concrete	250.00	1.987	57.00	7.842	0.51	1.593	14.9	57.11
Tub-161	BE-AD-58	193.667	BE-AD-59	193.647	Concrete	250.00	1.495	59.13	0.338	0.16	0.121	19.0	59.23
Tub-162	BE-27	196.963	BE-28	197.362	Concrete	250.00	2.237	60.05	6.645	0.50	1.477	17.5	60.04
Tub-163	BE-28	197.362	BE-29	197.809	Concrete	250.00	2.091	60.35	7.407	0.51	1.560	14.5	60.31
Tub-164	BE-25	196.333	BE-26	196.566	Concrete	250.00	8.381	61.57	3.784	0.60	1.693	30.9	61.47
Tub-165	BE-AD-25	192.806	BE-AD-28	191.401	Concrete	250.00	8.845	64.01	21.950	1.15	6.885	33.0	63.94
Tub-166	BE-AD-23	193.012	BE-AD-25	192.806	Concrete	250.00	8.845	64.31	3.203	0.58	1.518	32.3	64.42
Tub-167	BE-24	195.939	BE-25	196.333	Concrete	250.00	8.552	65.23	6.040	0.72	2.470	30.3	65.29
Tub-168	BE-55	195.088	BE-56	195.054	Concrete	300.00	12.473	5.18	6.562	0.81	3.018	28.4	5.13
Tub-169	BE-56	195.054	BE-AD-95	194.982	Concrete	300.00	13.066	4.27	16.873	1.15	6.451	28.8	4.22
Tub-170	BE-67	194.338	BE-146	194.258	Concrete	300.00	13.867	10.97	7.291	0.87	3.434	31.5	10.98
Tub-171	BE-58	195.110	BE-60	195.272	Concrete	300.00	12.473	21.64	7.486	0.85	3.347	38.0	21.63
Tub-172	BE-164	185.833	BE-165	185.388	Concrete	300.00	10.993	24.08	18.481	1.13	6.420	22.9	24.07
Tub-173	BE-69	194.392	BE-AD-95	194.982	Concrete	300.00	13.161	44.20	13.350	1.06	5.394	36.2	44.10
Tub-174	BE-69	194.392	BE-67	194.338	Concrete	300.00	13.161	47.55	1.136	0.44	0.769	36.6	47.54
Tub-175	BE-165	185.388	BE-170	183.848	Concrete	300.00	10.993	47.85	32.181	1.37	9.885	63.1	47.76
Tub-176	BE-163	185.900	BE-164	185.833	Concrete	300.00	6.165	48.46	1.382	0.38	0.656	27.1	48.37
Tub-177	BE-39	195.720	BE-60	195.272	Concrete	300.00	10.946	48.77	9.186	0.88	3.710	27.1	48.82
Tub-178	BE-161	186.198	BE-162	186.079	Concrete	300.00	3.540	49.68	2.395	0.39	0.793	18.8	49.56

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13/11/2015Bentley Systems, Inc. Haestad Methods Solution Center  
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666Bentley SewerCAD V8i (SELECTseries 4)  
[08.11.04.54]  
Page 11 of 13ALEJANDRO KOLES GALLUFFI  
INGENIERO SANITARIO  
REG. CIP. N° 21658

NAZARIO CACERES OLIVERA

INGENIERO CIVIL  
Reg. Cip. No 21658

FlexTable: Conduit Table

Label	Start Node	Invert (m)	Stop Node	Invert (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-179	BE-58	195.110	BE-55	195.088	Concrete	300.00	12.473	45.42	0.484	0.31	0.377	38.0	45.51
Tub-180	BE-151	193.436	BE-152	193.227	Concrete	300.00	13.867	50.60	4.131	0.71	2.195	30.9	50.51
Tub-181	BE-157	190.642	BE-158	188.444	Concrete	300.00	13.867	50.90	43.181	1.63	13.778	23.7	50.99
Tub-182	BE-150	193.612	BE-151	193.436	Concrete	300.00	13.867	60.05	2.931	0.63	1.672	33.6	60.11
Tub-183	BE-148	193.846	BE-149	193.759	Concrete	300.00	13.867	62.79	1.386	0.48	0.920	41.4	62.77
Tub-184	BE-158	188.444	BE-159	186.875	Concrete	300.00	13.867	64.01	24.513	1.33	8.864	36.7	63.93
Tub-185	BE-152	193.227	BE-153	192.617	Concrete	300.00	13.867	69.49	8.778	0.93	3.969	28.0	69.44
Tub-186	BE-162	186.079	BE-163	185.900	Concrete	300.00	3.889	70.71	2.531	0.41	0.863	23.6	70.72
Tub-187	BE-149	193.759	BE-150	193.612	Concrete	300.00	13.867	79.86	1.841	0.53	1.156	37.5	79.80
Tub-188	BE-153	192.617	BE-157	190.642	Concrete	300.00	13.867	79.86	24.732	1.34	8.926	25.0	79.96
Tub-189	BE-146	194.258	BE-147	193.964	Concrete	300.00	13.867	81.99	3.586	0.67	1.961	38.7	81.96
Tub-190	BE-147	193.964	BE-148	193.846	Concrete	300.00	13.867	92.66	1.273	0.46	0.861	43.6	92.72
Tub-191	BE-166	186.798	BE-167	186.401	Concrete	300.00	13.867	61.87	6.416	0.82	3.030	26.1	62.00
Tub-192	BE-168	186.146	BE-170	185.048	Concrete	350.00	13.867	70.41	15.595	1.12	6.060	21.5	70.39
Tub-193	BE-159	186.875	BE-166	186.798	Concrete	350.00	13.867	76.81	1.002	0.42	0.703	30.9	76.80
Tub-194	BE-167	186.401	BE-168	186.146	Concrete	350.00	13.867	82.30	3.099	0.63	1.713	26.1	82.32
Tub-195	BE-AD-38	183.374	BE-170	183.848	Concrete	1,300.00	3,020.978	17.07	27.770	5.63	79.173	61.6	17.04
Tub-196	BE-AD-174	187.702	BE-AD-173	188.129	Concrete	1,300.00	2,884.800	40.23	10.613	3.88	35.693	71.1	40.18
Tub-197	BE-AD-175	186.034	BE-AD-174	187.702	Concrete	1,300.00	2,972.337	142.95	11.668	4.06	38.997	62.9	142.94
Tub-198	BE-170	183.848	BE-AD-175	186.034	Concrete	1,300.00	2,972.337	170.69	12.807	4.20	42.088	72.0	170.79
Tub-199	BE-30	198.111	BE-31 (A)	198.922	Concrete	250.00	1.500	45.60	17.785	0.63	2.654	10.8	44.18
Tub-200	BE-42(A)	199.395	BE-43	197.036	Concrete	200.00	0.137	55.40	42.581	0.43	1.813	8.2	54.36
Tub-201	BE-63	196.401	BE-64 (A)	196.338	Concrete	200.00	0.128	49.70	-1.268	0.00	-0.621	30.1	48.53
Tub-202	BE-65	197.319	BE-57	196.517	Concrete	150.00	1.500	75.90	10.567	0.56	1.949	21.9	75.10
Tub-203	BE-56 (A)	195.054	BE-68	194.767	Concrete	150.00	1.500	46.50	6.172	0.46	1.279	23.4	44.79
Tub-204	BE-136	192.515	BE-137	194.008	Concrete	200.00	0.122	31.40	47.548	0.42	1.901	5.9	30.54
Tub-205	BE-144	188.987	BE-143 (A)	192.329	Concrete	200.00	0.125	48.00	69.625	0.49	2.557	10.7	46.70

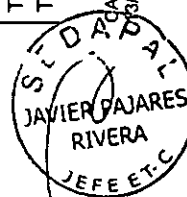
Bentley SewerCAD V8i (SELECTseries 4)  
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03/11/2015

*Alejandro*  
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REG. CIP. N° 21656

*Naazario*  
**NAZARIO CACERES OLIVERA**  
INGENIERO CIVIL  
Reg. Cip. No. 21000



**FlexTable: Conduit Table**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub-206	BE-75	196.849	BE-74 (A)	197.045	Concrete	200.00	1.500	47.90	4.092	0.39	0.884	17.2	46.96
Tub-207	BE-AD-122 (A)	189.536	BE-AD-126	189.159	Concrete	150.00	0.000	47.70	7.904	0.00	0.000	13.8	46.59
Tub-208	BE-88	197.549	BE-89	196.259	Concrete	200.00	0.305	68.20	18.915	0.41	1.415	7.7	68.18
Tub-209	BE-88	197.549	BE-105 (A)	197.971	Concrete	200.00	1.500	64.50	6.543	0.46	1.274	16.0	62.72



*Alejandro Rojas Galluffi*  
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*NAZARIO CACERES OLIVE*  
**NAZARIO CACERES OLIVE**  
 INGENIERO CIVIL  
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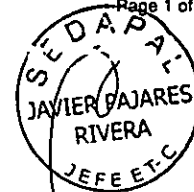
FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-01	211.597	211.597	210.577	1.02	1.20	280,291.96	8,669,936.50
BE-02	210.285	210.285	209.305	0.98	1.20	280,292.21	8,669,931.16
BE-03	208.682	208.682	206.782	1.90	1.20	280,305.46	8,669,931.44
BE-04	208.315	208.315	206.575	1.74	1.20	280,315.24	8,669,932.66
BE-05	206.992	206.992	205.142	1.85	1.20	280,362.67	8,669,938.93
BE-06	207.100	207.100	205.870	1.23	1.20	280,292.44	8,669,903.47
BE-07	210.042	210.042	209.002	1.04	1.20	280,291.00	8,669,928.44
BE-08	203.828	203.828	202.628	1.20	1.20	280,296.09	8,669,869.94
BE-09	203.574	203.574	202.124	1.45	1.20	280,297.13	8,669,862.95
BE-10	201.014	201.014	198.864	2.15	1.20	280,302.37	8,669,818.83
BE-11	206.756	206.756	204.986	1.77	1.20	280,339.69	8,669,923.49
BE-12	203.605	203.605	201.965	1.64	1.20	280,346.35	8,669,870.32
BE-13	205.914	205.914	204.324	1.59	1.20	280,364.94	8,669,919.09
BE-14	203.311	203.311	201.641	1.67	1.20	280,370.66	8,669,869.92
BE-15	201.866	201.866	200.146	1.72	1.20	280,374.16	8,669,839.32
BE-15 (A)	201.866	201.866	200.146	1.72	1.20	280,374.41	8,669,838.12
BE-16	200.515	200.515	198.615	1.90	1.20	280,352.94	8,669,815.95
BE-17	206.660	206.660	205.260	1.40	1.20	280,407.39	8,669,968.14
BE-18	204.968	204.968	203.648	1.32	1.20	280,411.24	8,669,935.29
BE-19	204.287	204.287	202.807	1.48	1.20	280,413.29	8,669,918.70
BE-20	202.299	202.299	200.699	1.60	1.20	280,419.15	8,669,869.17
BE-21	200.467	200.467	198.717	1.75	1.20	280,424.22	8,669,827.26
BE-22	200.046	200.046	198.316	1.73	1.20	280,087.68	8,669,734.96
BE-23	199.173	199.173	197.443	1.73	1.20	280,135.25	8,669,743.93
BE-24	198.789	198.789	195.939	2.85	1.20	280,183.35	8,669,747.98
BE-25	198.883	198.883	196.333	2.55	1.20	280,248.19	8,669,755.58
BE-26	199.036	199.036	196.566	2.47	1.20	280,309.23	8,669,762.86
BE-27	199.263	199.263	196.963	2.30	1.20	280,358.35	8,669,768.63
BE-28	199.512	199.512	197.362	2.15	1.20	280,417.98	8,669,775.59
BE-29	199.809	199.809	197.809	2.00	1.20	280,477.81	8,669,783.09
BE-30	200.061	200.061	198.111	1.95	1.20	280,522.47	8,669,788.04
BE-31	200.192	200.192	198.452	1.74	1.20	280,567.53	8,669,791.33
BE-31 (A)	200.192	200.192	198.862	1.33	1.20	280,566.52	8,669,791.28
BE-32	200.308	200.308	199.158	1.15	1.20	280,563.53	8,669,779.68
BE-33	200.033	200.033	198.633	1.40	1.20	280,523.96	8,669,775.42
BE-34	199.788	199.788	198.108	1.68	1.20	280,471.98	8,669,768.89
BE-35	199.651	199.651	197.651	2.00	1.20	280,419.72	8,669,762.54
BE-36	199.306	199.306	197.106	2.20	1.20	280,359.99	8,669,755.36
BE-36 (A)	199.306	199.306	197.106	2.20	1.20	280,360.05	8,669,754.60
BE-37	199.217	199.217	196.787	2.43	1.20	280,311.27	8,669,749.77
BE-38	198.679	198.679	196.169	2.51	1.20	280,243.93	8,669,741.49
BE-39	198.800	198.800	195.720	3.08	1.20	280,185.02	8,669,734.39
BE-40	200.290	200.290	198.610	1.68	1.20	280,581.14	8,669,793.02
BE-41	200.491	200.491	198.941	1.55	1.20	280,626.09	8,669,798.50
BE-42	200.545	200.545	199.395	1.15	1.20	280,684.68	8,669,805.41
BE-42(A)	200.545	200.545	199.395	1.15	1.20	280,685.73	8,669,805.43
BE-43	198.696	198.696	197.036	1.66	1.20	280,740.01	8,669,807.52
BE-44	195.028	195.028	193.298	1.73	1.20	280,805.45	8,669,783.49
BE-45	195.105	195.105	192.405	2.70	1.20	280,872.69	8,669,791.22
BE-46	192.079	192.079	190.429	1.65	1.20	280,953.95	8,669,801.41
BE-47	191.879	191.879	190.309	1.57	1.20	280,972.13	8,669,803.47
BE-48	193.199	193.199	190.729	2.47	1.20	280,762.62	8,669,754.09



*Alejandro Rojas Galluffi*  
ALEJANDRO ROJAS GALLUFFI  
INGENIERO SANITARIO  
REG. CIP. N° 21658

*Nazario Caceres Olivera*  
NAZARIO CACERES OLIVERA  
INGENIERO CIVIL  
Reg. C.p. No. 21805



FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-49	192.063	192.063	190.363	1.70	1.20	280,794.58	8,669,757.89
BE-50	198.394	198.394	197.224	1.17	1.20	280,099.70	8,669,708.69
BE-51	198.362	198.362	196.962	1.40	1.20	280,137.62	8,669,713.53
BE-52	198.715	198.715	197.095	1.62	1.20	280,093.16	8,669,682.73
BE-53	198.355	198.355	196.695	1.66	1.20	280,097.14	8,669,644.03
BE-54	198.141	198.141	194.521	3.62	1.20	280,102.16	8,669,602.65
BE-55	198.198	198.198	195.088	3.11	1.20	280,148.66	8,669,657.25
BE-56	198.184	198.184	195.054	3.13	1.20	280,144.27	8,669,654.60
BE-56 (A)	198.184	198.184	195.054	3.13	1.20	280,144.63	8,669,652.93
BE-57	198.267	198.267	195.417	2.85	1.20	280,192.02	8,669,661.60
BE-58	198.230	198.230	195.110	3.12	1.20	280,193.60	8,669,664.46
BE-59	198.321	198.321	195.621	2.70	1.20	280,189.07	8,669,685.56
BE-60	198.322	198.322	195.272	3.05	1.20	280,191.06	8,669,685.94
BE-61	198.403	198.403	195.803	2.60	1.20	280,224.89	8,669,690.27
BE-62	198.558	198.558	196.058	2.50	1.20	280,258.62	8,669,694.32
BE-63	198.751	198.751	196.401	2.35	1.20	280,316.26	8,669,701.13
BE-64	199.088	199.088	196.338	2.75	1.20	280,365.63	8,669,706.84
BE-64 (A)	199.088	199.088	196.338	2.75	1.20	280,364.46	8,669,706.75
BE-65	198.669	198.669	197.319	1.35	1.20	280,266.51	8,669,671.02
BE-65 (A)	198.669	198.669	197.319	1.35	1.20	280,267.38	8,669,671.13
BE-66	198.836	198.836	196.486	2.35	1.20	280,319.48	8,669,676.96
BE-67	198.158	198.158	194.338	3.82	1.20	280,102.07	8,669,599.26
BE-68	198.107	198.107	194.767	3.34	1.20	280,149.78	8,669,608.45
BE-69	198.092	198.092	194.392	3.70	1.20	280,149.02	8,669,606.68
BE-70	198.331	198.331	197.341	0.99	1.20	280,198.71	8,669,607.57
BE-71	198.880	198.880	196.800	2.08	1.20	280,325.19	8,669,629.64
BE-72	197.915	197.915	196.315	1.60	1.20	280,154.72	8,669,568.55
BE-73	197.898	197.898	196.698	1.20	1.20	280,159.62	8,669,528.87
BE-74	198.235	198.235	197.045	1.19	1.20	280,203.43	8,669,566.64
BE-74 (A)	198.235	198.235	197.045	1.19	1.20	280,204.39	8,669,566.77
BE-75	198.499	198.499	196.849	1.65	1.20	280,251.02	8,669,572.31
BE-76	198.744	198.744	196.594	2.15	1.20	280,290.91	8,669,577.27
BE-77	198.944	198.944	197.574	1.37	1.20	280,328.90	8,669,594.99
BE-78	198.991	198.991	196.351	2.64	1.20	280,330.62	8,669,582.03
BE-79	199.025	199.025	195.675	3.35	1.20	280,380.27	8,669,587.68
BE-80	199.219	199.219	197.419	1.80	1.20	280,429.59	8,669,593.50
BE-81	199.450	199.450	197.800	1.65	1.20	280,479.51	8,669,599.43
BE-82	199.613	199.613	197.973	1.64	1.20	280,519.49	8,669,604.10
BE-83	199.740	199.740	198.540	1.20	1.20	280,527.96	8,669,716.25
BE-84	199.852	199.852	198.252	1.60	1.20	280,533.85	8,669,660.29
BE-85	199.622	199.622	197.822	1.80	1.20	280,541.06	8,669,606.71
BE-86	195.731	195.731	194.581	1.15	1.20	280,588.43	8,669,612.10
BE-87	198.264	198.264	196.894	1.37	1.20	280,207.22	8,669,534.81
BE-88	199.249	199.249	197.549	1.70	1.20	280,431.76	8,669,578.28
BE-89	199.509	199.509	196.259	3.25	1.20	280,499.47	8,669,586.14
BE-90	199.331	199.331	195.251	4.08	1.20	280,547.58	8,669,591.91
BE-91	195.182	195.182	193.682	1.50	1.20	280,590.56	8,669,597.21
BE-92	198.057	198.057	196.467	1.59	1.20	280,215.66	8,669,463.44
BE-93	198.277	198.277	196.567	1.71	1.20	280,261.46	8,669,484.95
BE-94	198.459	198.459	196.889	1.57	1.20	280,295.72	8,669,489.57
BE-95	198.711	198.711	197.311	1.40	1.20	280,335.09	8,669,494.27
BE-96	198.977	198.977	197.677	1.30	1.20	280,377.20	8,669,499.10

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*Clemente*  
**INGENIERO SANITARIO**  
REG. CIP. N° 21658

