ANNEX-42

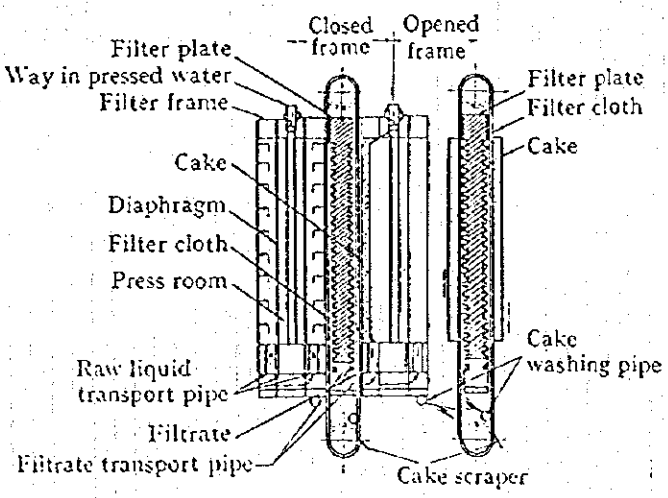
WATER QUALITY IMPROVEMENT

CONTENTS OF ANNEX-42

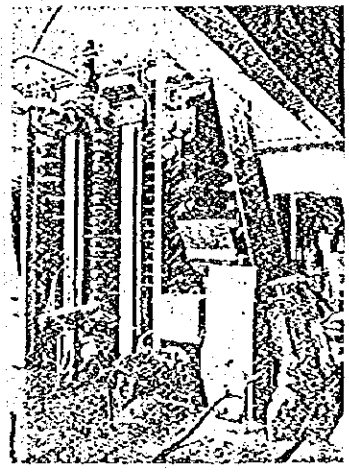
BAKU MUTU LIMBAH CAIR INDUSTRI/PERUSAHAAN/BADAN DI DAERAH KHUSUS IBUKOTA JAKARTA

No.	Parameter	Parameter	Satuan	BAKU MUTU
	A.FISIKA	A.Physical		
1	Suhu	Temperature	C	38
2	Zat padat terlarut(TDS)	Total disolve solid	mg/L	1000
3	Zat padat tersuspensi(SS)	Suspended solid	mg/L	100
	B.KIMIA	B.Chemical		
1	Air raksa	Mercury	mg/L	0.002
2	Amonia	NH4-N	mg-N/L	5.0
3	Arsen	As	mg/L	0.1
4	Besi	Fe	mg/L	5.0
5	Flourida	F	mg/L	2.0
6	Kadmium	Cd	mg/L	0.05
7	Khlorin bebas	CL2	mg-CL2/L	1.0
8	Krom(total)	Cr	mg/L	0.5
9	Kromium heksavalen	Cr-6	mg-Cr6+/L	0.1
10	Nikel	Ni	mg/L	0.1
11	Nitrat,sebagai N	NO3	mg-N/L	10
12	Nitrit,sebagai N	NO2	mg-N/L	1.0
13	pH	pH		6-9
14	Seng	Zn	mg/L	2.0
15	Sulfida,sebagai H2S	H2S	mg-S/L	0.05
16	Tembaga	Cu	mg/L	1.0
17	Timbal	Pb	mg/L	0.1
18	Mangan	Mn	mg/L	2.0
19	Fenol		mg/L	0.5
20	Minyak dan Lemak		mg/L	5.0
21	Senyawa Aktif Biru Metilen		mg/L	1.0
22	Sianida	SN	mg/L	0.05
23	Zat Organik(KMnO4)		mg/L	85.0
24	BOD		mg/L	75.0
25	COD(Bichromat)		mg/L	100