*Nazario*  
**INGENIERO CIVIL**  
Reg. CIP. No. 21805



FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-97	199.095	199.095	197.715	1.38	1.20	280,449.31	8,669,531.45
BE-98	199.012	199.012	197.072	1.94	1.20	280,478.12	8,669,535.00
BE-99	198.934	198.934	196.914	2.02	1.20	280,508.91	8,669,538.73
BE-100	198.873	198.873	196.503	2.37	1.20	280,556.68	8,669,544.26
BE-101	198.252	198.252	196.432	1.82	1.20	280,263.54	8,669,467.95
BE-102	198.230	198.230	196.270	1.96	1.20	280,267.12	8,669,437.17
BE-103	198.591	198.591	195.761	2.83	1.20	280,337.21	8,669,445.88
BE-104	198.412	198.412	194.912	3.50	1.20	280,396.37	8,669,452.59
BE-105	198.941	198.941	197.971	0.97	1.20	280,439.39	8,669,514.26
BE-105 (A)	198.941	198.941	197.971	0.97	1.20	280,439.29	8,669,516.02
BE-106	198.357	198.357	194.697	3.66	1.20	280,445.90	8,669,458.52
BE-107	198.932	198.932	197.432	1.50	1.20	280,462.79	8,669,521.13
BE-108	198.198	198.198	194.598	3.60	1.20	280,469.95	8,669,461.41
BE-109	198.787	198.787	197.467	1.32	1.20	280,510.37	8,669,526.92
BE-110	198.276	198.276	196.726	1.55	1.20	280,515.34	8,669,485.06
BE-111	196.867	196.867	195.167	1.70	1.20	280,562.62	8,669,496.28
BE-112	192.941	192.941	191.691	1.25	1.20	280,600.63	8,669,513.64
BE-113	197.745	197.745	196.205	1.54	1.20	280,520.40	8,669,443.12
BE-114	195.644	195.644	193.884	1.76	1.20	280,568.09	8,669,448.38
BE-115	191.814	191.814	189.664	2.15	1.20	280,607.38	8,669,454.73
BE-116	200.803	200.803	199.353	1.45	1.20	280,039.01	8,669,589.23
BE-117	200.299	200.299	198.969	1.33	1.20	280,058.91	8,669,554.71
BE-118	199.991	199.991	198.491	1.50	1.20	280,078.51	8,669,520.39
BE-119	199.473	199.473	197.723	1.75	1.20	280,090.38	8,669,499.71
BE-120	199.371	199.371	197.541	1.83	1.20	280,095.09	8,669,491.15
BE-121	199.218	199.218	197.868	1.35	1.20	280,116.12	8,669,454.90
BE-122	199.371	199.371	198.071	1.30	1.20	280,137.04	8,669,418.51
BE-123	202.623	202.623	201.473	1.15	1.20	280,148.60	8,669,400.49
BE-124	199.622	199.622	197.112	2.51	1.20	280,331.95	8,669,283.08
BE-125	203.269	203.269	200.569	2.70	1.20	280,337.86	8,669,230.86
BE-126	206.710	206.710	203.710	3.00	1.20	280,343.96	8,669,181.00
BE-127	199.490	199.490	196.340	3.15	1.20	280,382.23	8,669,267.09
BE-128	199.599	199.599	196.249	3.35	1.20	280,389.55	8,669,261.98
BE-129	202.382	202.382	201.002	1.38	1.20	280,390.18	8,669,198.94
BE-130	199.720	199.720	195.790	3.93	1.20	280,428.51	8,669,237.78
BE-131	203.421	203.421	200.711	2.71	1.20	280,540.26	8,669,145.68
BE-131(A)	203.421	203.421	201.621	1.80	1.20	280,541.03	8,669,145.07
BE-132	198.726	198.726	197.336	1.39	1.20	280,574.43	8,669,199.11
BE-133	196.449	196.449	194.799	1.65	1.20	280,537.77	8,669,231.79
BE-134	195.686	195.686	194.166	1.52	1.20	280,433.23	8,669,337.44
BE-135	194.969	194.969	193.099	1.87	1.20	280,468.51	8,669,315.54
BE-136	194.515	194.515	192.515	2.00	1.20	280,503.56	8,669,293.87
BE-137	195.318	195.318	194.008	1.31	1.20	280,529.71	8,669,278.15
BE-137 (A)	195.318	195.318	194.008	1.31	1.20	280,530.42	8,669,277.71
BE-138	195.435	195.435	193.615	1.82	1.20	280,556.72	8,669,261.71
BE-139	194.007	194.007	191.767	2.24	1.20	280,500.94	8,669,351.81
BE-140	195.046	195.046	192.916	2.13	1.20	280,561.83	8,669,270.86
BE-141	192.250	192.250	190.830	1.42	1.20	280,556.58	8,669,319.11
BE-142	192.908	192.908	190.308	2.60	1.20	280,552.64	8,669,359.42
BE-143	194.219	194.219	192.329	1.89	1.20	280,612.25	8,669,261.40
BE-143 (A)	194.219	194.219	192.329	1.89	1.20	280,612.18	8,669,262.83
BE-144	190.747	190.747	188.987	1.76	1.20	280,606.90	8,669,309.12

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*Alejandro*  
**ALEJANDRO ROJAS GALLUFFI**  
INGENIERO SANITARIO  
REG. CIP. N° 21656

*NAZARIO*  
**NAZARIO CACERES OLIVERA**  
INGENIERO CIVIL  
Reg. C.p. No. 21805

**JAVIER PAJARES RIVERA**  
JEFE ETC

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-145	191.278	191.278	188.678	2.60	1.20	280,600.55	8,669,365.32
BE-146	198.238	198.238	194.258	3.98	1.20	280,096.13	8,669,590.03
BE-147	198.044	198.044	193.964	4.08	1.20	280,148.65	8,669,527.12
BE-148	198.196	198.196	193.846	4.35	1.20	280,209.39	8,669,457.07
BE-149	198.379	198.379	193.759	4.62	1.20	280,266.02	8,669,429.99
BE-150	197.992	197.992	193.612	4.38	1.20	280,337.43	8,669,394.36
BE-151	197.956	197.956	193.436	4.52	1.20	280,397.10	8,669,401.60
BE-152	197.827	197.827	193.227	4.60	1.20	280,447.26	8,669,407.52
BE-153	196.737	196.737	192.617	4.12	1.20	280,516.21	8,669,415.72
BE-154	196.418	196.418	190.968	5.45	1.20	280,524.45	8,669,411.92
BE-155	194.160	194.160	189.710	4.45	1.20	280,572.11	8,669,417.69
BE-156	191.953	191.953	189.413	2.54	1.20	280,611.91	8,669,422.48
BE-157	192.892	192.892	190.642	2.25	1.20	280,595.58	8,669,425.19
BE-158	189.644	189.644	188.444	1.20	1.20	280,645.41	8,669,435.83
BE-159	188.175	188.175	186.875	1.30	1.20	280,704.56	8,669,460.01
BE-160	188.249	188.249	186.279	1.97	1.20	280,748.60	8,669,471.47
BE-161	188.398	188.398	186.198	2.20	1.20	280,779.53	8,669,474.00
BE-162	188.229	188.229	186.079	2.15	1.20	280,828.65	8,669,480.54
BE-163	188.250	188.250	185.900	2.35	1.20	280,898.96	8,669,488.12
BE-164	188.533	188.533	185.833	2.70	1.20	280,946.91	8,669,494.45
BE-165	188.348	188.348	185.388	2.96	1.20	280,944.37	8,669,470.52
BE-166	188.198	188.198	186.798	1.40	1.20	280,780.91	8,669,468.35
BE-167	188.171	188.171	186.401	1.77	1.20	280,842.46	8,669,475.75
BE-168	188.396	188.396	186.146	2.25	1.20	280,924.21	8,669,485.45
BE-170	187.908	187.908	183.848	4.06	1.20	280,962.21	8,669,426.25
BE-171	192.768	192.768	190.808	1.96	1.20	280,550.22	8,669,357.66
BE-AD-01	200.621	200.621	199.021	1.60	1.20	280,033.86	8,669,657.54
BE-AD-02	198.683	198.683	197.053	1.63	1.20	280,048.68	8,669,637.06
BE-AD-03	198.287	198.287	196.607	1.68	1.20	280,094.14	8,669,587.35
BE-AD-04	198.085	198.085	195.975	2.11	1.20	280,140.08	8,669,534.66
BE-AD-05	197.881	197.881	196.081	1.80	1.20	280,139.70	8,669,529.95
BE-AD-06	197.975	197.975	196.885	1.09	1.20	280,123.09	8,669,520.10
BE-AD-07	197.946	197.946	196.346	1.60	1.20	280,110.94	8,669,505.25
BE-AD-08	199.176	199.176	197.976	1.20	1.20	280,093.67	8,669,495.96
BE-AD-09	198.733	198.733	196.693	2.04	1.20	280,098.63	8,669,494.36
BE-AD-10	198.520	198.520	196.800	1.72	1.20	280,106.66	8,669,485.17
BE-AD-11	199.024	199.024	197.494	1.53	1.20	280,151.76	8,669,433.24
BE-AD-12	199.652	199.652	198.422	1.23	1.20	280,162.94	8,669,420.19
BE-AD-13	198.096	198.096	195.116	2.98	1.20	280,172.20	8,669,494.10
BE-AD-14	198.155	198.155	194.565	3.59	1.20	280,203.49	8,669,457.49
BE-AD-15	198.358	198.358	194.038	4.32	1.20	280,247.71	8,669,427.16
BE-AD-16	198.379	198.379	193.619	4.76	1.20	280,263.45	8,669,426.68
BE-AD-17	198.902	198.902	197.742	1.16	1.20	280,271.21	8,669,416.26
BE-AD-18	198.472	198.472	193.592	4.88	1.20	280,290.44	8,669,413.22
BE-AD-19	198.458	198.458	197.228	1.23	1.20	280,315.60	8,669,393.80
BE-AD-20	198.238	198.238	196.358	1.88	1.20	280,341.29	8,669,388.45
BE-AD-21	198.204	198.204	196.284	1.92	1.20	280,343.87	8,669,387.81
BE-AD-22	198.178	198.178	196.218	1.96	1.20	280,345.43	8,669,389.30
BE-AD-22 (A)	198.178	198.178	196.218	1.96	1.20	280,346.63	8,669,389.25
BE-AD-23	198.062	198.062	193.012	5.05	1.20	280,348.93	8,669,393.04
BE-AD-24	198.044	198.044	196.774	1.27	1.20	280,343.30	8,669,397.55
BE-AD-25	197.916	197.916	192.806	5.11	1.20	280,413.14	8,669,398.32

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*Nazario Caceres Olivera*  
NAZARIO CACERES OLIVERA  
INGENIERO CIVIL  
REG. CIP. N° 21805



FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-AD-26	197.966	197.966	196.136	1.83	1.20	280,471.93	8,669,413.20
BE-AD-27	197.727	197.727	194.647	3.08	1.20	280,475.05	8,669,401.78
BE-AD-27*	197.910	197.910	195.520	2.39	1.20	280,413.68	8,669,394.62
BE-AD-28	197.721	197.721	191.401	6.32	1.20	280,476.55	8,669,406.41
BE-AD-29	189.100	189.100	186.300	2.80	1.20	280,640.61	8,669,457.61
BE-AD-30	188.187	188.187	186.407	1.78	1.20	280,702.22	8,669,465.75
BE-AD-31	189.863	189.863	186.863	3.00	1.20	280,644.02	8,669,427.00
BE-AD-32	188.355	188.355	186.455	1.90	1.20	280,682.09	8,669,438.53
BE-AD-33	188.141	188.141	185.991	2.15	1.20	280,765.76	8,669,459.84
BE-AD-34	188.144	188.144	185.834	2.31	1.20	280,831.17	8,669,470.07
BE-AD-35	188.253	188.253	185.723	2.53	1.20	280,896.89	8,669,479.15
BE-AD-36	188.075	188.075	185.575	2.50	1.20	280,930.83	8,669,465.33
BE-AD-37	187.570	187.570	184.930	2.64	1.20	280,950.01	8,669,429.58
BE-AD-39	189.217	189.217	186.967	2.25	1.20	280,650.69	8,669,371.12
BE-AD-40	189.255	189.255	187.105	2.15	1.20	280,648.55	8,669,370.95
BE-AD-41	188.692	188.692	187.332	1.36	1.20	280,656.73	8,669,306.11
BE-AD-47	201.618	201.618	199.208	2.41	1.20	280,501.75	8,669,169.59
BE-AD-48	200.101	200.101	198.651	1.45	1.20	280,461.28	8,669,194.34
BE-AD-49	200.677	200.677	198.607	2.07	1.20	280,445.86	8,669,193.45
BE-AD-50	203.128	203.128	201.898	1.23	1.20	280,391.58	8,669,187.60
BE-AD-51	206.351	206.351	204.971	1.38	1.20	280,348.13	8,669,183.43
BE-AD-52	207.872	207.872	206.132	1.74	1.20	280,339.71	8,669,176.80
BE-AD-53	200.264	200.264	197.934	2.33	1.20	280,445.96	8,669,207.12
BE-AD-54	198.591	198.591	196.991	1.60	1.20	280,561.01	8,669,197.04
BE-AD-55	196.754	196.754	194.604	2.15	1.20	280,516.85	8,669,223.87
BE-AD-55*	197.208	197.208	195.228	1.98	1.20	280,527.90	8,669,217.09
BE-AD-56	195.744	195.744	193.944	1.80	1.20	280,479.67	8,669,246.33
BE-AD-57	196.075	196.075	193.905	2.17	1.20	280,440.64	8,669,256.83
BE-AD-58	195.897	195.897	193.667	2.23	1.20	280,446.88	8,669,266.37
BE-AD-59	196.647	196.647	193.647	3.00	1.20	280,396.38	8,669,297.32
BE-AD-60	198.770	198.770	196.650	2.12	1.20	280,330.80	8,669,295.66
BE-AD-61	197.533	197.533	196.113	1.42	1.20	280,349.53	8,669,326.19
BE-AD-62	197.570	197.570	196.530	1.04	1.20	280,342.97	8,669,334.37
BE-AD-63	197.432	197.432	195.282	2.15	1.20	280,369.82	8,669,337.61
BE-AD-64	197.240	197.240	193.200	4.04	1.20	280,428.32	8,669,344.67
BE-AD-65	214.753	214.753	212.603	2.15	1.20	280,357.75	8,669,989.32
BE-AD-65 (A)	214.753	214.753	212.603	2.15	1.20	280,358.63	8,669,988.95
BE-AD-66	208.018	208.018	206.938	1.08	1.20	280,457.41	8,669,961.35
BE-AD-67	205.590	205.590	204.130	1.46	1.20	280,459.21	8,669,942.45
BE-AD-68	202.760	202.760	201.170	1.59	1.20	280,465.18	8,669,890.10
BE-AD-69	201.083	201.083	199.833	1.25	1.20	280,376.42	8,669,821.30
BE-AD-70	200.425	200.425	198.225	2.20	1.20	280,471.76	8,669,832.93
BE-AD-71	202.326	202.326	200.726	1.60	1.20	280,502.64	8,669,867.23
BE-AD-72	201.794	201.794	200.244	1.55	1.20	280,530.66	8,669,836.49
BE-AD-73	201.756	201.756	199.876	1.88	1.20	280,547.09	8,669,828.26
BE-AD-74	201.599	201.599	198.999	2.60	1.20	280,572.13	8,669,822.58
BE-AD-75	201.380	201.380	198.640	2.74	1.20	280,578.02	8,669,817.95
BE-AD-76	199.425	199.425	197.595	1.83	1.20	280,356.12	8,669,790.22
BE-AD-77	202.087	202.087	200.977	1.11	1.20	280,503.85	8,669,863.52
BE-AD-78	202.018	202.018	199.458	2.56	1.20	280,505.80	8,669,861.69
BE-AD-79	201.839	201.839	200.439	1.40	1.20	280,514.94	8,669,852.19
BE-AD-80	200.525	200.525	199.385	1.14	1.20	280,518.43	8,669,823.39



**ALEJANDRO RODRÍGUEZ GALLUFFI**  
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**NAZARIO CÁCERES OLIVERA**  
INGENIERO CIVIL  
REG. CIP. N° 21656



**JAVIER PAJARES RIVERA**  
JEFE ETC

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-AD-81	201.599	201.599	199.269	2.33	1.20	280,577.07	8,669,822.46
BE-AD-82	199.447	199.447	197.767	1.68	1.20	280,411.21	8,669,753.01
BE-AD-83	199.374	199.374	197.574	1.80	1.20	280,415.76	8,669,712.73
BE-AD-83(A)	199.374	199.374	197.574	1.80	1.20	280,416.87	8,669,712.17
BE-AD-83*	199.392	199.392	197.612	1.78	1.20	280,419.90	8,669,710.87
BE-AD-84	199.401	199.401	198.031	1.37	1.20	280,463.94	8,669,716.36
BE-AD-84*	199.643	199.643	198.193	1.45	1.20	280,461.36	8,669,718.29
BE-AD-85	199.557	199.557	198.257	1.30	1.20	280,524.33	8,669,722.89
BE-AD-86	199.673	199.673	198.343	1.33	1.20	280,526.77	8,669,726.13
BE-AD-87	200.141	200.141	198.791	1.35	1.20	280,561.58	8,669,730.02
BE-AD-88	199.813	199.813	198.733	1.08	1.20	280,511.52	8,669,702.12
BE-AD-89	199.597	199.597	198.317	1.28	1.20	280,465.13	8,669,696.39
BE-AD-90	199.340	199.340	197.410	1.93	1.20	280,418.65	8,669,690.21
BE-AD-90*	199.365	199.365	197.565	1.80	1.20	280,422.85	8,669,692.05
BE-AD-91	199.817	199.817	198.477	1.34	1.20	280,522.21	8,669,653.57
BE-AD-92	199.547	199.547	197.677	1.87	1.20	280,471.04	8,669,648.11
BE-AD-93	199.290	199.290	197.240	2.05	1.20	280,424.21	8,669,641.57
BE-AD-94	199.019	199.019	195.919	3.10	1.20	280,374.72	8,669,636.01
BE-AD-95	198.172	198.172	194.982	3.19	1.20	280,143.52	8,669,650.44
BE-AD-96	198.330	198.330	197.260	1.07	1.20	280,197.69	8,669,614.36
BE-AD-96*	198.357	198.357	197.377	0.98	1.20	280,206.80	8,669,615.43
BE-AD-96*(A)	198.357	198.357	197.377	0.98	1.20	280,207.72	8,669,615.57
BE-AD-97	198.578	198.578	197.198	1.38	1.20	280,256.11	8,669,621.25
BE-AD-98	198.560	198.560	197.090	1.47	1.20	280,252.61	8,669,558.76
BE-AD-99	199.014	199.014	195.564	3.45	1.20	280,381.82	8,669,571.67
BE-AD-100	199.025	199.025	195.325	3.70	1.20	280,385.25	8,669,544.01
BE-AD-101	199.071	199.071	195.121	3.95	1.20	280,390.75	8,669,500.02
BE-AD-102	199.868	199.868	197.768	2.10	1.20	280,574.62	8,669,731.05
BE-AD-103	199.438	199.438	197.708	1.73	1.20	280,576.59	8,669,729.92
BE-AD-104	197.917	197.917	196.367	1.55	1.20	280,590.60	8,669,684.06
BE-AD-105	199.000	199.000	197.740	1.26	1.20	280,585.56	8,669,641.11
BE-AD-106	198.500	198.500	196.600	1.90	1.20	280,580.52	8,669,683.28
BE-AD-107	197.464	197.464	195.914	1.55	1.20	280,593.99	8,669,669.20
BE-AD-108	196.309	196.309	195.129	1.18	1.20	280,593.62	8,669,630.92
BE-AD-109	195.745	195.745	194.345	1.40	1.20	280,789.63	8,669,795.17
BE-AD-110	195.305	195.305	193.215	2.09	1.20	280,746.26	8,669,752.12
BE-AD-111	191.940	191.940	190.290	1.65	1.20	280,802.87	8,669,760.68
BE-AD-112	191.746	191.746	189.986	1.76	1.20	280,830.85	8,669,763.72
BE-AD-113	193.065	193.065	190.285	2.78	1.20	280,902.10	8,669,783.44
BE-AD-114	191.818	191.818	189.498	2.32	1.20	280,903.75	8,669,772.77
BE-AD-115	191.886	191.886	190.186	1.70	1.20	280,951.93	8,669,786.16
BE-AD-116	192.267	192.267	190.847	1.42	1.20	280,970.80	8,669,828.97
BE-AD-117	192.248	192.248	190.878	1.37	1.20	281,017.96	8,669,839.18
BE-AD-118	191.751	191.751	190.311	1.44	1.20	281,064.04	8,669,856.66
BE-AD-119	191.541	191.541	189.421	2.12	1.20	281,069.26	8,669,843.55
BE-AD-120	191.293	191.293	189.893	1.40	1.20	281,071.25	8,669,796.67
BE-AD-121	190.992	190.992	189.072	1.92	1.20	281,078.21	8,669,764.66
BE-AD-122	190.956	190.956	189.536	1.42	1.20	281,077.57	8,669,743.46
BE-AD-122 (A)	190.956	190.956	189.536	1.42	1.20	281,076.46	8,669,743.28
BE-AD-123	190.749	190.749	189.249	1.50	1.20	281,079.47	8,669,725.18
BE-AD-123 (A)	190.749	190.749	189.249	1.50	1.20	281,078.30	8,669,725.18
BE-AD-124	190.907	190.907	188.967	1.94	1.20	281,049.79	8,669,720.97