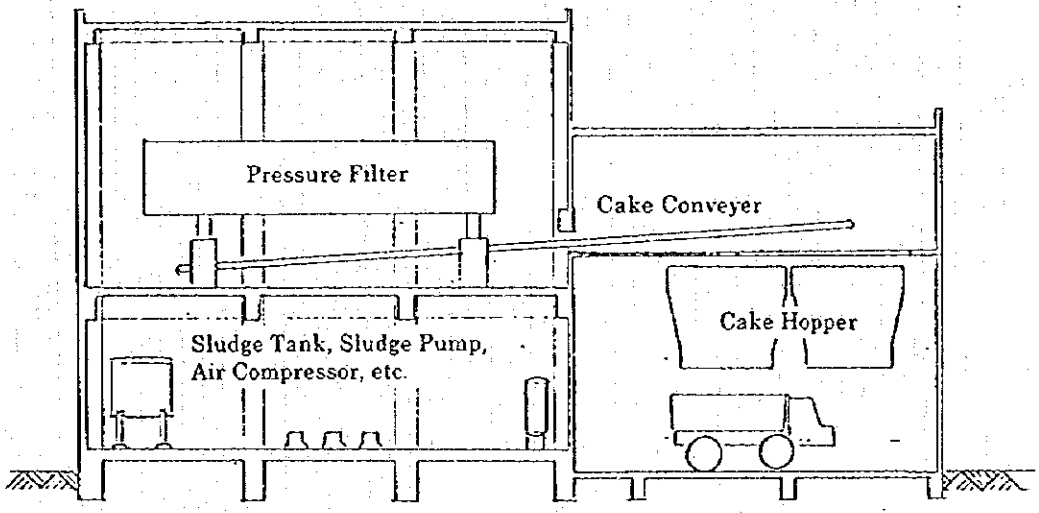
Lampiran V:Keputusan Gubernur KDKI Jakarta
Nomor:582 Tahun 1995
Tanggal:12Juli1995



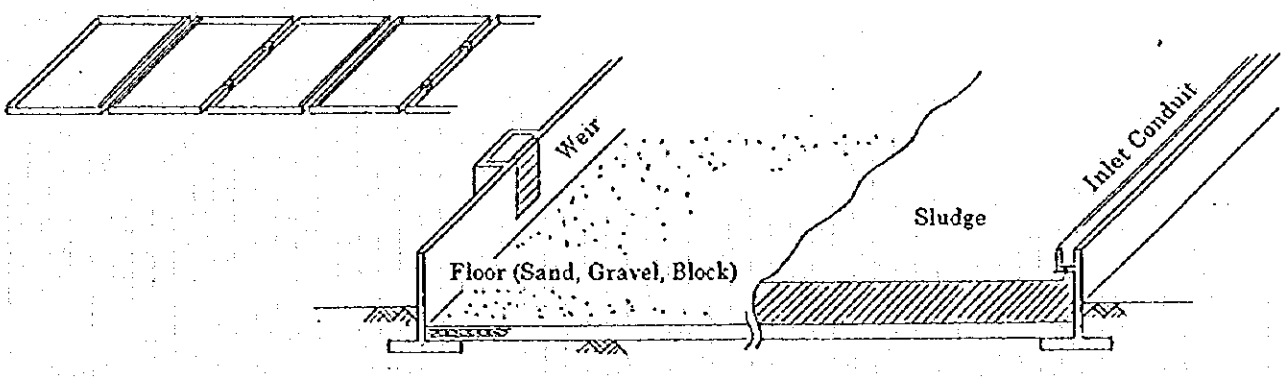
Structure of Pressure Filter



Example of Pressure Filter(Vertical Type)



Example of Sludge Treatment System by Pressure Filter

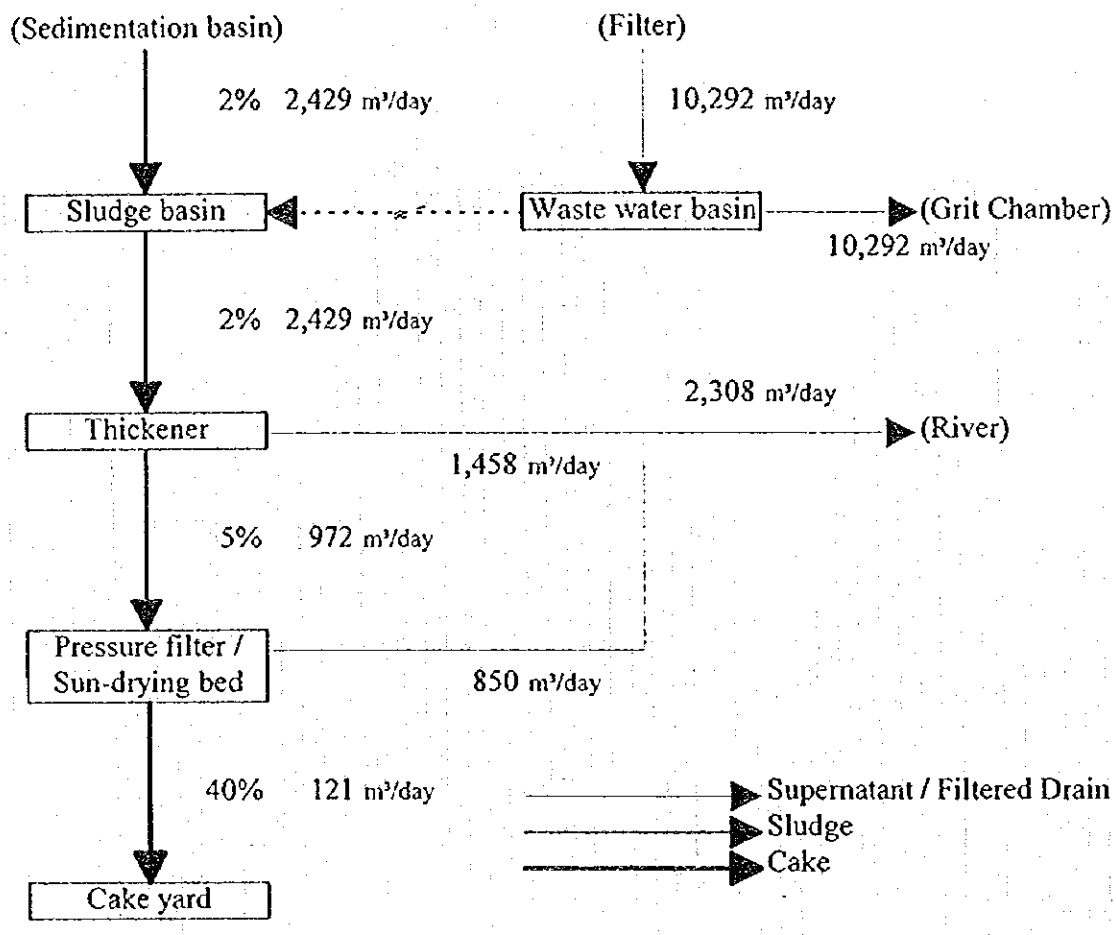


Example of Sun-drying Bed

Examples of Sludge Treatment

COMPARISON OF SLUDGE TREATMENT SYSTEM

Flow of Sludge



Capacity of Sludge Treatment Facilities

Sludge volume

Item	Turgidity (NTU)	Alum Dosage (mg/l)	Dry Solid (ton/day)	Sludge(m³/day) 1%	2%	3%	5%	10%	40%
Max(95%)	300	46	179	17,944	8,972	5,981	3,589	1,794	449
Average	80	25	49	4,858	2,429	1,619	972	486	121

*1NTU = (SS)1.3mg/l
*5.25m³/sec = 453,600m³/day
*Alum : Liquid Alum,Al2O3 8%
*Dosage rate = 3.6059 * T^0.4455

Sludge basin

Number	2 unit
W	10 m
L	25 m
H	5 m
Volume	1,250 m³
Total volume	2,500 m³

	Detention time (hr)
Max(5%)	0.7
Average(2%)	1.0

Thickener

Number	4 unit
W	18 m
L	18 m
H	5 m
Volume	1,620 m³
Surface area	324 m²
Total volume	6,480 m³
Total area	1,296 m²

	Load (kg/m²/day)	Velocity (cm/min)	Detention time (hr)
Max(5%)	138	0.19	43
Average(2%)	37	0.13	64

Sun-drying bed

Number	60 unit
W	20 m
L	50 m
H	1.5 m
Volume	1,500 m³
Surface area	1,000 m²
Total volume	90,000 m³
Total area	60,000 m²

	Load (kg/m²/year)	Detention time (day)
Average(5%)	296	93

Press Filter

Number	8 unit
Area	500 m²
Total area	4,000 m²
Cycle	2 c/day

	Load (kg/m²/c)
Average(5%)	6.1

Comparison of Construction Cost

Sun-drying bed

Bed	Unit cost		132	*1,000Rp/m²
	Area		60,000	m²
	Cost		7,920,000	*1,000Rp
Land	Unit cost		800	*1,000Rp/m²
	Area	Bed*1.2	72,000	m²
	Cost		57,600,000	*1,000Rp
Total			65,520,000	*1,000Rp