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R.C. N° 21895



FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-AD-125	191.660	191.660	190.290	1.37	1.20	281,024.05	8,669,789.28
BE-AD-126	191.109	191.109	189.159	1.95	1.20	281,030.18	8,669,737.87
BE-AD-127	190.885	190.885	189.125	1.76	1.20	281,032.55	8,669,718.69
BE-AD-128	191.310	191.310	189.790	1.52	1.20	280,976.98	8,669,755.64
BE-AD-129	190.900	190.900	189.540	1.36	1.20	280,981.35	8,669,712.60
BE-AD-129*	190.920	190.920	189.640	1.28	1.20	280,971.25	8,669,711.41
BE-AD-130	190.940	190.940	189.570	1.37	1.20	280,961.15	8,669,709.86
BE-AD-131	190.100	190.100	188.630	1.47	1.20	281,056.02	8,669,667.32
BE-AD-132	190.500	190.500	188.560	1.94	1.20	281,007.85	8,669,662.07
BE-AD-133	190.400	190.400	189.150	1.25	1.20	280,966.45	8,669,656.53
BE-AD-133 (A)	190.400	190.400	189.150	1.25	1.20	280,967.54	8,669,656.55
BE-AD-134	191.006	191.006	189.026	1.98	1.20	280,909.06	8,669,719.91
BE-AD-135	190.200	190.200	188.820	1.38	1.20	280,917.97	8,669,650.63
BE-AD-136	191.020	191.020	189.540	1.48	1.20	280,849.63	8,669,707.49
BE-AD-137	190.210	190.210	188.710	1.50	1.20	280,856.45	8,669,642.20
BE-AD-138	189.710	189.710	187.950	1.76	1.20	280,861.49	8,669,598.67
BE-AD-139	189.720	189.720	188.530	1.19	1.20	280,867.23	8,669,597.81
BE-AD-140	189.879	189.879	188.279	1.60	1.20	280,933.21	8,669,606.83
BE-AD-140*	189.843	189.843	188.153	1.69	1.20	280,933.39	8,669,605.15
BE-AD-140* (A)	189.843	189.843	188.193	1.65	1.20	280,934.65	8,669,605.32
BE-AD-141	189.496	189.496	188.036	1.46	1.20	280,980.93	8,669,611.31
BE-AD-142	189.703	189.703	188.383	1.32	1.20	281,013.17	8,669,615.68
BE-AD-143	190.110	190.110	188.820	1.29	1.20	281,038.12	8,669,618.87
BE-AD-144	189.580	189.580	187.660	1.92	1.20	280,934.51	8,669,593.77
BE-AD-145	188.970	188.970	187.790	1.18	1.20	280,985.81	8,669,564.83
BE-AD-146	188.680	188.680	186.470	2.21	1.20	280,940.79	8,669,541.68
BE-AD-147	188.860	188.860	187.540	1.32	1.20	280,990.30	8,669,527.73
BE-AD-148	188.560	188.560	186.040	2.52	1.20	280,942.55	8,669,522.09
BE-AD-149	191.020	191.020	189.550	1.47	1.20	280,898.00	8,669,721.94
BE-AD-150	191.000	191.000	189.400	1.60	1.20	280,851.52	8,669,716.74
BE-AD-151	190.870	190.870	189.120	1.75	1.20	280,799.81	8,669,710.36
BE-AD-152	190.937	190.937	189.287	1.65	1.20	280,750.92	8,669,714.34
BE-AD-153	190.780	190.780	188.930	1.85	1.20	280,752.32	8,669,704.08
BE-AD-154	190.010	190.010	188.160	1.85	1.20	280,758.30	8,669,644.27
BE-AD-155	189.820	189.820	188.000	1.82	1.20	280,759.38	8,669,636.39
BE-AD-156	190.457	190.457	189.137	1.32	1.20	280,739.90	8,669,634.63
BE-AD-157	189.460	189.460	187.570	1.89	1.20	280,767.55	8,669,572.27
BE-AD-158	189.142	189.142	187.812	1.33	1.20	280,636.32	8,669,505.48
BE-AD-159	188.690	188.690	187.560	1.13	1.20	280,684.14	8,669,511.34
BE-AD-160	188.670	188.670	187.290	1.38	1.20	280,738.87	8,669,517.77
BE-AD-161	188.820	188.820	186.930	1.89	1.20	280,773.63	8,669,521.95
BE-AD-162	190.730	190.730	188.970	1.76	1.20	280,802.43	8,669,687.63
BE-AD-163	190.290	190.290	188.620	1.67	1.20	280,808.12	8,669,640.44
BE-AD-164	189.750	189.750	188.320	1.43	1.20	280,813.03	8,669,599.52
BE-AD-165	189.260	189.260	187.930	1.33	1.20	280,818.69	8,669,555.17
BE-AD-166	188.890	188.890	187.690	1.20	1.20	280,821.83	8,669,527.44
BE-AD-167	188.960	188.960	187.880	1.08	1.20	280,845.44	8,669,530.18
BE-AD-167 (A)	188.960	188.960	187.880	1.08	1.20	280,846.83	8,669,530.35
BE-AD-168	189.010	189.010	187.410	1.60	1.20	280,869.20	8,669,533.40
BE-AD-169	189.620	189.620	188.120	1.50	1.20	280,888.88	8,669,571.33
BE-AD-170	189.070	189.070	187.360	1.71	1.20	280,893.33	8,669,535.59
BE-AD-172	190.669	190.669	188.609	2.06	1.20	281,082.89	8,669,722.20



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**FlexTable: Manhole Table**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-AD-173	191.149	191.149	188.129	3.02	1.20	281,104.26	8,669,750.12
BE-AD-174	190.532	190.532	187.702	2.83	1.20	281,085.02	8,669,714.86
BE-AD-175	189.254	189.254	186.034	3.22	1.20	281,031.78	8,669,582.21

CAJA DE AGUA.stsw  
13/11/2015

Bentley Systems, Inc. Haestad Methods  
Solution Center  
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Watertown, CT 06795 USA +1-203-755-1666

Bentley SewerCAD V8i (SELECTseries 4)  
[08.11.04.54]  
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**SISTEMA A CAMBIAR**

## **Memoria de Calculo**



"Consultoría para la Elaboración del Estudio Definitivo y Expediente  
Técnico de Obra: Cambio de Redes de Alcantarillado Urb. Caja de Agua  
distrito de San Juan de Lurigancho"

SIMULACIÓN  
HIDRAÚLICA DEL  
SISTEMA A CAMBIAR

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SEDAPAL



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## MEMORIA DESCRIPTIVA SIMULACIÓN HIDRÁULICA – SISTEMA A CAMBIAR

### I. OBJETIVO

Determinar las condiciones finales de operación del Sistema de Alcantarillado a Cambiar de la Urb. Caja de Agua del distrito de San Juan de Lurigancho, a fin de que estas cumplan los parámetros establecidos por la reglamentación correspondiente (RNE)

### II. TOPOLOGÍA

La topología considerada para la simulación para evitar confusiones es la siguiente:

**Cuadro 2 – 1: Topología**

ELEMENTO CONSIDERADO	TOPOLOGÍA EN LA SIMULACIÓN
<b>TUBERÍAS</b> Las tuberías para el sistema existente son tanto de PVC (Rehabilitadas) como de concreto (a rehabilitar).	<b>Conduit</b> Representan los colectores y sus características físicas de funcionamiento.
<b>BUZONES</b> Los buzones que se encuentran dentro de la zona de estudio, para este caso tenemos los buzones rehabilitados y a rehabilitar.	<b>Manhole</b> Representadas por circunferencias en cada cambio de dirección o pendiente, es donde se asignan tanto las descargas domiciliarias como los aportes.
<b>BUZONES DE DESCARGA</b> Buzones en los que finaliza todo el recorrido de las tuberías que provienen de un sector definido.	<b>Out Fall</b> Se coloca la válvula reductora de Presión bajo las mismas condiciones de la simulación original.

### III. SOFTWARE

Para realizar el modelamiento hidráulico se ha utilizado el software Bentley® SewerCAD® V8i (SELECTseries 4)

### IV. DATOS DE INGRESO

#### Los aportes

Los aportes en la simulación original muestran los siguientes datos:

	Aporte total (L/s)
CAUDAL	41.13

El caudal proviene de la Demanda de Alcantarillado para el Año 20 (2036) indicada en el Anexo 01: Demanda de Alcantarillado. El dato fue determinado tanto usando los consumos para cada tipo de usuario, como también el total de conexiones dentro de la zona de estudio con una proyección

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SIMULACIÓN  
HIDRAÚLICA DEL  
SISTEMA A CAMBIAR

de 20 años, estos fueron evaluados y asignados a cada buzón dependiendo de la zona en la que se encuentre cada uno de estos. Estos caudales asignados se adjuntan al reporte de simulación hidráulica.

Cabe resaltar que los caudales para los tramos de arranque que presentan una magnitud menor a 1.5 l/s, fue reemplazada por este valor sin alterar las condiciones de los tramos continuos.

### Elevaciones

Las elevaciones son proporcionadas por el estudio topográfico y exportadas a través de las tablas flexibles que son herramientas de SewerCAD, del mismo modo las profundidades de los buzones y las caídas para cada colector a la llegada a los buzones.

## **V. RESULTADOS DEL SISTEMA DE ALCANTARILLADO A CAMBIAR**

Una vez hecho el trazado final de la red, con el listado final de buzones que se van a rehabilitar, buzones existentes que no serán cambiados y buzones a reubicar, se procedió a hacer el cálculo hidráulico de este sistema, teniendo en consideración que al ser este un proyecto de cambio únicamente, las condiciones iniciales no deben variar, o variar en lo más mínimo.

Con respecto al Sistema Existente, se modificaron ciertos tramos porque estos colectores se encuentran en las veredas teniendo vías en las cuales podrían ubicarse, esto con el fin de mejorar las condiciones operativas y de mantenimiento del sistema.

También se modificaron las profundidades de algunos buzones para permitir que se cumpla con los parámetros que especifica el RNE, en cuanto a tensión tractiva y velocidades. A fin de que estos cumplan los valores mínimos.

El programa Sewercad puede determinar estos parámetros, y expresarlos mediante tablas para su modificación. Para la determinación del parámetro más importante (Tensión Tractiva – Arrastre de sólidos) el programa usa la siguiente fórmula:

$$\tau = \gamma \cdot Rh \cdot S$$

donde:

$\tau$  = Fuerza tractiva ( Kg/m<sup>2</sup> )  
 $\gamma$  = Peso específico del agua ( Kg/m<sup>3</sup> )  
 $Rh$  = Radio hidráulico ( m )  
 $S$  = Pendiente de la tubería ( n/m )

Una vez ingresados todos los tramos nuevos (Tub PVC) y también ingresadas las nuevas condiciones físicas del sistema, se procedió a modificar las profundidades de los buzones hasta hacer cumplir la primera condición ( $T \geq 1Pa$ ), en este caso se logró hacer que todos los tramos de los colectores a cambiar cumplan con dicha condición, pero los otros parámetros no fueron cumplidos en su totalidad, teniendo en total un 12.57% de tuberías que presentan velocidades

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menores a 0.6 m/s siendo la mínima velocidad hallada 0.39 m/s, y habiendo encontrado un solo tramo con velocidad mayor a 5 m/s ubicado entre los buzones BE-170 y BE-346 que pertenece al colector primario "Próceres" y que no se considera su cambio para el proyecto por ser parte de un sistema externo más grande.

## VI. CONCLUSIONES

- El 100% de tuberías a cambiar y/o reubicar cumplen con la primera condición que es Tensión Tractiva mayor a 1 Pascal ( $T > 1\text{Pa}$ ).
- El 99% de tuberías a cambiar cumplen la condición de velocidad mayor a 0.6 m/s ( $v \geq 0.6$  m/s). Sin embargo, el valor predominante es la tensión tractiva.
- No hay necesidad de modificar los diámetros de las tuberías ya que las dimensiones del sistema existente puede aguantar las condiciones futuras del proyecto y se cumple las condiciones hidráulicas requeridas.
- La mayor profundización que se hizo a los buzones fue al buzón BR-164 con 0.38 m por debajo de la cota de fondo del buzón existente.

Nota: Las conclusiones presentadas son una interpretación de lo expuesto en los reportes anexados.

## VII. OBSERVACIONES

- Las tuberías de PVC-U que no serán cambiadas presentan en su mayoría tensiones tractivas mayores a 0.6 Pa que según el Artículo 9.2.4 del Reglamento de Elaboración de Proyectos de agua potable y Alcantarillado para Habilitaciones Urbanas de Lima Metropolitana y Callao de SEDAPAL es el límite mínimo para tuberías de PVC-U. Sin embargo, existen 04 colectores que se indican a continuación que no cumplen con el límite pero han sido cambiadas por emergencia y según el Equipo de Operación y Mantenimiento – SJL no se realizarán cambios para las tuberías que actualmente son de PVC-U.

Tramo	Longitud (ml)	Ubicación de Referencia	Tensión Tractiva (Pa)
_Tub PVC 200-190	19.33	Puerto Maldonado	0.422
_Tub PVC 200-203	69.85	Ica y Chiclayo	0.587
_Tub PVC 200-204	62.10	Chiclayo e Ica	0.425
_Tub PVC 200-199	48.45	Chiclayo y Av. Proceres	0.511

SEDAPAL

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CONSORCIO PROYECTOS-LIMA



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## VIII. ANEXO

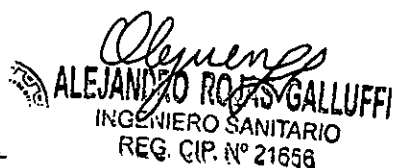
Anexo 01: Demanda de Alcantarillado

AÑO		POBLACION	COBERTURA		POBLACION SERVIDA	VIVIENDAS SERVIDAS	CONEXIONES					
			CONEX.	OTROS MEDIOS			DOMES	COMER	MULTIFAM	ESTATAL	INDUSTRIAL	INDUSTRI
Base	2,015	8,076	100.0%	0.0%	8,076	1,776	1,039	42	737	4	3	1,825
0	2,016	8,279	100.0%	0.0%	8,279	1,821	1,065	42	756	4	3	1,870
1	2,017	8,477	100.0%	0.0%	8,477	1,864	1,090	45	774	4	3	1,916
2	2,018	8,670	100.0%	0.0%	8,670	1,907	1,114	47	791	4	3	1,960
3	2,019	8,856	100.0%	0.0%	8,856	1,947	1,136	49	808	4	3	2,001
4	2,020	9,037	100.0%	0.0%	9,037	1,987	1,158	51	825	4	3	2,041
5	2,021	9,211	100.0%	0.0%	9,211	2,026	1,178	53	841	5	3	2,079
6	2,022	9,379	100.0%	0.0%	9,379	2,062	1,196	55	856	5	3	2,115
7	2,023	9,540	100.0%	0.0%	9,540	2,098	1,213	57	871	5	3	2,149
8	2,024	9,695	100.0%	0.0%	9,695	2,132	1,229	59	885	5	3	2,181
9	2,025	9,843	100.0%	0.0%	9,843	2,164	1,244	62	898	5	3	2,212
10	2,026	9,986	100.0%	0.0%	9,986	2,196	1,257	64	911	5	3	2,241
11	2,027	10,121	100.0%	0.0%	10,121	2,226	1,269	66	924	5	3	2,268
12	2,028	10,250	100.0%	0.0%	10,250	2,254	1,280	69	935	5	4	2,293
13	2,029	10,373	100.0%	0.0%	10,373	2,281	1,289	72	947	5	4	2,316
14	2,030	10,489	100.0%	0.0%	10,489	2,307	1,297	75	957	5	4	2,338
15	2,031	10,599	100.0%	0.0%	10,599	2,331	1,304	77	967	5	4	2,358
16	2,032	10,703	100.0%	0.0%	10,703	2,354	1,310	80	977	5	4	2,376
17	2,033	10,801	100.0%	0.0%	10,801	2,375	1,315	84	986	5	4	2,393
18	2,034	10,893	100.0%	0.0%	10,893	2,395	1,318	87	994	5	4	2,408
19	2,035	10,978	100.0%	0.0%	10,978	2,414	1,320	90	1,002	5	4	2,421
20	2,036	11,059	100.0%	0.0%	11,059	2,432	1,321	94	1,009	5	4	2,434

SEDAPAL

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Anexo 01: Demanda de Alcantarillado

AÑO	POBLACION	DEMANDA DESAGUE (80%)			Q <sub>md</sub> lt/seg	Q <sub>máx h</sub> lt/seg
		lt/seg	lt/día	m3/año		
Base	2,015	8,076	17.80	1,537,819	561,304	23.14
0	2,016	8,279	18.13	1,566,034	571,602	23.56
1	2,017	8,477	18.49	1,597,824	583,206	24.04
2	2,018	8,670	18.83	1,626,553	593,692	24.47
3	2,019	8,856	19.15	1,654,200	603,783	24.89
4	2,020	9,037	19.46	1,680,973	613,555	25.29
5	2,021	9,211	19.75	1,706,659	622,930	25.68
6	2,022	9,379	20.04	1,731,364	631,948	26.05
7	2,023	9,540	20.31	1,754,986	640,570	26.41
8	2,024	9,695	20.57	1,777,634	648,836	26.75
9	2,025	9,843	20.82	1,799,208	656,711	27.07
10	2,026	9,986	21.06	1,819,929	664,274	27.38
11	2,027	10,121	21.29	1,839,487	671,413	27.68
12	2,028	10,250	21.51	1,858,105	678,208	27.96
13	2,029	10,373	21.71	1,875,796	684,666	28.22
14	2,030	10,489	21.90	1,892,467	690,751	28.47
15	2,031	10,599	22.09	1,908,238	696,507	28.71
16	2,032	10,703	22.26	1,923,126	701,941	28.94
17	2,033	10,801	22.42	1,937,146	707,058	29.15
18	2,034	10,893	22.57	1,950,315	711,865	29.35
19	2,035	10,978	22.71	1,962,547	716,330	29.53
20	2,036	11,059	22.85	1,974,179	720,575	29.70
						41.13