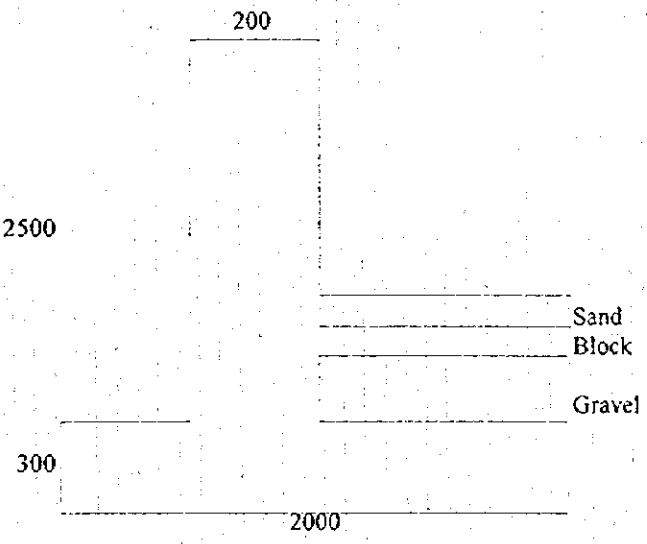
Press filter

Building			8,180,000	*1,000Rp
Filter			35,800,000	*1,000Rp
Electrical equipment			9,770,000	*1,000Rp
	Sub total		53,750,000	*1,000Rp
Land	Unit cost		800	*1,000Rp/m²
	Area	70*50	3,500	m²
	Cost		2,800,000	*1,000Rp
Total			56,550,000	*1,000Rp

***) Land cost by which each plan cost is same**

669 *1,000Rp/m²

Unit Cost of Sun-drying bed



Bed	Gravel	20 cm	35,000 Rp/m³	7,000 Rp/m²
	Concrete sand	10 cm	40,000 Rp/m³	4,000 Rp/m²
	Block		10,000 Rp/m²	10,000 Rp/m²
				21,000 Rp/m²
Wall	Concrete	1.1 m³/m	150,000 Rp/m³	165,000 Rp/m
(20m*50m)	Reinforcement	110 kg/m	1,800 Rp/kg	198,000 Rp/m
	Form	9.6 m²/m	12,000 Rp/m²	115,200 Rp/m
				478,200 Rp/m
				66,948 Rp/m²
Bed-total				87,948 Rp/m²
Others	Bed-total * 50%			43,974 Rp/m²
Total				131,922 Rp/m²
				132,000 Rp/m²

Cost of Press filter

		*1000Rp
Building		8,180,000
	Architecture	5,900,000
	Mechanical equipm	200,000
	Electrical equipmen	390,000
	General expenses	1,690,000
Filter		35,800,000
	Equipment	26,810,000
	Piping & Laying	5,440,000
	General expenses	3,550,000
Electrical equipment		9,770,000
	Equipment	8,070,000
	Laying	810,000
	General expenses	890,000
Total		**53,750,000**

ANNEX-43

STUDY AND PRELIMINARY DESIGN OF RAW WATER TRANSMISSION FROM BEKASI TO NEW EAST TREATMENT PLANT

THE STUDY ON THE REVISE OF THE JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

STUDY AND PRELIMINARY DESIGN OF RAW WATER TRANSMISSION FROM BEKASI TO NEW EAST TREATMENT PLANT

Table of Contents

THE STUDY ON THE REVISE OF THE JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

STUDY AND PRELIMINARY DESIGN OF RAW WATER TRANSMISSION FROM BEKASI TO NEW EAST TREATMENT PLANT

1. Introduction

Purpose of this paper is to describe the results of the studies and preliminary design on raw water transmission pipeline from Silt Trap at Bekasi, just downstream of the Bekasi Weir, to the location of the New East Treatment Plant at Cipayung.

Supplemental data and information relating raw water resources development and future water supply facilities, it is recommended to refer **Chapter 2 "Raw Water Resources"**, **Chapter 3 "Revised Alternative Studies on water Supply Facilities"** and **Chapter 5 "Alternative Study of Water Supply Facilities for the Feasibility Study"**.