## Reportes

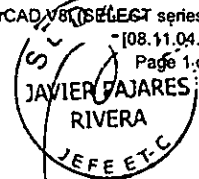
**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-1	211.597	211.597	210.577	1.02	1,200.00	280,291.83	8,669,936.08
BE-2	210.285	210.285	209.305	0.98	1,200.00	280,292.33	8,669,930.99
BE-6	207.100	207.100	205.870	1.23	1,200.00	280,292.44	8,669,903.47
BE-8	203.828	203.828	202.628	1.20	1,200.00	280,296.03	8,669,871.61
BE-9	203.574	203.574	202.124	1.45	1,200.00	280,296.66	8,669,867.21
BE-10	201.014	201.014	198.864	2.15	1,200.00	280,302.46	8,669,817.76
BE-22	200.046	200.046	198.316	1.73	1,200.00	280,087.42	8,669,734.29
BE-31	200.192	200.192	198.452	1.74	1,200.00	280,567.53	8,669,791.33
BE-31*	200.192	200.192	198.862	1.33	1,200.00	280,566.78	8,669,791.25
BE-64	199.088	199.088	196.338	2.75	1,200.00	280,365.63	8,669,706.84
BE-70	198.331	198.331	197.341	0.99	1,200.00	280,198.71	8,669,607.57
BE-79	199.025	199.025	195.675	3.35	1,500.00	280,380.27	8,669,587.68
BE-83	199.740	199.740	198.540	1.20	1,200.00	280,527.96	8,669,716.27
BE-85	199.622	199.622	197.822	1.80	1,200.00	280,541.06	8,669,606.71
BE-126	206.710	206.710	203.710	3.00	1,500.00	280,343.96	8,669,181.03
BE-142	192.908	192.908	190.308	2.60	1,200.00	280,552.64	8,669,359.44
BE-154	196.418	196.418	191.098	5.32	1,500.00	280,524.45	8,669,411.92
BE-155	194.160	194.160	190.370	3.79	1,500.00	280,572.11	8,669,417.69
BE-156	191.953	191.953	189.413	2.54	1,200.00	280,611.91	8,669,422.50
BE-159	188.175	188.175	186.875	1.30	1,200.00	280,704.56	8,669,460.01
BE-160	188.249	188.249	186.189	2.06	1,200.00	280,748.60	8,669,471.47
BE-170	187.908	187.908	183.848	4.06	1,500.00	280,962.21	8,669,426.25
BE-171	192.768	192.768	190.808	1.96	1,200.00	280,550.22	8,669,357.66
BE-173	200.621	200.621	199.021	1.60	1,200.00	280,033.86	8,669,657.54
BE-174	198.683	198.683	197.053	1.63	1,200.00	280,048.68	8,669,637.06
BE-175	198.287	198.287	196.607	1.68	1,200.00	280,094.14	8,669,587.35
BE-178	197.975	197.975	196.885	1.09	1,200.00	280,123.09	8,669,520.10
BE-180	199.176	199.176	197.976	1.20	1,200.00	280,093.67	8,669,495.96
BE-182	198.520	198.520	196.800	1.72	1,200.00	280,106.66	8,669,485.17
BE-183	199.024	199.024	197.494	1.53	1,200.00	280,151.76	8,669,433.24
BE-184	199.652	199.652	198.422	1.23	1,200.00	280,162.94	8,669,420.19
BE-185	198.096	198.096	195.116	2.98	1,500.00	280,172.48	8,669,498.06
BE-186	198.155	198.155	194.565	3.59	1,500.00	280,209.39	8,669,457.07
BE-187	198.379	198.379	193.619	4.76	1,500.00	280,263.45	8,669,426.68
BE-188	198.902	198.902	197.742	1.16	1,200.00	280,271.21	8,669,416.26
BE-189	198.472	198.472	193.530	4.94	1,500.00	280,290.44	8,669,413.22
BE-190	198.458	198.458	197.228	1.23	1,200.00	280,315.60	8,669,393.80
BE-195	198.044	198.044	196.774	1.27	1,200.00	280,343.30	8,669,397.55
BE-197	197.966	197.966	196.136	1.83	1,200.00	280,471.93	8,669,413.20
BE-199	197.910	197.910	195.520	2.39	1,200.00	280,413.68	8,669,394.62
BE-200	197.727	197.727	194.647	3.08	1,500.00	280,475.05	8,669,401.80
BE-201	189.100	189.100	186.300	2.80	1,200.00	280,640.61	8,669,457.61
BE-202	188.187	188.187	186.407	1.78	1,200.00	280,702.22	8,669,465.75
BE-204	188.355	188.355	186.455	1.90	1,200.00	280,682.09	8,669,438.53
BE-205	188.141	188.141	185.991	2.15	1,200.00	280,765.75	8,669,459.84
BE-206	188.144	188.144	185.924	2.22	1,200.00	280,831.17	8,669,470.07
BE-207	188.253	188.253	185.723	2.53	1,200.00	280,896.89	8,669,479.15
BE-208	188.075	188.075	185.575	2.50	1,200.00	280,930.83	8,669,465.33
BE-209	187.570	187.570	184.930	2.64	1,200.00	280,950.01	8,669,429.58
BE-216	203.128	203.128	201.898	1.23	1,200.00	280,393.03	8,669,188.76
BE-217	206.351	206.351	204.971	1.38	1,200.00	280,348.10	8,669,183.37
BE-218	207.872	207.872	206.132	1.74	1,200.00	280,340.96	8,669,175.49



*Alejandro Rojas Galluffi*  
**ALEJANDRO ROJAS GALLUFFI**  
 INGENIERO SANITARIO  
 REG. CIP. N° 21656

*Nazario Caceres Olivera*  
**NAZARIO CACERES OLIVERA**  
 INGENIERO CIVIL



*Javier Pajares Rivera*  
**JAVIER PAJARES RIVERA**  
 JEFE E.T.C.

**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-229	197.570	197.570	196.530	1.04	1,200.00	280,342.97	8,669,334.39
BE-230	197.432	197.432	195.282	2.15	1,200.00	280,369.83	8,669,337.68
BE-231	197.240	197.240	193.200	4.04	1,500.00	280,428.32	8,669,344.67
BE-232	214.753	214.753	212.603	2.15	1,200.00	280,356.81	8,669,989.67
BE-232*	214.753	214.753	212.603	2.15	1,200.00	280,357.78	8,669,989.44
BE-233	208.018	208.018	206.938	1.08	1,200.00	280,457.41	8,669,961.35
BE-234	205.590	205.590	204.130	1.46	1,200.00	280,459.21	8,669,942.45
BE-235	202.760	202.760	201.170	1.59	1,200.00	280,465.18	8,669,890.10
BE-236	201.083	201.083	199.203	1.88	1,200.00	280,376.42	8,669,821.30
BE-237	200.425	200.425	198.225	2.20	1,200.00	280,471.76	8,669,832.93
BE-238	202.326	202.326	200.726	1.60	1,200.00	280,502.64	8,669,867.23
BE-239	201.794	201.794	200.244	1.55	1,200.00	280,530.66	8,669,836.49
BE-240	201.756	201.756	199.876	1.88	1,200.00	280,547.09	8,669,828.26
BE-243	199.425	199.425	197.595	1.83	1,200.00	280,356.12	8,669,790.22
BE-248	201.599	201.599	199.719	1.88	1,200.00	280,577.07	8,669,822.46
BE-249	199.447	199.447	197.767	1.68	1,200.00	280,411.21	8,669,753.01
BE-250	199.374	199.374	197.574	1.80	1,200.00	280,415.76	8,669,712.73
BE-251	199.392	199.392	197.612	1.78	1,200.00	280,419.90	8,669,710.87
BE-252	199.401	199.401	198.031	1.37	1,200.00	280,463.94	8,669,716.36
BE-253	199.557	199.557	198.257	1.30	1,200.00	280,524.33	8,669,722.89
BE-254	199.673	199.673	198.343	1.33	1,200.00	280,526.77	8,669,726.13
BE-256	199.813	199.813	198.733	1.08	1,200.00	280,517.96	8,669,700.74
BE-257	199.597	199.597	198.317	1.28	1,200.00	280,465.33	8,669,694.46
BE-258	199.365	199.365	197.565	1.80	1,200.00	280,422.85	8,669,692.05
BE-259	199.340	199.340	197.410	1.93	1,200.00	280,418.65	8,669,690.21
BE-260	199.817	199.817	198.477	1.34	1,200.00	280,528.92	8,669,654.89
BE-261	199.547	199.547	197.677	1.87	1,200.00	280,471.15	8,669,647.91
BE-262	199.290	199.290	197.240	2.05	1,200.00	280,424.21	8,669,641.57
BE-263	199.019	199.019	195.919	3.10	1,500.00	280,374.72	8,669,636.01
BE-264	190.937	190.937	189.287	1.65	1,200.00	280,750.92	8,669,714.34
BE-265	198.330	198.330	197.260	1.07	1,200.00	280,197.69	8,669,614.36
BE-266	198.357	198.357	197.377	0.98	1,200.00	280,206.80	8,669,615.43
BE-266*	198.357	198.357	197.377	0.98	1,200.00	280,207.50	8,669,615.50
BE-267	198.578	198.578	197.080	1.50	1,200.00	280,256.11	8,669,621.25
BE-268	198.560	198.560	197.090	1.47	1,200.00	280,252.61	8,669,558.76
BE-269	199.014	199.014	195.564	3.45	1,500.00	280,381.82	8,669,571.69
BE-270	199.025	199.025	195.325	3.70	1,500.00	280,385.25	8,669,544.01
BE-271	199.071	199.071	195.121	3.95	1,500.00	280,390.75	8,669,500.04
BE-272	199.868	199.868	197.768	2.10	1,200.00	280,574.62	8,669,731.05
BE-273	199.438	199.438	197.708	1.73	1,200.00	280,576.59	8,669,729.92
BE-274	197.917	197.917	196.367	1.55	1,200.00	280,590.60	8,669,684.06
BE-275	199.000	199.000	197.740	1.26	1,200.00	280,585.56	8,669,641.11
BE-276	198.500	198.500	196.600	1.90	1,200.00	280,580.52	8,669,683.28
BE-277	197.464	197.464	195.914	1.55	1,200.00	280,593.99	8,669,669.20
BE-278	196.309	196.309	195.129	1.18	1,200.00	280,593.62	8,669,630.92
BE-279	195.745	195.745	194.345	1.40	1,200.00	280,789.63	8,669,795.17
BE-280	195.305	195.305	193.215	2.09	1,200.00	280,746.26	8,669,752.12
BE-280*	195.305	195.305	193.215	2.09	1,200.00	280,747.47	8,669,752.30
BE-281	191.940	191.940	190.290	1.65	1,200.00	280,802.87	8,669,760.68
BE-282	191.746	191.746	189.986	1.76	1,200.00	280,830.85	8,669,763.72
BE-283	193.065	193.065	190.285	2.78	1,200.00	280,902.10	8,669,783.44
BE-284	191.818	191.818	189.498	2.32	1,200.00	280,903.75	8,669,772.77



**ALEJANDRO ROJAS GALLUFFI**  
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**NAZARIO CARRERES OLIVERA**  
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REG. CIP. N° 21657



**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-286	192.267	192.267	190.847	1.42	1,200.00	280,970.80	8,669,828.97
BE-287	192.248	192.248	190.878	1.37	1,200.00	281,017.96	8,669,839.18
BE-288	191.751	191.751	190.311	1.44	1,200.00	281,064.04	8,669,856.66
BE-289	191.541	191.541	189.421	2.12	1,200.00	281,069.26	8,669,843.55
BE-291	190.992	190.992	189.072	1.92	1,200.00	281,078.21	8,669,764.66
BE-294	190.907	190.907	188.967	1.94	1,200.00	281,049.79	8,669,720.97
BE-295	191.660	191.660	190.290	1.37	1,200.00	281,024.05	8,669,789.28
BE-296	191.109	191.109	189.159	1.95	1,200.00	281,030.18	8,669,737.87
BE-297	190.885	190.885	189.125	1.76	1,200.00	281,032.55	8,669,718.69
BE-298	191.310	191.310	189.790	1.52	1,200.00	280,976.98	8,669,755.64
BE-299	190.900	190.900	189.540	1.36	1,200.00	280,981.35	8,669,712.60
BE-300	190.920	190.920	189.640	1.28	1,200.00	280,971.25	8,669,711.41
BE-302	190.100	190.100	188.630	1.47	1,200.00	281,056.02	8,669,667.32
BE-303	190.500	190.500	188.560	1.94	1,200.00	281,007.85	8,669,662.07
BE-304	190.400	190.400	189.150	1.25	1,200.00	280,967.54	8,669,656.55
BE-304*	190.400	190.400	189.150	1.25	1,200.00	280,968.09	8,669,656.63
BE-305	191.006	191.006	189.026	1.98	1,200.00	280,909.06	8,669,719.91
BE-306	190.200	190.200	188.820	1.38	1,200.00	280,917.97	8,669,650.63
BE-307	191.020	191.020	189.540	1.48	1,200.00	280,849.63	8,669,707.49
BE-308	190.210	190.210	188.710	1.50	1,200.00	280,856.45	8,669,642.20
BE-309	189.710	189.710	187.950	1.76	1,200.00	280,861.49	8,669,598.67
BE-310	189.720	189.720	188.530	1.19	1,200.00	280,867.23	8,669,597.81
BE-311	189.879	189.879	188.279	1.60	1,200.00	280,933.21	8,669,606.83
BE-312	189.843	189.843	188.153	1.69	1,200.00	280,933.39	8,669,605.15
BE-312*	189.843	189.843	188.193	1.65	1,200.00	280,934.14	8,669,605.23
BE-313	189.496	189.496	188.036	1.46	1,200.00	280,980.93	8,669,611.31
BE-314	189.703	189.703	188.383	1.32	1,200.00	281,013.17	8,669,615.68
BE-315	190.110	190.110	188.820	1.29	1,200.00	281,038.12	8,669,618.87
BE-316	189.580	189.580	187.660	1.92	1,200.00	280,934.51	8,669,593.77
BE-317	188.970	188.970	187.790	1.18	1,200.00	280,985.81	8,669,564.83
BE-319	188.860	188.860	187.540	1.32	1,200.00	280,990.30	8,669,527.73
BE-321	191.020	191.020	189.550	1.47	1,200.00	280,897.99	8,669,721.96
BE-322	191.000	191.000	189.400	1.60	1,200.00	280,851.52	8,669,716.74
BE-323	190.870	190.870	189.120	1.75	1,200.00	280,799.81	8,669,710.36
BE-324	190.780	190.780	188.930	1.85	1,200.00	280,752.32	8,669,704.08
BE-325	190.010	190.010	188.160	1.85	1,200.00	280,758.30	8,669,644.27
BE-326	189.820	189.820	188.000	1.82	1,200.00	280,759.38	8,669,636.39
BE-327	190.457	190.457	189.137	1.32	1,200.00	280,739.90	8,669,634.63
BE-328	189.460	189.460	187.570	1.89	1,200.00	280,767.55	8,669,572.27
BE-329	189.142	189.142	187.812	1.33	1,200.00	280,636.32	8,669,505.48
BE-330	188.690	188.690	187.560	1.13	1,200.00	280,684.14	8,669,511.34
BE-331	188.670	188.670	187.290	1.38	1,200.00	280,738.87	8,669,517.77
BE-332	188.820	188.820	186.930	1.89	1,200.00	280,773.63	8,669,521.95
BE-333	190.730	190.730	188.970	1.76	1,200.00	280,801.54	8,669,695.83
BE-334	190.290	190.290	188.620	1.67	1,200.00	280,808.12	8,669,640.44
BE-335	189.750	189.750	188.320	1.43	1,200.00	280,813.03	8,669,599.52
BE-336	189.260	189.260	187.930	1.33	1,200.00	280,818.69	8,669,555.17
BE-337	188.890	188.890	187.690	1.20	1,200.00	280,821.83	8,669,527.44
BE-338	188.960	188.960	187.880	1.08	1,200.00	280,845.44	8,669,530.18
BE-338*	188.960	188.960	187.880	1.08	1,200.00	280,846.11	8,669,530.26
BE-339	189.010	189.010	187.410	1.60	1,200.00	280,869.20	8,669,533.40
BE-340	189.620	189.620	188.120	1.50	1,200.00	280,886.62	8,669,589.99

*Alejandro Rojas*  
**ALEJANDRO ROJAS GOTTUFFI**  
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*Nazario Caceres*  
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*Javier Tajares*  
**JAVIER TAJARES RIVERA**  
JEFE ETC

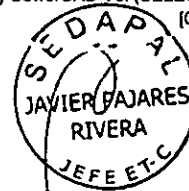
**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-341	189.070	189.070	187.070	2.00	1,200.00	280,893.33	8,669,535.59
BE-342	190.669	190.669	188.609	2.06	1,200.00	281,082.89	8,669,722.20
BE-343	191.149	191.149	188.129	3.02	1,500.00	281,104.26	8,669,750.12
BE-344	190.532	190.532	187.702	2.83	1,200.00	281,085.02	8,669,714.86
BE-345	189.254	189.254	186.034	3.22	1,500.00	281,031.78	8,669,582.21
BP-3	208.234	208.234	206.782	1.45	1,200.00	280,299.73	8,669,929.07
BP-5	206.794	206.794	205.160	1.63	1,200.00	280,359.57	8,669,936.05
BP-11	207.150	207.150	205.950	1.20	1,200.00	280,335.45	8,669,930.92
BP-12	203.550	203.550	201.965	1.59	1,200.00	280,342.98	8,669,869.86
BP-13	205.810	205.810	204.324	1.49	1,200.00	280,361.57	8,669,918.68
BP-14	203.250	203.250	201.641	1.61	1,200.00	280,367.24	8,669,869.53
BP-15	201.850	201.850	200.190	1.66	1,200.00	280,370.53	8,669,841.03
BP-16	200.880	200.880	199.150	1.73	1,200.00	280,348.84	8,669,822.31
BP-18	204.968	204.968	203.648	1.32	1,200.00	280,411.28	8,669,934.94
BP-44	195.020	195.020	193.340	1.68	1,200.00	280,795.51	8,669,782.30
BP-45	195.105	195.105	192.405	2.70	1,200.00	280,886.12	8,669,793.16
BP-50	198.921	198.921	197.224	1.70	1,200.00	280,097.38	8,669,710.41
BP-52	198.410	198.410	197.130	1.28	1,200.00	280,091.74	8,669,696.56
BP-60	198.322	198.322	195.272	3.05	1,500.00	280,191.38	8,669,683.45
BP-61	198.310	198.310	195.710	2.60	1,200.00	280,225.20	8,669,687.78
BP-62	198.430	198.430	195.900	2.53	1,200.00	280,258.94	8,669,691.83
BP-63	198.751	198.751	196.250	2.50	1,200.00	280,314.11	8,669,698.36
BP-63*	198.751	198.751	196.730	2.02	1,200.00	280,315.86	8,669,698.57
BP-66	198.789	198.789	196.380	2.41	1,200.00	280,317.00	8,669,676.70
BP-71	198.862	198.862	196.660	2.20	1,200.00	280,322.71	8,669,629.35
BP-72	197.926	197.926	195.835	2.09	1,200.00	280,152.73	8,669,568.31
BP-73	197.927	197.927	196.727	1.20	1,200.00	280,157.63	8,669,528.63
BP-74	198.233	198.233	197.033	1.20	1,200.00	280,207.35	8,669,564.58
BP-75	198.569	198.569	196.773	1.80	1,200.00	280,251.73	8,669,569.87
BP-76	198.792	198.792	196.540	2.25	1,200.00	280,291.21	8,669,574.78
BP-77	198.950	198.950	197.600	1.35	1,200.00	280,327.31	8,669,586.41
BP-78	198.974	198.974	196.300	2.67	1,200.00	280,330.96	8,669,579.04
BP-79	199.052	199.052	195.654	3.40	1,500.00	280,380.56	8,669,584.68
BP-80	199.220	199.220	197.419	1.80	1,200.00	280,429.95	8,669,590.52
BP-81	199.396	199.396	197.730	1.67	1,200.00	280,479.87	8,669,596.45
BP-82	199.536	199.536	198.073	1.46	1,200.00	280,529.13	8,669,602.20
BP-88	199.216	199.216	197.480	1.74	1,200.00	280,433.42	8,669,581.10
BP-89	199.507	199.507	196.259	3.25	1,500.00	280,499.14	8,669,589.02
BP-90	199.175	199.175	195.251	3.92	1,500.00	280,553.02	8,669,595.58
BP-92	198.078	198.078	196.440	1.64	1,200.00	280,212.61	8,669,467.96
BP-94	198.525	198.525	196.889	1.64	1,200.00	280,304.19	8,669,492.47
BP-95	198.739	198.739	197.311	1.43	1,200.00	280,343.92	8,669,497.25
BP-96	198.998	198.998	197.677	1.32	1,200.00	280,384.16	8,669,502.31
BP-97	199.105	199.105	197.740	1.36	1,200.00	280,442.56	8,669,528.81
BP-98	199.056	199.056	197.075	1.98	1,200.00	280,478.36	8,669,533.21
BP-99	198.903	198.903	196.890	2.01	1,200.00	280,509.15	8,669,536.95
BP-100	198.892	198.892	196.503	2.39	1,200.00	280,559.38	8,669,542.76
BP-107	198.980	198.980	197.470	1.51	1,200.00	280,460.06	8,669,525.79
BP-108	198.170	198.170	196.300	1.87	1,200.00	280,467.55	8,669,463.19
BP-109	198.870	198.870	197.574	1.30	1,200.00	280,509.66	8,669,532.91
BP-111	196.642	196.642	195.167	1.47	1,200.00	280,565.10	8,669,496.58
BP-116	200.570	200.570	199.400	1.17	1,200.00	280,038.78	8,669,595.55



*Alejandro Rojas Galluffi*  
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REG. CIP. N° 21635



**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BP-117	200.116	200.116	198.969	1.15	1,200.00	280,061.65	8,669,556.41
BP-118	199.740	199.740	198.491	1.25	1,200.00	280,081.63	8,669,522.16
BP-121	198.930	198.930	197.820	1.11	1,200.00	280,118.90	8,669,456.47
BP-122	199.330	199.330	198.071	1.26	1,200.00	280,139.88	8,669,420.16
BP-129	202.730	202.730	201.120	1.61	1,200.00	280,392.89	8,669,193.53
BP-130	199.298	199.298	195.813	3.49	1,500.00	280,426.55	8,669,238.95
BP-133	196.570	196.570	194.840	1.73	1,200.00	280,535.89	8,669,228.82
BP-134	195.370	195.370	194.170	1.20	1,200.00	280,442.26	8,669,334.74
BP-135	194.860	194.860	193.099	1.76	1,200.00	280,469.89	8,669,317.83
BP-136	194.564	194.564	192.515	2.05	1,200.00	280,495.28	8,669,302.24
BP-136A	194.332	194.332	192.407	1.92	914.40	280,498.12	8,669,306.87
BP-137	195.307	195.307	194.008	1.30	1,200.00	280,531.75	8,669,279.87
BP-137*	195.307	195.307	194.008	1.30	1,200.00	280,531.11	8,669,280.25
BP-138	195.300	195.300	193.325	1.98	1,200.00	280,555.15	8,669,265.53
BP-139	194.220	194.220	191.860	2.36	1,200.00	280,493.24	8,669,347.63
BP-140	194.940	194.940	192.916	2.02	1,200.00	280,558.85	8,669,271.62
BP-141	192.311	192.311	191.040	1.27	1,200.00	280,553.92	8,669,318.79
BP-148	198.040	198.040	194.020	4.02	1,500.00	280,199.38	8,669,464.82
BP-165	188.340	188.340	185.350	2.99	1,500.00	280,923.43	8,669,491.35
BP-172	200.070	200.070	198.870	1.20	1,200.00	280,385.29	8,669,255.55
BP-177	198.000	198.000	195.768	2.23	1,200.00	280,142.26	8,669,532.21
BP-211	188.720	188.720	187.690	1.03	1,200.00	280,657.22	8,669,300.87
BP-214	200.207	200.207	198.501	1.71	1,200.00	280,460.95	8,669,197.01
BP-214A	200.196	200.196	198.247	1.95	914.40	280,463.04	8,669,209.00
BP-224	196.022	196.022	193.905	2.12	1,200.00	280,438.45	8,669,258.01
BP-225	195.922	195.922	193.659	2.26	1,200.00	280,445.96	8,669,269.52
BP-234	205.230	205.230	203.880	1.35	1,200.00	280,441.07	8,669,938.46
BP-255	200.080	200.080	198.820	1.26	1,200.00	280,569.38	8,669,730.47
BP-285	191.967	191.967	190.220	1.75	1,200.00	280,953.84	8,669,793.36
BP-322	198.379	198.379	197.000	1.38	1,200.00	280,134.99	8,669,715.21
BP-323	198.226	198.226	196.840	1.39	1,200.00	280,204.98	8,669,532.42
BP-324	198.067	198.067	194.757	3.31	1,200.00	280,147.80	8,669,608.20
BP-325	195.673	195.673	193.967	1.71	1,200.00	280,570.24	8,669,451.59
BP-326	198.311	198.311	196.591	1.72	1,200.00	280,264.36	8,669,487.80
BP-327	201.476	201.476	199.168	2.31	1,200.00	280,500.43	8,669,173.86
BP-328	190.971	190.971	189.601	1.37	1,200.00	280,963.18	8,669,714.21
BP-329	199.086	199.086	196.320	2.77	1,200.00	280,365.94	8,669,704.40
BP-330	201.028	201.028	198.351	2.68	1,200.00	280,337.95	8,669,262.90
BP-331	201.348	201.348	198.699	2.65	1,200.00	280,334.66	8,669,259.13
BP-332	199.044	199.044	197.846	1.20	1,200.00	280,440.81	8,669,519.21
BP-333	195.350	195.350	193.614	1.74	1,200.00	280,592.64	8,669,600.08
BP-334	192.220	192.220	189.525	2.70	1,200.00	280,612.27	8,669,437.28
BP-335	191.680	191.680	189.664	2.02	1,200.00	280,609.86	8,669,456.73
BP-336	192.777	192.777	191.691	1.09	1,200.00	280,601.41	8,669,527.46
BR-5	206.992	206.992	205.202	1.79	1,200.00	280,362.67	8,669,938.93
BR-15	201.866	201.866	200.146	1.72	1,200.00	280,374.16	8,669,839.32
BR-15*	201.866	201.866	200.146	1.72	1,200.00	280,373.38	8,669,838.64
BR-16	200.515	200.515	198.615	1.90	1,200.00	280,352.94	8,669,815.95
BR-17	206.660	206.660	205.260	1.40	1,200.00	280,407.39	8,669,968.14
BR-19	204.287	204.287	202.807	1.48	1,200.00	280,413.29	8,669,918.70
BR-20	202.299	202.299	200.699	1.60	1,200.00	280,419.15	8,669,869.17
BR-21	200.467	200.467	198.717	1.75	1,200.00	280,424.22	8,669,827.26



**ALEJANDRO ROJAS GALLUFFI**  
INGENIERO SANITARIO  
REG. CIP. N° 21856

**NAZARIO GAZERES OLIVERA**  
INGENIERO CIVIL  
REG. CIP. N° 21856



**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-23	199.173	199.173	197.443	1.73	1,200.00	280,134.89	8,669,743.02
BR-24	198.789	198.789	195.939	2.85	1,200.00	280,183.35	8,669,747.98
BR-25	198.883	198.883	196.333	2.55	1,200.00	280,248.19	8,669,755.58
BR-26	199.036	199.036	196.566	2.47	1,200.00	280,309.23	8,669,762.86
BR-27	199.263	199.263	196.963	2.30	1,200.00	280,358.35	8,669,768.63
BR-28	199.512	199.512	197.362	2.15	1,200.00	280,417.98	8,669,775.59
BR-29	199.809	199.809	197.809	2.00	1,200.00	280,477.81	8,669,783.09
BR-30	200.061	200.061	198.111	1.95	1,200.00	280,522.47	8,669,788.04
BR-32	200.308	200.308	198.908	1.40	1,200.00	280,563.53	8,669,779.68
BR-33	200.033	200.033	198.633	1.40	1,200.00	280,523.96	8,669,775.42
BR-34	199.788	199.788	198.108	1.68	1,200.00	280,479.99	8,669,769.89
BR-35	199.651	199.651	197.651	2.00	1,200.00	280,419.72	8,669,762.54
BR-36	199.306	199.306	197.106	2.20	1,200.00	280,359.99	8,669,755.36
BR-36*	199.306	199.306	197.106	2.20	1,200.00	280,360.14	8,669,754.37
BR-37	199.217	199.217	196.787	2.43	1,200.00	280,311.27	8,669,749.77
BR-38	198.679	198.679	196.169	2.51	1,200.00	280,249.62	8,669,742.29
BR-39	198.800	198.800	195.720	3.08	1,500.00	280,185.02	8,669,734.39
BR-40	200.290	200.290	198.515	1.77	1,200.00	280,581.14	8,669,793.02
BR-41	200.491	200.491	198.941	1.55	1,200.00	280,626.09	8,669,798.50
BR-42	200.545	200.545	199.395	1.15	1,200.00	280,684.68	8,669,805.41
BR-42*	200.545	200.545	199.395	1.15	1,200.00	280,685.46	8,669,805.37
BR-43	198.696	198.696	197.036	1.66	1,200.00	280,740.01	8,669,807.52
BR-46	192.079	192.079	190.429	1.65	1,200.00	280,953.95	8,669,801.41
BR-47	191.879	191.879	190.309	1.57	1,200.00	280,972.13	8,669,803.47
BR-48	193.199	193.199	190.729	2.47	1,200.00	280,762.62	8,669,754.09
BR-49	192.063	192.063	190.363	1.70	1,200.00	280,794.58	8,669,757.89
BR-51	198.362	198.362	196.962	1.40	1,200.00	280,137.62	8,669,713.53
BR-53	198.355	198.355	196.695	1.66	1,200.00	280,097.14	8,669,644.03
BR-54	198.141	198.141	194.521	3.62	1,500.00	280,102.16	8,669,602.65
BR-55	198.198	198.198	195.030	3.17	1,500.00	280,148.71	8,669,659.30
BR-56	198.184	198.184	195.000	3.18	1,500.00	280,144.18	8,669,656.19
BR-57	198.267	198.267	195.417	2.85	1,200.00	280,192.02	8,669,661.60
BR-58	198.230	198.230	195.110	3.12	1,500.00	280,193.60	8,669,664.46
BR-65	198.669	198.669	197.319	1.35	1,200.00	280,267.38	8,669,671.13
BR-65*	198.669	198.669	197.319	1.35	1,200.00	280,268.01	8,669,671.20
BR-67	198.158	198.158	194.338	3.82	1,500.00	280,102.07	8,669,599.26
BR-68	198.107	198.107	194.767	3.34	1,500.00	280,149.78	8,669,608.45
BR-74	198.235	198.235	197.065	1.17	1,200.00	280,203.43	8,669,566.64
BR-84	199.852	199.852	198.215	1.64	1,200.00	280,534.61	8,669,661.45
BR-86	195.731	195.731	194.581	1.15	1,200.00	280,588.43	8,669,612.10
BR-87	198.264	198.264	196.874	1.39	1,200.00	280,207.22	8,669,534.81
BR-93	198.277	198.277	196.567	1.71	1,200.00	280,261.46	8,669,484.95
BR-101	198.252	198.252	196.442	1.81	1,200.00	280,263.54	8,669,467.95
BR-102	198.230	198.230	196.260	1.97	1,200.00	280,267.12	8,669,437.17
BR-103	198.591	198.591	195.761	2.83	1,200.00	280,342.77	8,669,445.90
BR-104	198.412	198.412	194.912	3.50	1,500.00	280,396.36	8,669,452.61
BR-105	198.941	198.941	197.971	0.97	1,200.00	280,439.39	8,669,514.28
BR-105*	198.941	198.941	197.971	0.97	1,200.00	280,439.34	8,669,514.80
BR-106	198.357	198.357	194.697	3.66	1,500.00	280,445.90	8,669,458.55
BR-108	198.198	198.198	194.598	3.60	1,500.00	280,469.95	8,669,461.43
BR-110	198.276	198.276	196.726	1.55	1,200.00	280,515.34	8,669,485.08
BR-113	197.745	197.745	196.205	1.54	1,200.00	280,520.40	8,669,443.14



**ALEJANDRO ROJAS GALLUFFI**  
INGENIERO SANITARIO  
REG. CIP. N° 21656

**NAZARIO CACERES OLIVERA**  
INGENIERO CIVIL



**JAVIER PAJARES RIVERA**  
JEFE ETC.

**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-114	195.644	195.644	193.884	1.76	1,200.00	280,568.09	8,669,448.38
BR-125	203.269	203.269	200.569	2.70	1,200.00	280,337.86	8,669,230.88
BR-127	199.490	199.490	196.340	3.15	1,500.00	280,382.23	8,669,267.11
BR-128	199.599	199.599	196.249	3.35	1,500.00	280,389.55	8,669,262.00
BR-131	203.421	203.421	201.621	1.80	1,200.00	280,541.03	8,669,145.10
BR-131*	203.421	203.421	200.711	2.71	1,200.00	280,540.45	8,669,145.42
BR-132	198.726	198.726	197.336	1.39	1,200.00	280,574.43	8,669,199.14
BR-138	195.435	195.435	193.425	2.01	1,200.00	280,556.72	8,669,261.71
BR-139	194.007	194.007	191.767	2.24	1,200.00	280,500.94	8,669,351.81
BR-143	194.219	194.219	192.329	1.89	1,200.00	280,612.25	8,669,261.42
BR-143*	194.219	194.219	192.329	1.89	1,200.00	280,612.14	8,669,262.10
BR-144	190.747	190.747	189.057	1.69	1,200.00	280,606.90	8,669,309.14
BR-145	191.278	191.278	188.678	2.60	1,200.00	280,600.55	8,669,365.32
BR-146	198.080	198.080	194.290	3.79	1,500.00	280,104.31	8,669,572.92
BR-147	198.030	198.030	194.150	3.88	1,500.00	280,158.02	8,669,511.80
BR-149	198.379	198.379	193.700	4.68	1,500.00	280,266.02	8,669,429.99
BR-150	197.992	197.992	193.565	4.43	1,500.00	280,337.43	8,669,394.36
BR-151	197.956	197.956	193.436	4.52	1,500.00	280,397.10	8,669,401.60
BR-152	197.827	197.827	193.227	4.60	1,500.00	280,447.26	8,669,407.52
BR-153	196.737	196.737	192.617	4.12	1,500.00	280,516.22	8,669,415.78
BR-157	192.892	192.892	190.642	2.25	1,200.00	280,595.58	8,669,425.21
BR-158	189.644	189.644	187.584	2.06	1,200.00	280,645.41	8,669,435.83
BR-161	188.398	188.398	186.000	2.40	1,200.00	280,779.53	8,669,474.00
BR-162	188.229	188.229	185.820	2.41	1,200.00	280,828.65	8,669,480.54
BR-163	188.250	188.250	185.580	2.67	1,200.00	280,898.96	8,669,488.12
BR-164	188.533	188.533	185.450	3.08	1,500.00	280,946.91	8,669,494.45
BR-166	188.198	188.198	186.745	1.45	1,200.00	280,780.91	8,669,468.35
BR-167	188.171	188.171	186.401	1.77	1,200.00	280,842.46	8,669,475.75
BR-168	188.396	188.396	185.300	3.10	1,500.00	280,924.21	8,669,485.45
BR-176	198.085	198.085	195.815	2.27	1,200.00	280,140.08	8,669,534.66
BR-179	197.946	197.946	196.346	1.60	1,200.00	280,110.94	8,669,505.25
BR-181	198.733	198.733	196.693	2.04	1,200.00	280,098.63	8,669,494.36
BR-192	198.204	198.204	196.104	2.10	1,200.00	280,343.87	8,669,387.81
BR-192*	198.204	198.204	196.104	2.10	1,200.00	280,344.93	8,669,387.80
BR-194	198.062	198.062	193.012	5.05	1,500.00	280,348.93	8,669,393.04
BR-196	197.916	197.916	192.806	5.11	1,500.00	280,413.14	8,669,398.32
BR-198	197.721	197.721	191.401	6.32	1,500.00	280,476.55	8,669,406.41
BR-203	189.863	189.863	186.840	3.02	1,500.00	280,644.02	8,669,427.00
BR-210	189.217	189.217	186.967	2.25	1,200.00	280,650.68	8,669,371.14
BR-213	201.618	201.618	199.208	2.41	1,200.00	280,501.74	8,669,169.61
BR-220	198.591	198.591	196.991	1.60	1,200.00	280,561.01	8,669,197.04
BR-221	197.208	197.208	195.228	1.98	1,200.00	280,527.90	8,669,217.11
BR-222	196.754	196.754	194.604	2.15	1,200.00	280,516.85	8,669,223.89
BR-223	195.744	195.744	193.944	1.80	1,200.00	280,479.67	8,669,246.35
BR-226	196.647	196.647	193.490	3.16	1,500.00	280,396.38	8,669,297.34
BR-227	198.770	198.770	196.650	2.12	1,200.00	280,334.59	8,669,296.22
BR-228	197.533	197.533	196.113	1.42	1,200.00	280,349.50	8,669,326.13
BR-241	201.599	201.599	198.999	2.60	1,200.00	280,572.13	8,669,822.58
BR-242	201.380	201.380	198.640	2.74	1,200.00	280,578.02	8,669,817.95
BR-244	202.087	202.087	200.887	1.20	1,200.00	280,503.85	8,669,863.52
BR-246	201.839	201.839	200.439	1.40	1,200.00	280,514.94	8,669,852.19
BR-247	200.525	200.525	199.385	1.14	1,200.00	280,518.43	8,669,823.39



*Alejandro Rojas Galluffi*  
ALEJANDRO ROJAS GALLUFFI  
INGENIERO SANITARIO  
REG. CIP. N° 21658

*Nazario Caceres Olivera*  
NAZARIO CACERES OLIVERA  
INGENIERO CIVIL





**FlexTable: Manhole Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-290	191.293	191.293	189.893	1.40	1,200.00	281,071.25	8,669,796.67
BR-292	190.956	190.956	189.536	1.42	1,200.00	281,077.57	8,669,743.46
BR-292*	190.956	190.956	189.536	1.42	1,200.00	281,076.88	8,669,743.44
BR-293	190.749	190.749	189.249	1.50	1,200.00	281,079.47	8,669,725.18
BR-301	190.940	190.940	189.570	1.37	1,200.00	280,961.15	8,669,710.22
BR-318	188.680	188.680	186.470	2.21	1,200.00	280,940.79	8,669,541.68
BR-320	188.560	188.560	186.040	2.52	1,200.00	280,942.55	8,669,522.09
BR-321	201.562	201.562	200.362	1.20	1,200.00	280,456.44	8,669,171.15

*Alejandro Rojas Calluffi*  
**ALEJANDRO ROJAS CALLUFFI**  
INGENIERO SANITARIO  
REG. CIP N° 21666