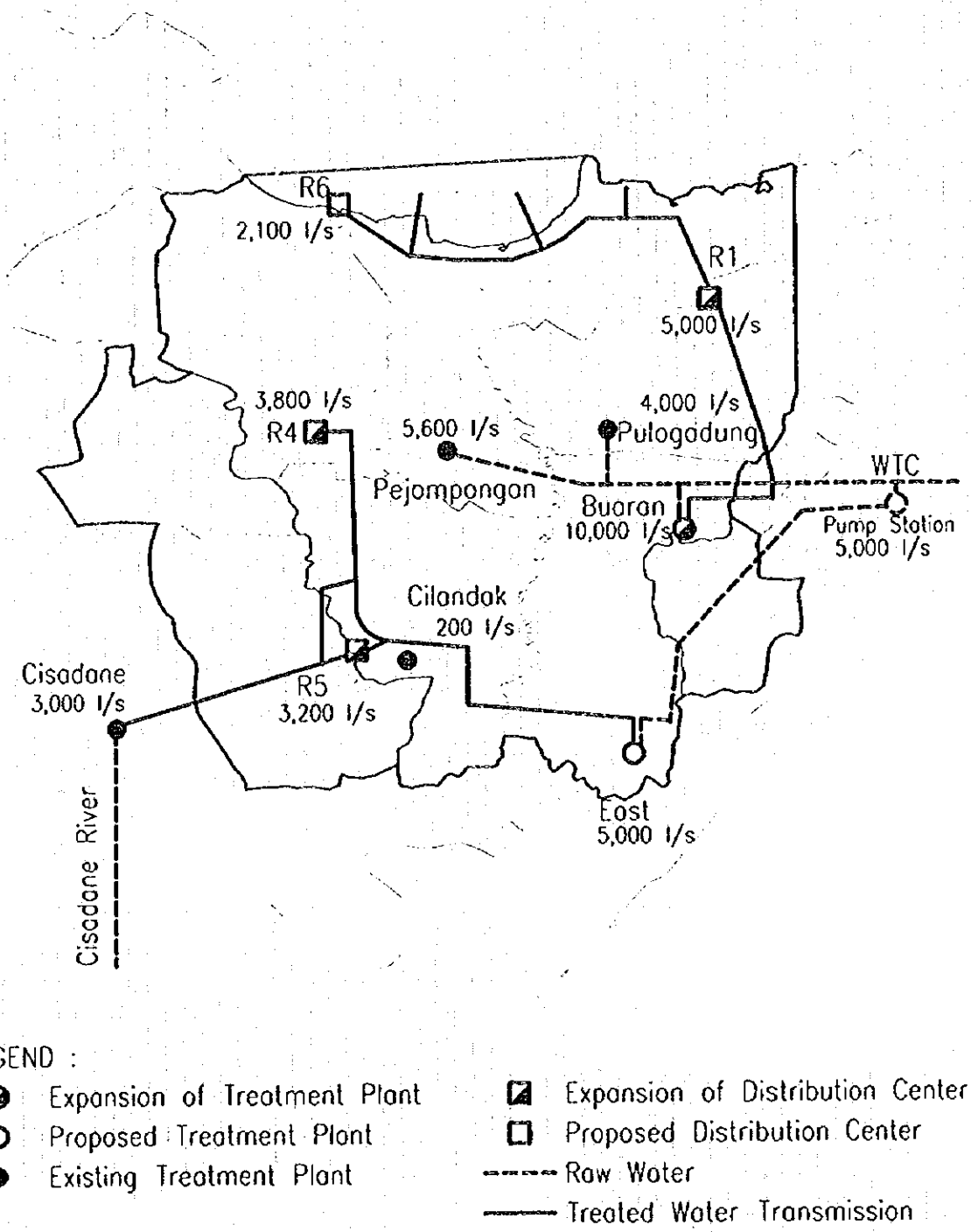
Raw water for Part One Project, expansion of the existing Buaran Treatment Plant, will be supplied from WTC directly through upgraded canal.

For the Part Two Project, construction of New East Treatment Plant at Cipayung, hereinafter refereed to as Cipayung Treatment Plant, will receive raw water also from WTC. To convey raw water from WTC to Cipayung in amount of 5 m3/sec, it is necessary to install raw water transmission pipeline.

In this paper, the raw water transmission pipeline for Part Two Project is studied and the results of the study is explained hereunder.

Water supply facilities required for the Part Two Project are shown on **Figure 1.1**.

Figure 1.1 **FUTURE WATER SUPPLY SYSTEM IN 2008**
PART TWO PROJECT



2. Location of Raw Water Intake Pump Station

To convey raw water from WTC of which ground level is 18 m in average around Bekasi to the Cipayung Treatment Plant of which ground level is about 65 m, raw water pump station will be necessary along the WTC.

Land space required for the raw water pump station will be about 4,500 m2. For the selection of the location of the raw water pump station, following points were considered.

- Minimize length of raw water transmission
- Good access to the high way, because it will be very difficult to install huge raw water transmission along the heavy traffic local road. The pipe will be installed along the high way as much as possible.