*Nazario Gacenas Oliver*  
**NAZARIO GACENAS OLIVER**  
INGENIERO CIVIL



**FlexTable: Conduit Table (Simulación Hidráulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub CR 1300-1	BE-170	183.848	BE-346	183.374	Concrete	1,300.00	3,035.47	17.04	27.82	5.64	79.44	61.78	17.04
Tub CR 1300-2	BE-343	188.129	BE-344	187.702	Concrete	1,300.00	2,884.80	40.17	10.63	3.89	35.74	71.13	40.18
Tub CR 1300-3	BE-344	187.702	BE-345	186.034	Concrete	1,300.00	2,972.49	142.93	11.67	4.06	39.00	62.88	142.94
Tub CR 1300-4	BE-345	186.034	BE-170	183.848	Concrete	1,300.00	2,972.49	170.78	12.80	4.20	42.07	72.05	170.79
Tub PVC 160-1	BE-288	190.311	BR-290	189.893	PVC	152.00	1.50	60.42	6.92	0.62	1.19	20.83	60.42
Tub PVC 160-2	BE-184	198.422	BE-183	197.494	PVC	152.00	1.50	17.19	53.98	1.28	5.86	17.12	17.22
Tub PVC 160-3	BE-183	197.494	BE-182	196.800	PVC	152.00	1.50	68.77	10.09	0.71	1.59	20.00	68.78
Tub PVC 160-4	BE-182	196.800	BR-181	196.693	PVC	152.00	1.50	12.21	8.76	0.68	1.43	20.31	12.21
Tub PVC 200-1	BE-262	197.240	BE-263	195.919	PVC	190.20	2.01	49.80	26.53	1.06	3.69	20.87	49.81
Tub PVC 200-10	BR-127	196.340	BR-128	196.249	PVC	190.20	1.50	8.93	10.19	0.70	1.54	14.98	8.93
Tub PVC 200-100	BE-218	206.132	BE-217	204.971	PVC	190.20	2.63	10.64	109.14	1.88	12.49	22.89	10.70
Tub PVC 200-101	BE-217	204.971	BE-216	201.898	PVC	190.20	2.74	45.25	67.90	1.61	8.78	23.37	45.36
Tub PVC 200-102	BE-216	201.898	BP-214	198.501	PVC	190.20	2.87	68.41	49.66	1.47	7.02	26.65	68.49
Tub PVC 200-104	BE-126	203.710	BR-125	200.569	PVC	190.20	1.50	50.23	62.54	1.31	6.26	12.70	50.32
Tub PVC 200-106	BE-232	212.603	BR-5	205.202	PVC	190.20	1.50	51.07	144.91	1.74	12.06	11.97	51.61
Tub PVC 200-108	BR-227	196.650	BR-228	196.113	PVC	190.20	1.50	33.42	16.07	0.81	2.19	14.31	33.43
Tub PVC 200-109	BR-228	196.113	BR-226	194.890	PVC	190.20	1.50	55.01	22.23	0.91	2.82	13.88	55.08
Tub PVC 200-110	BP-129	201.120	BP-172	198.870	PVC	190.20	1.50	62.49	36.01	1.07	4.11	13.31	62.53
Tub PVC 200-111	BP-172	198.870	BR-128	196.249	PVC	190.20	1.50	7.73	338.92	2.35	23.20	11.33	8.17
Tub PVC 200-115	BR-131*	200.711	BR-213	199.208	PVC	190.20	1.50	46.31	32.46	1.04	3.78	13.41	45.67
Tub PVC 200-118	BR-131	201.621	BR-132	197.336	PVC	190.20	1.50	63.53	67.45	1.35	6.63	12.62	63.68
Tub PVC 200-119	BR-132	197.336	BR-143	192.329	PVC	190.20	1.50	72.86	68.72	1.36	6.73	12.60	73.04
Tub PVC 200-12	BP-52	197.130	BR-53	196.695	PVC	190.20	1.50	52.80	8.24	0.64	1.31	15.32	52.80
Tub PVC 200-120	BR-143*	192.329	BR-144	189.057	PVC	190.20	1.50	48.02	68.14	1.36	6.69	12.61	47.44
Tub PVC 200-121	BR-144	189.057	BR-145	188.678	PVC	190.20	1.50	56.54	6.70	0.60	1.11	28.19	56.54
Tub PVC 200-122	BR-220	196.991	BR-221	195.228	PVC	190.20	1.50	38.72	45.53	1.17	4.91	13.03	38.76
Tub PVC 200-123	BR-221	195.228	BR-222	194.604	PVC	190.20	1.50	12.96	48.13	1.20	5.12	12.97	12.98
Tub PVC 200-124	BR-222	194.604	BR-223	193.944	PVC	190.20	1.50	43.44	15.19	0.80	2.10	14.39	43.44
Tub PVC 200-125	BE-232*	212.603	BR-17	205.260	PVC	190.20	1.50	54.97	133.58	1.70	11.32	12.03	54.48
Tub PVC 200-126	BR-223	193.944	BP-225	193.659	PVC	190.20	1.50	40.91	6.97	0.61	1.15	24.37	40.91
Tub PVC 200-127	BP-134	194.170	BP-135	193.099	PVC	190.20	1.50	32.40	33.06	1.05	3.83	13.39	32.41
Tub PVC 200-128	BP-135	193.099	BP-136	192.515	PVC	190.20	1.50	29.79	19.60	0.87	2.56	14.04	29.80
Tub PVC 200-129	BP-137	194.008	BP-138	193.325	PVC	190.20	1.50	27.45	24.88	0.95	3.08	13.74	27.46
Tub PVC 200-13	BR-53	196.695	BR-54	196.360	PVC	190.20	1.50	41.68	8.04	0.64	1.28	15.37	41.74



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**FlexTable: Conduit Table (Simulación Hidráulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-130	BP-138	193.325	BP-140	192.916	PVC	190.20	1.50	7.12	57.41	1.27	5.86	12.79	7.14
Tub PVC 200-131	BP-137*	194.008	BP-136	192.515	PVC	190.20	1.50	42.78	34.90	1.06	4.01	13.34	42.07
Tub PVC 200-132(1)	BP-136	192.515	BP-136A	192.407	PVC	190.20	1.50	5.43	19.81	0.88	2.58	14.03	5.43
Tub PVC 200-132(2)	BP-136A	192.407	BP-139	191.860	PVC	190.20	1.50	41.05	13.34	0.77	1.89	14.57	41.05
Tub PVC 200-133	BP-139	191.860	BR-139	191.767	PVC	190.20	1.50	8.76	10.61	0.71	1.59	26.58	8.77
Tub PVC 200-134	BR-17	205.260	BP-18	203.648	PVC	190.20	1.50	33.43	48.22	1.20	5.13	12.97	33.47
Tub PVC 200-135	BP-140	192.916	BP-141	191.040	PVC	190.20	1.50	47.42	39.56	1.11	4.41	13.19	47.46
Tub PVC 200-136	BP-141	191.040	BE-171	190.808	PVC	190.20	1.50	39.05	5.94	0.57	1.01	27.13	39.06
Tub PVC 200-137	BP-133	194.840	BR-138	193.425	PVC	190.20	1.50	38.93	36.34	1.09	4.11	13.27	38.96
Tub PVC 200-138	BR-138	193.425	BP-138	193.325	PVC	190.20	1.50	4.13	24.23	0.94	3.01	13.77	4.13
Tub PVC 200-139	BR-143	192.329	BM-212	188.803	PVC	190.20	1.50	41.03	85.93	1.47	7.98	12.38	41.18
Tub PVC 200-140	BE-280	193.215	BE-264	189.287	PVC	190.20	1.50	38.07	103.17	1.55	9.27	12.25	38.27
Tub PVC 200-141	BE-264	189.287	BE-324	188.930	PVC	190.20	1.50	10.35	34.50	1.06	3.97	17.11	10.35
Tub PVC 200-142	BE-324	188.930	BE-325	188.160	PVC	190.20	1.53	60.11	12.81	0.76	1.85	14.79	60.12
Tub PVC 200-143	BP-18	203.648	BR-19	202.807	PVC	190.20	1.50	16.37	51.38	1.22	5.38	12.90	16.39
Tub PVC 200-144	BE-329	187.812	BE-330	187.560	PVC	190.20	1.50	48.17	5.23	0.55	0.92	16.11	48.17
Tub PVC 200-145	BE-330	187.560	BE-331	187.290	PVC	190.20	1.50	55.11	4.90	0.54	0.87	16.23	55.11
Tub PVC 200-146	BE-331	187.290	BE-332	186.930	PVC	190.20	1.50	35.01	10.28	0.70	1.55	21.05	35.01
Tub PVC 200-147	BE-321	189.550	BE-322	189.400	PVC	190.20	1.50	46.77	3.21	0.46	0.63	17.07	46.77
Tub PVC 200-148	BE-322	189.400	BE-323	189.120	PVC	190.20	1.50	52.10	5.37	0.56	0.94	16.06	52.10
Tub PVC 200-149	BE-323	189.120	BE-324	188.930	PVC	190.20	1.50	47.90	3.97	0.50	0.74	17.11	47.91
Tub PVC 200-150	BE-333	188.970	BE-334	188.620	PVC	190.20	1.50	55.79	6.27	0.59	1.06	15.79	55.79
Tub PVC 200-151	BE-2	209.305	BE-6	205.870	PVC	190.20	1.50	27.52	124.84	1.66	10.75	19.54	27.73
Tub PVC 200-152	BR-19	202.807	BR-20	200.699	PVC	190.20	1.50	49.87	42.27	1.14	4.64	13.13	49.92
Tub PVC 200-153	BE-334	188.620	BE-335	188.320	PVC	190.20	1.50	41.21	7.28	0.62	1.19	15.54	41.21
Tub PVC 200-154	BE-335	188.320	BE-336	187.930	PVC	190.20	1.50	44.71	8.72	0.66	1.36	15.23	44.71
Tub PVC 200-155	BE-336	187.930	BE-337	187.690	PVC	190.20	1.50	27.91	8.60	0.65	1.35	15.25	27.91
Tub PVC 200-156	BE-337	187.690	BE-332	186.930	PVC	190.20	1.50	48.51	15.67	0.81	2.15	21.05	48.51
Tub PVC 200-157	BE-338	187.880	BE-337	187.690	PVC	190.20	1.50	23.77	7.99	0.64	1.28	15.38	23.77
Tub PVC 200-158	BE-338*	187.880	BE-339	187.410	PVC	190.20	1.50	23.98	19.60	0.87	2.56	19.85	23.31
Tub PVC 200-159	BE-339	187.410	BE-341	187.070	PVC	190.20	2.64	24.23	14.03	0.92	2.54	23.34	24.23
Tub PVC 200-160	BE-341	187.070	BR-163	186.280	PVC	190.20	2.95	47.80	16.53	1.01	3.03	19.99	47.82
Tub PVC 200-161	BE-340	188.120	BE-341	187.070	PVC	190.20	1.50	54.82	19.15	0.87	2.51	20.50	54.83
Tub PVC 200-162	BE-307	189.540	BE-308	188.710	PVC	190.20	1.50	65.65	12.64	0.75	1.82	19.05	65.65
Tub PVC 200-163	BR-20	200.699	BR-21	199.020	PVC	190.20	1.50	42.22	39.77	1.11	4.43	13.19	42.27

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**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start)	Stop Node	Invert (Stop)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-164	BE-308	188.710	BE-309	187.950	PVC	190.20	2.30	43.82	17.34	0.95	2.81	21.65	43.82
Tub PVC 200-165	BE-309	187.950	BE-339	187.410	PVC	190.20	2.53	65.72	8.22	0.75	1.64	22.45	65.72
Tub PVC 200-166	BE-310	188.530	BE-311	188.279	PVC	190.20	1.50	66.60	3.77	0.49	0.71	16.74	66.60
Tub PVC 200-167	BE-311	188.279	BE-312	188.153	PVC	190.20	1.50	1.69	74.58	1.40	7.16	12.69	1.69
Tub PVC 200-168	BE-312*	188.193	BE-313	188.036	PVC	190.20	1.50	47.92	3.28	0.47	0.64	24.05	47.19
Tub PVC 200-169	BE-313	188.036	BE-317	187.790	PVC	190.20	4.86	46.73	5.26	0.78	1.55	31.19	46.73
Tub PVC 200-17	BE-265	197.260	BR-68	196.460	PVC	190.20	1.50	48.27	16.57	0.82	2.25	14.27	48.34
Tub PVC 200-170	BE-317	187.790	BE-319	187.540	PVC	190.20	4.94	37.37	6.69	0.85	1.88	28.56	37.37
Tub PVC 200-171	BE-319	187.540	BR-320	186.980	PVC	190.20	4.96	48.08	11.65	1.04	2.90	26.90	48.10
Tub PVC 200-172	BE-312	188.153	BE-316	187.660	PVC	190.20	1.50	11.43	43.12	1.15	4.71	13.10	11.44
Tub PVC 200-173	BE-316	187.660	BR-318	186.470	PVC	190.20	1.50	52.47	22.68	0.92	2.86	17.14	52.48
Tub PVC 200-174	BE-233	206.938	BE-234	204.130	PVC	190.20	1.50	18.98	147.94	1.76	12.25	11.95	19.19
Tub PVC 200-175	BR-318	186.470	BR-320	186.040	PVC	190.20	1.54	19.67	21.86	0.92	2.82	24.41	19.67
Tub PVC 200-176	BR-48	190.729	BR-49	190.363	PVC	190.20	1.50	32.19	11.37	0.72	1.67	14.81	32.19
Tub PVC 200-177	BR-49	190.363	BE-281	190.290	PVC	190.20	1.50	8.74	8.35	0.65	1.32	15.30	8.75
Tub PVC 200-178	BE-281	190.290	BE-282	189.986	PVC	190.20	1.50	28.14	10.80	0.71	1.61	14.89	28.14
Tub PVC 200-179	BE-279	194.345	BR-49	190.363	PVC	190.20	1.50	37.61	105.88	1.56	9.46	12.23	37.82
Tub PVC 200-18	BE-266	197.377	BE-265	197.260	PVC	190.20	1.50	9.17	12.75	0.75	1.83	14.63	9.17
Tub PVC 200-180	BP-44	193.340	BP-45	192.405	PVC	190.20	1.50	91.26	10.25	0.70	1.55	14.97	91.26
Tub PVC 200-181	BP-45	192.405	BR-46	190.429	PVC	190.20	1.50	68.32	28.92	1.00	3.45	13.55	68.35
Tub PVC 200-182	BR-46	190.429	BR-47	190.309	PVC	190.20	1.50	18.30	6.56	0.59	1.10	17.32	18.30
Tub PVC 200-183	BE-286	190.847	BR-47	190.610	PVC	190.20	1.50	25.54	9.28	0.67	1.43	15.13	25.55
Tub PVC 200-184	BE-234	204.130	BE-235	201.170	PVC	190.20	1.50	52.69	56.17	1.26	5.77	12.81	52.78
Tub PVC 200-185	BR-47	190.309	BE-298	189.790	PVC	190.20	1.61	48.08	10.80	0.72	1.66	17.99	48.08
Tub PVC 200-186	BE-298	189.790	BE-299	189.540	PVC	190.20	1.74	43.26	5.78	0.60	1.06	18.96	43.26
Tub PVC 200-187	BE-300	189.640	BE-299	189.540	PVC	190.20	1.50	10.17	9.83	0.69	1.50	18.30	10.17
Tub PVC 200-188	BE-299	189.540	BE-297	189.125	PVC	190.20	1.98	51.57	8.05	0.70	1.45	23.42	51.57
Tub PVC 200-189	BE-297	189.125	BE-294	188.967	PVC	190.20	3.79	17.39	9.09	0.88	2.13	24.09	17.39
Tub PVC 200-19	BE-266*	197.377	BE-267	197.080	PVC	190.20	1.50	49.65	5.98	0.58	1.02	15.87	48.95
Tub PVC 200-190	BE-296	189.159	BE-297	189.125	PVC	190.20	1.77	19.33	1.76	0.39	0.42	24.39	19.33
Tub PVC 200-191	BE-287	190.878	BE-295	190.290	PVC	190.20	1.50	50.27	11.70	0.73	1.71	17.37	50.28
Tub PVC 200-192	BE-295	190.290	BE-296	189.159	PVC	190.20	1.63	51.77	21.85	0.93	2.89	19.64	51.78
Tub PVC 200-193	BR-290	189.893	BR-292	189.536	PVC	190.20	1.50	53.59	6.66	0.60	1.10	15.66	53.59
Tub PVC 200-194	BE-235	201.170	BE-237	198.225	PVC	190.20	1.50	57.55	51.18	1.22	5.37	21.80	57.62
Tub PVC 200-195	BR-292	189.536	BR-293	189.249	PVC	190.20	1.50	18.38	15.62	0.81	2.14	14.35	18.38



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**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-196	BR-293	189.249	BE-342	188.609	PVC	190.20	1.50	4.54	140.99	1.73	11.81	63.33	4.58
Tub PVC 200-197	BR-292*	189.536	BE-296	189.159	PVC	190.20	1.50	47.72	7.90	0.63	1.27	19.27	47.02
Tub PVC 200-198	BE-294	188.967	BE-302	188.630	PVC	190.20	3.79	54.01	6.24	0.77	1.59	30.71	54.01
Tub PVC 200-199	BE-302	188.630	BE-303	188.560	PVC	190.20	3.95	48.45	1.44	0.46	0.51	31.67	48.45
Tub PVC 200-200	BE-303	188.560	BE-314	188.383	PVC	190.20	4.32	46.70	3.79	0.67	1.13	29.59	46.70
Tub PVC 200-201	BE-315	188.820	BE-314	188.383	PVC	190.20	1.50	25.15	17.37	0.84	2.33	23.50	25.16
Tub PVC 200-202	BE-314	188.383	BE-313	188.036	PVC	190.20	4.54	32.53	10.67	0.98	2.61	30.53	32.53
Tub PVC 200-203	BE-305	189.026	BE-306	188.820	PVC	190.20	1.50	69.85	2.95	0.45	0.59	19.51	69.85
Tub PVC 200-204	BE-306	188.820	BE-308	188.710	PVC	190.20	1.77	62.10	1.77	0.39	0.43	21.31	62.10
Tub PVC 200-205	BE-237	198.225	BR-29	197.809	PVC	190.20	3.60	50.20	8.29	0.84	1.94	23.74	50.20
Tub PVC 200-206	BE-282	189.986	BE-284	189.498	PVC	190.20	1.50	73.46	6.64	0.60	1.10	15.66	73.46
Tub PVC 200-207	BE-283	190.285	BE-284	189.498	PVC	190.20	1.50	10.79	72.91	1.39	7.04	12.54	10.82
Tub PVC 200-208	BE-284	189.498	BE-305	189.026	PVC	190.20	1.50	53.13	8.88	0.66	1.38	17.25	53.13
Tub PVC 200-210	BR-301	189.570	BE-304	189.150	PVC	190.20	1.50	54.05	7.77	0.63	1.25	15.44	54.05
Tub PVC 200-211	BE-304*	189.150	BE-303	188.560	PVC	190.20	1.50	40.68	14.50	0.79	2.02	23.09	40.13
Tub PVC 200-212	BE-304	189.150	BE-306	188.820	PVC	190.20	1.50	49.93	6.61	0.59	1.10	19.28	49.93
Tub PVC 200-214	BR-56	196.100	BR-51	196.962	PVC	190.20	1.77	57.72	14.93	0.84	2.23	15.65	57.75
Tub PVC 200-216	BE-188	197.742	BE-189	196.570	PVC	190.20	1.50	19.47	60.20	1.30	6.08	12.74	19.92
Tub PVC 200-217	BE-238	200.726	BE-239	200.244	PVC	190.20	1.70	41.60	11.59	0.75	1.80	18.34	41.60
Tub PVC 200-218	BE-239	200.244	BE-240	199.876	PVC	190.20	1.78	18.37	20.03	0.93	2.81	18.70	18.38
Tub PVC 200-219	BE-240	199.876	BR-241	198.999	PVC	190.20	1.83	25.68	34.16	1.13	4.30	22.31	25.69
Tub PVC 200-220	BE-6	205.870	BE-8	202.628	PVC	190.20	2.50	32.06	101.12	1.82	11.43	28.54	32.23
Tub PVC 200-221	BR-241	198.999	BR-242	198.640	PVC	190.20	3.39	7.50	47.87	1.53	7.36	19.50	7.51
Tub PVC 200-223	BR-244	200.887	BR-246	200.439	PVC	190.20	1.50	15.86	28.24	0.99	3.39	13.58	15.87
Tub PVC 200-224	BR-246	200.439	BR-247	199.385	PVC	190.20	1.50	29.01	36.34	1.09	4.11	13.27	29.03
Tub PVC 200-225	BR-247	199.385	BR-241	198.999	PVC	190.20	1.50	53.70	7.19	0.62	1.17	21.40	53.70
Tub PVC 200-226	BE-248	199.719	BR-242	199.550	PVC	190.20	1.50	4.61	36.67	1.09	4.14	13.26	4.73
Tub PVC 200-227	BR-242	198.640	BR-40	198.515	PVC	190.20	2.08	25.13	4.97	0.60	1.02	20.73	25.13
Tub PVC 200-228	BR-40	198.515	BE-31	198.452	PVC	190.20	2.35	13.71	4.59	0.60	1.01	21.89	13.71
Tub PVC 200-229	BE-31	198.452	BE-272	197.768	PVC	190.20	2.58	60.70	11.27	0.85	2.12	19.43	60.71
Tub PVC 200-23	BE-70	197.341	BR-74	197.065	PVC	190.20	1.50	41.20	6.70	0.60	1.11	17.01	41.20
Tub PVC 200-230	BE-272	197.768	BE-273	197.708	PVC	190.20	2.58	2.27	26.43	1.14	4.11	23.22	2.27
Tub PVC 200-231	BE-8	202.628	BE-9	202.124	PVC	190.20	6.14	4.45	113.31	2.47	18.73	35.21	4.48
Tub PVC 200-232	BE-273	197.708	BE-274	196.367	PVC	190.20	2.96	47.95	27.97	1.21	4.56	24.24	47.97
Tub PVC 200-233	BE-274	196.367	BE-277	195.914	PVC	190.20	3.06	15.24	29.72	1.25	4.87	19.31	15.25

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**Alejandro Rojas Galluffi**  
 INGENIERO SANITARIO  
 REG. CIP. No 21656

**NAZARIO CACERES OLIVERA**  
 INGENIERO CIVIL  
 Reg. Cip. No 22095



CAJA DE AGUA,ISW  
 08/01/2016

**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-234	BE-277	195.914	BE-278	195.129	PVC	190.20	3.06	38.28	20.51	1.10	3.65	25.10	38.29
Tub PVC 200-235	BE-278	195.129	BR-86	194.730	PVC	190.20	3.37	19.52	20.44	1.13	3.80	20.96	19.53
Tub PVC 200-236	BE-275	197.740	BE-276	196.600	PVC	190.20	1.50	42.47	26.85	0.97	3.26	13.64	42.48
Tub PVC 200-237	BE-276	196.600	BE-274	196.367	PVC	190.20	1.50	10.11	23.05	0.92	2.90	20.74	10.11
Tub PVC 200-238	BR-42	199.395	BR-41	198.941	PVC	190.20	1.50	59.00	7.70	0.63	1.24	15.45	59.00
Tub PVC 200-239	BR-41	198.941	BR-40	198.515	PVC	190.20	1.50	45.28	9.41	0.68	1.45	19.19	45.29
Tub PVC 200-24	BR-74	197.065	BR-87	196.874	PVC	190.20	1.50	32.06	5.96	0.58	1.02	15.89	32.06
Tub PVC 200-240	BE-9	202.124	BE-10	199.480	PVC	190.20	6.27	49.79	53.10	1.90	10.51	26.39	49.90
Tub PVC 200-246	BP-11	205.950	BP-12	201.965	PVC	190.20	1.50	61.52	64.78	1.33	6.43	12.66	61.65
Tub PVC 200-247	BP-12	201.965	BP-16	199.150	PVC	190.20	1.50	47.92	58.75	1.28	5.97	12.76	48.00
Tub PVC 200-248	BE-10	198.864	BR-26	197.130	PVC	190.20	6.46	55.31	31.35	1.59	7.07	28.02	55.36
Tub PVC 200-249	BP-16	199.150	BR-16	199.070	PVC	190.20	1.50	7.56	10.59	0.70	1.58	14.92	7.58
Tub PVC 200-250	BR-15*	200.146	BR-16	198.615	PVC	190.20	1.50	31.56	48.51	1.20	5.15	12.97	30.57
Tub PVC 200-251	BR-16	198.615	BE-243	197.595	PVC	190.20	1.50	25.93	39.34	1.11	4.38	13.19	25.95
Tub PVC 200-252	BE-243	197.595	BR-27	197.310	PVC	190.20	1.50	21.71	13.13	0.76	1.87	14.59	21.72
Tub PVC 200-254	BR-42*	199.395	BR-43	197.036	PVC	190.20	1.50	55.37	42.60	1.14	4.67	13.12	54.64
Tub PVC 200-255	BR-43	197.036	BE-280	193.215	PVC	190.20	1.50	55.75	68.53	1.36	6.71	12.60	55.88
Tub PVC 200-256	BR-36*	197.106	BE-64	196.338	PVC	190.20	1.50	48.85	15.72	0.81	2.16	14.34	47.86
Tub PVC 200-258(1)	BE-64	196.338	BP-329	196.320	PVC	190.20	1.33	2.46	7.33	0.60	1.13	19.74	2.46
Tub PVC 200-258(2)	BP-329	196.320	BE-263	195.919	PVC	190.20	2.83	68.95	5.82	0.69	1.32	21.85	68.96
Tub PVC 200-259	BE-249	197.767	BE-250	197.574	PVC	190.20	1.50	40.53	4.76	0.53	0.85	16.29	40.53
Tub PVC 200-260	BE-250	197.574	BE-259	197.410	PVC	190.20	1.50	22.71	7.22	0.62	1.18	15.54	22.71
Tub PVC 200-261	BE-259	197.410	BE-262	197.240	PVC	190.20	1.50	48.96	3.47	0.48	0.67	18.35	48.96
Tub PVC 200-262	BE-251	197.612	BE-258	197.565	PVC	190.20	1.50	19.05	2.47	0.42	0.51	17.65	19.05
Tub PVC 200-263	BE-258	197.565	BE-259	197.410	PVC	190.20	1.50	4.59	33.76	1.05	3.90	13.37	4.59
Tub PVC 200-264	BE-252	198.031	BE-251	197.612	PVC	190.20	1.50	44.38	9.44	0.68	1.45	17.65	44.39
Tub PVC 200-265	BE-253	198.257	BE-252	198.031	PVC	190.20	1.50	60.74	3.72	0.49	0.70	16.77	60.74
Tub PVC 200-266	BE-254	198.343	BE-253	198.257	PVC	190.20	1.50	4.06	21.20	0.90	2.72	13.94	4.06
Tub PVC 200-267	BP-255	198.820	BE-254	198.343	PVC	190.20	1.50	42.83	11.14	0.72	1.65	14.84	42.83
Tub PVC 200-268	BE-83	198.540	BR-84	198.215	PVC	190.20	1.50	55.23	5.88	0.57	1.01	15.90	55.23
Tub PVC 200-269	BE-256	198.733	BE-257	198.317	PVC	190.20	1.50	53.00	7.85	0.63	1.26	15.41	53.00
Tub PVC 200-270	BE-257	198.317	BE-258	197.565	PVC	190.20	1.50	42.55	17.67	0.84	2.36	14.18	42.55
Tub PVC 200-271	BR-84	198.215	BE-85	197.822	PVC	190.20	1.50	55.12	7.13	0.61	1.17	15.58	55.12
Tub PVC 200-272	BE-260	198.477	BE-261	197.880	PVC	190.20	1.50	58.19	10.26	0.70	1.55	14.97	58.19
Tub PVC 200-273	BE-261	197.677	BE-262	197.240	PVC	190.20	1.50	47.37	9.23	0.67	1.42	18.35	47.37

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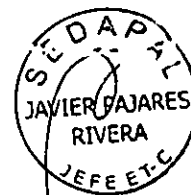
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*Nazario*  
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**FlexTable: Conduit Table (Simulación Hidráulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-275	BE-2	209.305	BE-1	210.577	PVC	190.20	1.50	5.12	248.41	2.11	18.27	11.55	5.28
Tub PVC 200-276	BR-39	195.720	BR-38	196.169	PVC	190.20	1.50	65.08	6.90	0.61	1.14	31.96	65.08
Tub PVC 200-277	BR-38	196.169	BR-37	196.787	PVC	190.20	1.50	62.09	9.95	0.69	1.51	15.01	62.10
Tub PVC 200-278	BR-37	196.787	BR-36	197.106	PVC	190.20	1.50	49.05	6.50	0.59	1.09	15.74	49.05
Tub PVC 200-279	BR-36	197.106	BR-35	197.651	PVC	190.20	1.50	60.15	9.06	0.67	1.41	15.16	60.16
Tub PVC 200-280	BR-34	198.108	BR-33	198.633	PVC	190.20	1.50	44.31	11.85	0.73	1.73	14.74	44.31
Tub PVC 200-281	BR-33	198.633	BR-32	198.908	PVC	190.20	1.50	39.81	6.91	0.61	1.14	15.61	39.81
Tub PVC 200-282	BR-24	195.939	BR-23	197.443	PVC	190.20	1.59	48.71	30.88	1.04	3.73	33.69	48.73
Tub PVC 200-283	BR-23	197.443	BE-22	198.316	PVC	190.20	1.50	48.27	18.08	0.85	2.40	17.25	48.28
Tub PVC 200-284	BR-35	197.651	BR-34	198.108	PVC	190.20	1.50	60.72	7.53	0.63	1.21	15.46	60.72
Tub PVC 200-285	BR-48	190.729	BE-280*	193.215	PVC	190.20	1.50	16.47	150.94	1.77	12.45	11.93	15.45
Tub PVC 200-286	BP-18	203.648	BP-234	203.880	PVC	190.20	1.50	30.00	7.73	0.63	1.25	15.44	30.00
Tub PVC 200-288	BP-323	196.840	BP-92	196.440	PVC	190.20	1.50	64.91	6.16	0.58	1.04	15.81	64.91
Tub PVC 200-290	BP-77	197.600	BP-71	196.660	PVC	190.20	1.50	43.19	21.76	0.91	2.77	13.91	43.20
Tub PVC 200-291	BP-66	196.380	BP-71	196.660	PVC	190.20	1.50	47.69	5.87	0.57	1.00	15.89	47.69
Tub PVC 200-292	BP-63	196.250	BP-66	196.380	PVC	190.20	1.50	21.85	5.95	0.57	1.01	15.86	21.85
Tub PVC 200-293	BP-322	197.000	BP-51	196.962	PVC	190.20	1.50	3.12	12.18	0.74	1.77	17.76	3.12
Tub PVC 200-294	BP-322	197.000	BP-50	197.224	PVC	190.20	1.50	37.92	5.91	0.57	1.01	15.89	37.92
Tub PVC 200-295	BP-72	195.835	BP-73	196.727	PVC	190.20	1.50	39.98	22.31	0.91	2.83	13.87	39.99
Tub PVC 200-296	BP-324	194.757	BP-72	195.835	PVC	190.20	1.50	40.20	26.82	0.97	3.26	35.45	40.21
Tub PVC 200-297	BP-328	189.601	BR-301	189.570	PVC	190.20	1.50	4.48	6.92	0.61	1.14	17.01	4.48
Tub PVC 200-298	BR-5	205.202	BP-5	205.160	PVC	190.20	1.50	4.23	9.93	0.69	1.51	15.02	4.23
Tub PVC 200-299	BP-5	205.160	BP-3	206.782	PVC	190.20	1.50	60.24	26.92	0.98	3.27	13.64	60.27
Tub PVC 200-3	BP-62	195.900	BP-61	195.710	PVC	190.20	1.64	33.98	5.59	0.58	1.01	18.08	33.98
Tub PVC 200-300	BP-76	196.540	BP-75	196.773	PVC	190.20	1.50	39.78	5.86	0.57	1.00	16.99	39.78
Tub PVC 200-301	BP-78	196.300	BP-76	196.540	PVC	190.20	1.50	39.98	6.00	0.58	1.02	15.86	39.98
Tub PVC 200-302	BP-79	195.980	BP-78	196.300	PVC	190.20	1.50	49.92	6.41	0.59	1.08	15.76	49.93
Tub PVC 200-303	BP-79	197.100	BP-80	197.419	PVC	190.20	1.50	49.73	6.41	0.59	1.08	15.76	49.76
Tub PVC 200-304	BP-81	197.730	BP-80	197.419	PVC	190.20	1.51	50.27	6.19	0.58	1.05	15.86	50.27
Tub PVC 200-305	BP-81	197.730	BP-82	198.073	PVC	190.20	1.50	49.59	6.92	0.61	1.14	17.04	49.59
Tub PVC 200-306	BP-332	197.846	BP-88	197.480	PVC	190.20	1.50	62.32	5.87	0.57	1.00	17.02	62.33
Tub PVC 200-307	BP-285	190.220	BP-328	189.601	PVC	190.20	1.50	79.70	7.77	0.63	1.25	15.43	79.70
Tub PVC 200-308	BP-98	197.075	BP-97	197.740	PVC	190.20	1.50	36.06	18.44	0.85	2.44	14.13	36.07
Tub PVC 200-309	BP-99	196.890	BP-98	197.075	PVC	190.20	1.50	31.02	5.96	0.58	1.02	15.87	31.02
Tub PVC 200-310	BP-99	196.890	BP-100	196.503	PVC	190.20	1.50	50.57	7.65	0.63	1.23	15.42	50.57

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08/01/2016

  
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**JAVIER PAJARES RIVERA**  
JEFE ETC.

**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-311	BP-100	196.503	BP-111	195.167	PVC	190.20	1.50	46.53	28.71	1.00	3.44	13.56	46.55
Tub PVC 200-312	BP-325	193.967	BP-111	195.167	PVC	190.20	1.50	45.28	26.50	0.97	3.23	13.66	45.30
Tub PVC 200-313	BR-114	193.884	BP-325	193.967	PVC	190.20	1.50	3.86	21.48	0.90	2.74	13.92	3.87
Tub PVC 200-314	BR-86	194.581	BP-333	193.614	PVC	190.20	3.72	12.74	75.90	1.85	10.97	28.41	12.78
Tub PVC 200-315	BP-336	191.691	BP-333	193.614	PVC	190.20	4.50	73.14	26.29	1.34	5.25	30.23	73.16
Tub PVC 200-316	BP-335	189.664	BP-336	191.691	PVC	190.20	4.74	71.24	28.45	1.40	5.71	24.15	71.27
Tub PVC 200-317	BP-326	196.591	BR-93	196.567	PVC	190.20	1.50	4.07	5.90	0.57	1.01	15.89	4.07
Tub PVC 200-318	BP-334	189.525	BP-335	189.664	PVC	190.20	4.74	19.59	7.09	0.86	1.93	27.78	19.59
Tub PVC 200-319	BP-334	189.525	BE-156	189.413	PVC	190.20	4.74	14.79	7.57	0.88	2.04	45.49	14.79
Tub PVC 200-32	BE-268	197.090	BR-93	196.567	PVC	190.20	1.50	74.34	7.04	0.61	1.15	15.58	74.34
Tub PVC 200-320	BP-214	198.501	BR-321	200.362	PVC	190.20	1.50	26.24	70.91	1.37	6.89	23.34	26.31
Tub PVC 200-321	BP-224	193.905	BP-225	193.659	PVC	190.20	4.75	13.75	17.91	1.19	3.99	31.20	13.75
Tub PVC 200-322	BP-130	195.813	BP-224	193.905	PVC	190.20	4.75	22.46	84.93	2.06	13.37	22.10	22.54
Tub PVC 200-323(1)	BP-214	198.501	BP-214A	198.247	PVC	190.20	4.46	12.18	20.82	1.24	4.35	24.06	12.18
Tub PVC 200-323(2)	BP-214A	198.247	BP-130	196.690	PVC	190.20	4.46	47.21	32.99	1.45	6.24	23.09	47.27
Tub PVC 200-325	BP-214	198.501	BP-327	199.168	PVC	190.20	1.50	45.77	14.57	0.79	2.03	23.34	45.77
Tub PVC 200-326	BR-213	199.208	BP-327	199.168	PVC	190.20	1.50	4.45	9.00	0.67	1.40	15.18	4.45
Tub PVC 200-327	BP-330	198.351	BP-331	198.699	PVC	190.20	1.50	5.00	69.54	1.37	6.79	12.59	5.02
Tub PVC 200-328	BP-326	196.591	BP-94	196.889	PVC	190.20	1.50	40.11	7.43	0.62	1.20	15.48	40.11
Tub PVC 200-329	BP-330	198.351	BR-227	196.650	PVC	190.20	1.50	33.49	50.80	1.22	5.34	12.92	33.53
Tub PVC 200-33	BR-93	196.567	BR-101	196.442	PVC	190.20	1.50	17.12	7.30	0.62	1.19	15.49	17.12
Tub PVC 200-330	BP-95	197.311	BP-94	196.889	PVC	190.20	1.50	40.01	10.55	0.70	1.58	14.92	40.02
Tub PVC 200-331	BP-96	197.677	BP-95	197.311	PVC	190.20	1.50	40.55	9.02	0.67	1.40	15.17	40.56
Tub PVC 200-332	BE-186	195.640	BP-92	196.440	PVC	190.20	1.50	11.36	70.41	1.37	6.85	12.57	11.52
Tub PVC 200-333	BR-87	196.874	BP-323	196.840	PVC	190.20	1.50	3.27	10.40	0.70	1.56	14.93	3.27
Tub PVC 200-334	BR-125	200.569	BP-331	198.699	PVC	190.20	1.50	28.43	65.78	1.34	6.51	12.65	28.49
Tub PVC 200-335	BP-75	196.773	BP-74	197.033	PVC	190.20	1.50	44.70	5.82	0.57	1.00	15.92	44.70
Tub PVC 200-336	BE-267	197.080	BP-71	196.660	PVC	190.20	1.50	67.10	6.26	0.58	1.06	15.80	67.10
Tub PVC 200-337	BR-65*	197.319	BP-66	196.380	PVC	190.20	1.50	49.93	18.81	0.86	2.48	14.10	49.31
Tub PVC 200-338	BP-63	196.250	BP-62	195.900	PVC	190.20	1.50	55.55	6.30	0.59	1.06	17.39	55.56
Tub PVC 200-339	BR-128	196.249	BP-130	195.813	PVC	190.20	1.50	43.59	10.01	0.67	1.52	23.84	43.59
Tub PVC 200-34	BR-101	196.442	BR-102	196.260	PVC	190.20	1.50	30.99	5.87	0.59	1.00	15.89	30.99
Tub PVC 200-340	BP-333	193.614	BP-90	195.251	PVC	190.20	1.50	39.88	41.05	1.14	4.52	23.42	39.91
Tub PVC 200-341	BP-90	195.251	BP-89	196.259	PVC	190.20	1.50	54.27	18.57	0.86	2.46	14.13	54.28
Tub PVC 200-342	BP-89	196.259	BP-88	197.480	PVC	190.20	1.50	66.19	18.45	0.86	2.44	14.14	66.20

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**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-343	BE-85	197.822	BR-86	194.581	PVC	190.20	1.50	47.67	67.98	1.35	6.67	22.00	47.78
Tub PVC 200-344	BP-63*	196.730	BP-329	196.320	PVC	190.20	1.50	52.18	7.86	0.63	1.26	20.24	50.42
Tub PVC 200-345	BP-5	205.160	BP-13	204.324	PVC	190.20	1.50	17.49	47.80	1.19	5.09	17.10	17.51
Tub PVC 200-35	BR-102	196.260	BR-103	195.761	PVC	190.20	1.50	76.15	6.55	0.59	1.09	17.13	76.15
Tub PVC 200-36	BR-103	195.761	BR-104	195.410	PVC	190.20	1.54	54.01	6.50	0.60	1.10	15.95	54.02
Tub PVC 200-4	BP-61	195.710	BP-60	195.272	PVC	190.20	1.75	34.10	12.84	0.79	1.97	34.11	34.11
Tub PVC 200-42	BR-105*	197.971	BP-332	197.846	PVC	190.20	1.50	5.13	24.37	0.94	3.03	13.76	4.66
Tub PVC 200-56	BP-116	199.400	BP-117	198.969	PVC	190.20	1.50	45.33	9.51	0.68	1.46	15.09	45.33
Tub PVC 200-57	BP-117	198.969	BP-118	198.491	PVC	190.20	1.50	39.65	12.06	0.74	1.75	17.17	39.65
Tub PVC 200-58	BP-118	198.491	BR-181	196.693	PVC	190.20	1.56	32.58	55.19	1.27	5.79	13.07	32.63
Tub PVC 200-59	BP-122	198.071	BP-121	197.820	PVC	190.20	1.50	41.94	5.99	0.58	1.02	15.87	41.94
Tub PVC 200-60	BP-121	197.820	BR-181	197.193	PVC	190.20	1.50	42.97	14.59	0.79	2.03	14.45	42.99
Tub PVC 200-61	BR-181	196.693	BR-179	196.346	PVC	190.20	1.50	16.43	21.11	0.90	2.71	13.95	16.44
Tub PVC 200-63	BR-179	196.346	BP-177	195.768	PVC	190.20	1.50	41.32	13.98	0.78	1.96	25.24	41.33
Tub PVC 200-65	BE-180	197.976	BE-178	196.885	PVC	190.20	2.75	38.05	28.67	1.20	4.51	18.35	38.07
Tub PVC 200-66	BE-178	196.885	BR-176	196.295	PVC	190.20	2.75	22.38	26.36	1.16	4.23	18.50	22.41
Tub PVC 200-67	BP-13	204.324	BP-14	201.641	PVC	190.20	1.53	49.48	54.23	1.26	5.67	17.40	49.55
Tub PVC 200-68	BP-14	201.641	BP-15	200.190	PVC	190.20	1.61	28.69	50.58	1.24	5.49	13.37	28.72
Tub PVC 200-69	BE-229	196.530	BE-230	195.282	PVC	190.20	1.50	27.06	46.11	1.18	4.95	13.02	27.09
Tub PVC 200-7	BR-65	197.319	BR-57	196.520	PVC	190.20	1.50	75.95	10.52	0.70	1.58	14.93	75.98
Tub PVC 200-70	BE-230	195.282	BE-231	193.200	PVC	190.20	1.50	58.90	35.35	1.07	4.05	25.87	58.94
Tub PVC 200-71	BP-15	200.190	BR-15	200.146	PVC	190.20	1.61	4.01	10.96	0.73	1.68	17.69	4.01
Tub PVC 200-72	BP-211	187.690	BR-210	186.967	PVC	190.20	1.50	70.58	10.24	0.70	1.54	30.29	70.58
Tub PVC 200-73	BR-105	197.971	BR-106	196.350	PVC	190.20	1.50	56.12	28.89	1.00	3.45	13.55	56.21
Tub PVC 200-74	BP-107	197.470	BP-108	196.300	PVC	190.20	1.50	63.05	18.56	0.86	2.45	14.12	63.06
Tub PVC 200-75	BP-108	196.300	BR-108	196.270	PVC	190.20	1.50	2.97	10.09	0.69	1.53	15.00	3.43
Tub PVC 200-78	BR-15	200.146	BE-236	199.203	PVC	190.20	1.64	18.16	51.93	1.26	5.65	18.27	18.18
Tub PVC 200-8	BR-57	195.417	BR-56	195.000	PVC	190.20	1.50	48.15	8.66	0.66	1.36	34.10	48.15
Tub PVC 200-82	BR-114	193.884	BE-155	192.360	PVC	190.20	1.50	30.95	49.24	1.21	5.21	12.95	31.15
Tub PVC 200-83	BP-109	197.574	BR-110	196.726	PVC	190.20	1.50	48.16	17.61	0.84	2.35	14.19	48.17
Tub PVC 200-84	BR-110	196.726	BR-113	196.205	PVC	190.20	1.50	42.25	12.33	0.74	1.78	14.68	42.25
Tub PVC 200-85	BR-113	196.205	BE-154	194.620	PVC	190.20	1.50	31.48	50.35	1.22	5.30	12.93	31.89
Tub PVC 200-86	BE-201	187.100	BE-202	186.407	PVC	190.20	1.50	62.15	11.15	0.72	1.65	14.84	62.15
Tub PVC 200-87	BE-202	186.407	BE-160	186.189	PVC	190.20	1.50	46.72	4.67	0.53	0.84	16.33	46.72
Tub PVC 200-88	BE-160	186.189	BR-161	186.000	PVC	190.20	1.50	31.03	6.09	0.58	1.03	21.27	31.03

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**Alejandro Rojas Galluffi**  
INGENIERO SANITARIO  
REG. CIP. No. 21656

**NAZARIO CACERES OLIVERA**  
INGENIERO CIVIL  
Reg. CIP. No. 21805



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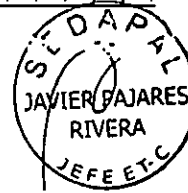
**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 200-89	BE-236	199.203	BR-21	198.717	PVC	190.20	1.82	48.17	10.09	0.73	1.66	20.97	48.17
Tub PVC 200-90	BE-195	196.774	BE-197	196.136	PVC	190.20	1.50	129.58	4.92	0.54	0.88	16.22	129.58
Tub PVC 200-91	BE-197	196.136	BE-198	195.720	PVC	190.20	1.50	8.21	50.64	1.22	5.33	12.92	9.48
Tub PVC 200-92	BE-190	197.228	BR-192	196.104	PVC	190.20	1.73	28.90	38.90	1.16	4.64	14.17	28.92
Tub PVC 200-95	BR-21	198.717	BE-237	198.225	PVC	190.20	2.75	47.88	10.28	0.83	2.03	24.88	47.88
Tub PVC 200-96	BR-192	196.104	BR-194	195.821	PVC	190.20	1.73	7.28	38.86	1.16	4.63	14.17	7.91
Tub PVC 200-97	BR-192*	196.104	BE-199	195.520	PVC	190.20	1.50	70.14	8.33	0.65	1.32	15.30	69.08
Tub PVC 200-98	BE-199	195.520	BE-200	194.647	PVC	190.20	1.50	61.79	14.13	0.78	1.98	14.48	61.79
Tub PVC 200-99	BE-200	194.647	BR-198	194.290	PVC	190.20	1.50	4.84	73.71	1.39	7.10	12.53	5.83
Tub PVC 250-10	BE-186	194.565	BE-187	193.619	PVC	237.60	6.42	62.01	15.25	1.20	3.86	22.35	62.02
Tub PVC 250-11	BE-187	193.619	BE-189	193.530	PVC	237.60	6.42	30.16	2.95	0.67	1.07	28.04	30.16
Tub PVC 250-12	BE-189	193.530	BR-194	193.012	PVC	237.60	7.54	61.88	8.37	1.02	2.60	30.83	61.88
Tub PVC 250-13	BR-194	193.012	BR-196	192.806	PVC	237.60	9.27	64.42	3.20	0.77	1.33	32.12	64.42
Tub PVC 250-14	BR-196	192.806	BR-198	192.390	PVC	237.60	9.27	63.92	6.51	0.99	2.33	29.46	63.94
Tub PVC 250-15	BE-231	193.200	BR-139	191.767	PVC	237.60	6.86	72.98	19.64	1.34	4.84	28.37	72.99
Tub PVC 250-16	BR-139	191.767	BE-171	190.808	PVC	237.60	7.41	49.53	19.32	1.36	4.95	29.38	49.64
Tub PVC 250-17	BE-171	190.808	BE-142	190.308	PVC	237.60	7.85	3.00	166.65	2.94	27.06	30.10	3.04
Tub PVC 250-18	BE-142	190.308	BR-145	188.678	PVC	237.60	8.13	48.27	33.77	1.70	7.96	30.95	48.30
Tub PVC 250-19	BR-145	188.678	BR-210	186.967	PVC	237.60	8.74	50.47	33.90	1.74	8.24	32.20	50.50
Tub PVC 250-2	BR-24	195.939	BR-39	195.720	PVC	237.60	13.80	13.69	16.00	1.53	5.60	32.85	13.69
Tub PVC 250-20	BR-210	186.967	BR-203	186.840	PVC	237.60	9.31	56.25	2.26	0.68	1.01	46.33	56.25
Tub PVC 250-23	BP-225	193.659	BR-226	193.490	PVC	237.60	5.74	56.85	2.97	0.65	1.03	26.12	56.85
Tub PVC 250-24	BR-226	193.490	BE-231	193.200	PVC	237.60	6.39	57.10	5.08	0.81	1.63	27.32	57.10
Tub PVC 250-25	BE-325	188.160	BE-326	188.000	PVC	237.60	1.53	7.96	20.11	0.86	2.51	13.65	7.96
Tub PVC 250-26	BE-327	189.137	BE-326	188.000	PVC	237.60	1.50	19.55	58.15	1.23	5.68	13.59	19.59
Tub PVC 250-27	BE-326	188.000	BE-328	187.570	PVC	237.60	1.87	64.63	6.65	0.62	1.17	14.61	64.63
Tub PVC 250-28	BE-328	187.570	BE-332	186.930	PVC	237.60	2.01	50.69	12.63	0.79	1.98	17.47	50.70
Tub PVC 250-29	BE-332	186.930	BR-161	186.590	PVC	237.60	3.63	48.31	7.04	0.77	1.64	18.20	48.32
Tub PVC 250-30	BR-320	186.040	BR-164	185.450	PVC	237.60	5.68	27.99	21.08	1.30	4.71	20.39	27.99
Tub PVC 250-31	BE-31*	198.862	BR-30	198.111	PVC	237.60	1.50	45.18	16.62	0.80	2.15	10.74	44.43
Tub PVC 250-32	BR-30	198.111	BR-29	197.809	PVC	237.60	1.50	44.93	6.72	0.58	1.07	16.77	44.93
Tub PVC 250-33	BR-29	197.809	BR-28	197.362	PVC	237.60	3.85	60.30	7.41	0.80	1.76	20.96	60.31
Tub PVC 250-34	BR-28	197.362	BR-27	196.963	PVC	237.60	4.04	60.04	6.65	0.78	1.65	23.07	60.04
Tub PVC 250-35	BR-27	196.963	BR-26	196.566	PVC	237.60	5.53	49.45	8.03	0.91	2.19	31.03	49.46
Tub PVC 250-36	BR-26	196.566	BR-25	196.333	PVC	237.60	12.00	61.47	3.79	0.87	1.70	37.30	61.47

**ALEJANDRO ROJAS GALLUFFI**  
 INGENIERO SANITARIO  
 REG. C.P. N° 21656

**NAZARIO CACERES OLIVE**

INGENIERO CIVIL  
 REG. C.P. N° 21305



**FlexTable: Conduit Table (Simulación Hidráulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 250-37	BR-25	196.333	BR-24	195.939	PVC	237.60	12.21	65.29	6.04	1.04	2.47	38.70	65.29
Tub PVC 250-38	BP-165	185.350	BR-164	185.450	PVC	237.60	5.68	23.68	4.22	0.73	1.35	31.09	23.68
Tub PVC 250-39	BE-79	195.675	BP-79	195.654	PVC	237.60	2.81	3.01	6.91	0.71	1.45	18.82	3.01
Tub PVC 250-4	BE-263	195.919	BE-79	195.675	PVC	237.60	2.81	48.65	5.02	0.64	1.13	16.64	48.65
Tub PVC 250-40	BP-79	195.654	BE-269	195.564	PVC	237.60	3.60	13.05	6.91	0.76	1.61	18.15	13.05
Tub PVC 250-5	BE-173	199.021	BE-174	197.053	PVC	237.60	1.60	25.28	77.85	1.39	7.32	13.57	25.35
Tub PVC 250-6	BE-174	197.053	BE-175	196.607	PVC	237.60	1.77	67.36	6.62	0.61	1.14	14.31	67.36
Tub PVC 250-7	BE-175	196.607	BR-176	195.815	PVC	237.60	1.96	69.90	11.33	0.76	1.81	19.03	69.91
Tub PVC 250-8(1)	BR-176	195.815	BP-177	195.768	PVC	237.60	4.88	3.27	14.30	1.08	3.25	25.08	3.28
Tub PVC 250-8(2)	BP-177	195.768	BE-185	195.116	PVC	237.60	6.37	45.61	14.30	1.17	3.66	26.96	45.61
Tub PVC 250-9	BE-185	195.116	BE-186	194.565	PVC	237.60	6.52	55.16	9.99	1.04	2.80	23.54	55.16
Tub PVC 315-1	BR-55	195.030	BR-56	195.000	PVC	299.60	15.72	5.50	5.46	1.05	2.46	32.07	5.50
Tub PVC 315-10	BR-150	193.565	BR-151	193.436	PVC	299.60	17.42	60.11	2.15	0.78	1.23	34.43	60.11
Tub PVC 315-11	BR-151	193.436	BR-152	193.227	PVC	299.60	17.42	50.51	4.14	0.98	2.07	31.63	50.51
Tub PVC 315-12	BR-152	193.227	BR-153	192.617	PVC	299.60	17.42	69.46	8.78	1.29	3.74	29.02	69.46
Tub PVC 315-13	BR-153	192.617	BR-157	190.642	PVC	299.60	17.42	79.91	24.71	1.85	8.40	26.23	79.94
Tub PVC 315-14	BR-157	190.642	BR-158	187.584	PVC	299.60	17.42	50.94	60.03	2.54	16.74	24.36	51.03
Tub PVC 315-15	BR-158	187.584	BE-159	186.875	PVC	299.60	17.42	63.91	11.09	1.40	4.49	34.68	63.91
Tub PVC 315-16	BR-104	194.912	BR-106	194.697	PVC	299.60	5.35	49.89	4.31	0.71	1.28	18.35	49.89
Tub PVC 315-17	BR-106	194.697	BR-108	194.598	PVC	299.60	5.52	24.22	4.09	0.70	1.24	18.78	24.22
Tub PVC 315-18	BR-108	194.598	BR-198	194.140	PVC	299.60	5.84	55.42	8.26	0.91	2.20	16.84	55.51
Tub PVC 315-19	BE-269	195.564	BE-270	195.325	PVC	299.60	3.67	27.89	8.57	0.80	1.84	15.19	27.89
Tub PVC 315-2	BR-56	195.000	BR-68	194.767	PVC	299.60	16.57	48.07	4.85	1.03	2.30	32.61	48.07
Tub PVC 315-20	BE-270	195.325	BE-271	195.121	PVC	299.60	3.83	44.31	4.60	0.66	1.16	15.47	44.31
Tub PVC 315-21	BE-271	195.121	BR-104	194.912	PVC	299.60	3.93	47.76	4.38	0.65	1.12	16.88	47.76
Tub PVC 315-22	BR-198	191.401	BE-154	191.098	PVC	299.60	16.00	48.22	6.28	1.11	2.77	32.43	48.22
Tub PVC 315-23	BE-154	191.098	BE-155	190.370	PVC	299.60	16.99	48.01	15.16	1.55	5.67	33.38	48.02
Tub PVC 315-24	BE-155	190.370	BE-156	189.413	PVC	299.60	17.91	40.09	23.87	1.85	8.27	36.07	40.10
Tub PVC 315-25	BE-156	189.413	BR-203	187.570	PVC	299.60	22.72	32.42	56.85	2.69	18.05	28.01	32.52
Tub PVC 315-26	BR-203	186.840	BE-204	186.455	PVC	299.60	32.03	39.78	9.68	1.59	5.24	39.36	39.78
Tub PVC 315-27	BE-204	186.455	BE-205	185.991	PVC	299.60	32.03	86.34	5.37	1.28	3.29	53.78	86.34
Tub PVC 315-28	BE-205	185.991	BE-206	185.924	PVC	299.60	32.03	66.21	1.01	0.68	0.84	53.78	66.21
Tub PVC 315-29	BE-206	185.924	BE-207	185.723	PVC	299.60	32.03	66.34	3.03	1.04	2.08	45.47	66.34
Tub PVC 315-3(1)	BR-68	194.767	BP-324	194.757	PVC	299.60	16.79	2.00	5.13	1.05	2.41	33.46	2.00
Tub PVC 315-3(2)	BP-324	194.757	BR-54	194.521	PVC	299.60	18.29	45.97	5.13	1.08	2.50	31.61	45.97



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 Reg. Cip. No. 21806



**FlexTable: Conduit Table (Simulación Hidraulica Sistema A Cambiar)**

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub PVC 315-30	BE-207	185.723	BE-208	185.575	PVC	299.60	32.03	36.64	4.04	1.15	2.61	43.71	36.64
Tub PVC 315-31	BE-208	185.575	BE-209	184.930	PVC	299.60	32.03	40.57	15.90	1.89	7.75	37.38	40.58
Tub PVC 315-32	BE-209	184.930	BE-170	184.850	PVC	299.60	32.03	12.64	6.33	1.36	3.74	41.47	12.69
Tub PVC 315-33	BR-161	186.000	BR-162	185.820	PVC	299.60	4.26	49.56	3.63	0.62	1.01	16.81	49.56
Tub PVC 315-34	BR-162	185.820	BR-163	185.580	PVC	299.60	4.89	70.72	3.39	0.63	1.02	19.77	70.72
Tub PVC 315-35	BR-163	185.580	BP-165	185.350	PVC	299.60	7.84	24.68	9.32	1.04	2.76	25.71	24.68
Tub PVC 315-38	BR-39	195.720	BP-60	195.272	PVC	299.60	13.98	51.33	8.73	1.20	3.38	30.71	51.33
Tub PVC 315-39	BP-60	195.272	BR-58	195.110	PVC	299.60	15.72	19.13	8.47	1.23	3.47	33.52	19.13
Tub PVC 315-4	BR-54	194.521	BR-67	194.338	PVC	299.60	17.42	3.40	53.90	2.44	15.39	35.23	3.40
Tub PVC 315-40	BR-58	195.110	BR-55	195.030	PVC	299.60	15.72	45.18	1.77	0.70	1.01	33.52	45.18
Tub PVC 315-41	BP-165	185.350	BR-168	185.300	PVC	299.60	13.53	5.95	8.41	1.18	3.24	36.33	5.95
Tub PVC 315-5	BR-67	194.338	BR-146	194.290	PVC	299.60	17.42	26.44	1.82	0.73	1.08	37.39	26.44
Tub PVC 315-6	BR-146	194.290	BR-147	194.150	PVC	299.60	17.42	81.36	1.72	0.72	1.03	36.74	81.36
Tub PVC 315-7	BR-147	194.150	BP-148	194.020	PVC	299.60	17.42	62.59	2.08	0.77	1.20	34.59	62.59
Tub PVC 315-8	BP-148	194.020	BR-149	193.700	PVC	299.60	17.42	75.20	4.26	0.99	2.12	35.59	75.20
Tub PVC 315-9	BR-149	193.700	BR-150	193.565	PVC	299.60	17.42	79.80	1.69	0.71	1.02	36.67	79.80
Tub PVC 355-1	BE-159	186.875	BR-166	186.745	PVC	337.60	17.42	76.80	1.69	0.71	1.01	30.27	76.80
Tub PVC 355-2	BR-166	186.745	BR-167	186.401	PVC	337.60	17.42	62.00	5.55	1.08	2.56	26.09	62.00
Tub PVC 355-3	BR-167	186.401	BR-168	186.146	PVC	337.60	17.42	82.32	3.10	0.88	1.62	27.97	82.32
Tub PVC 355-4	BR-168	185.300	BE-170	184.850	PVC	337.60	30.94	70.36	6.40	1.34	3.67	34.50	70.37
Tub PVC 450-1	BE-342	188.609	BE-344	187.702	PVC	426.00	87.69	7.64	118.64	4.98	54.63	100.00	7.70
Tub PVC 450-2	BE-289	189.421	BE-291	189.072	PVC	426.00	87.10	79.40	4.40	1.53	4.08	45.42	79.40
Tub PVC 450-3	BE-291	189.072	BE-342	188.609	PVC	426.00	87.10	42.71	10.84	2.12	8.36	48.87	42.72



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