Taking account of points listed above, possible location will be around Bekasi Weir or between Buaran Treatment Plant and Bekasi Weir. Two alternative location was selected through site investigation in the area, namely at Jakasampruna or at Silt Trap.

All other possible location for the raw water pump station around the Bekasi Weir has been investigated and it was found that these area have been developed such as construction of housing estates or huge shopping center annexed by luxury hotel.

Advantages and disadvantages of two alternative locations mentioned above are as follows.

At Jakasampruna

Advantages

- Location is very near from WTC
- Land space is available
- Good access to highway

Disadvantages

- Additional raw water transmission from the upstream of WTC will be required
- Land acquisition cost will be expensive

At Silt Trap

Silt trap at the Bekasi Weir was constructed to remove suspended solid contained in raw water mainly entered from Bekasi River after confluence of WTC and Bekasi River. According to the plan of upgrading WTC in terms of water quality and quantity, WTC will be isolated from Bekasi River in near future. In this case, role of the Silt Trap will not be expected any more. Therefore, construction of raw water pump station will be possible at the Silt Trap by backfilling the Trap.

Advantages

- Direct intake from WTC will be possible
- Good access to the highway
- No land acquisition cost will be required

Disadvantages

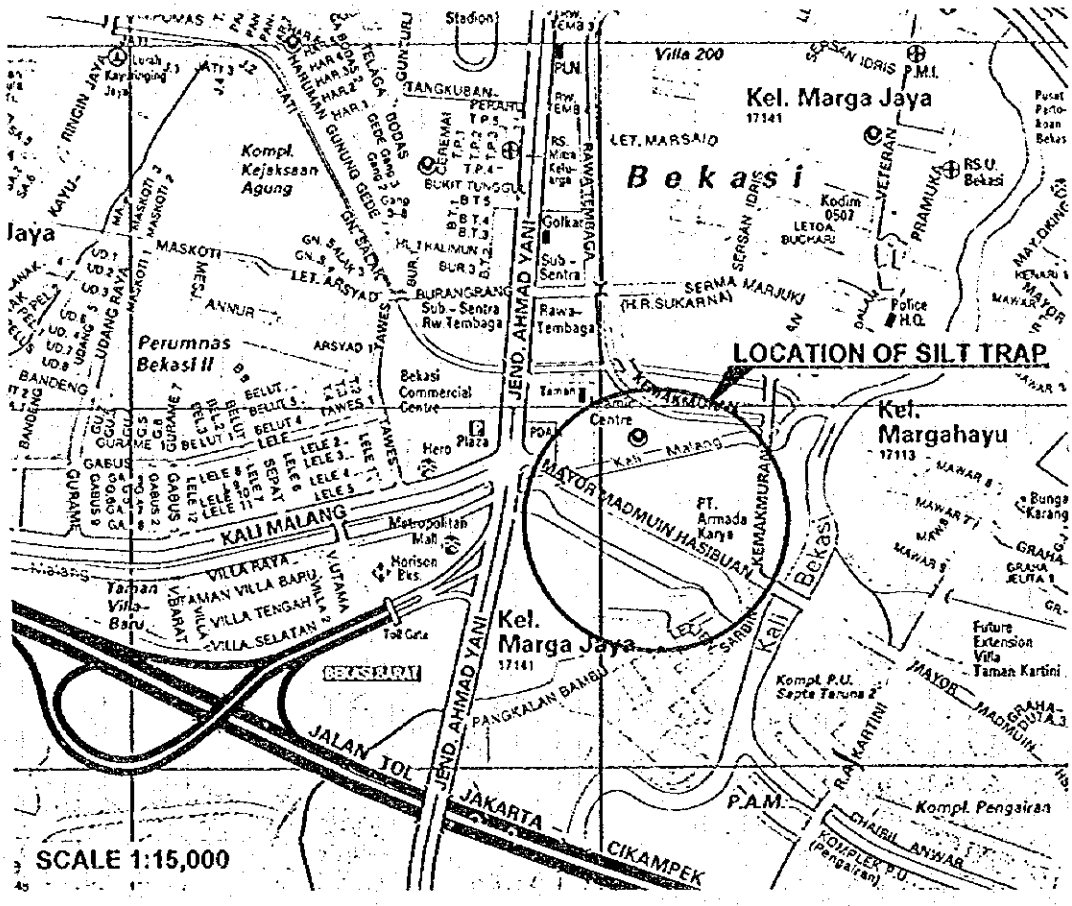
- Construction works will be rather complicated
- High trubidity water will be produced during construction works

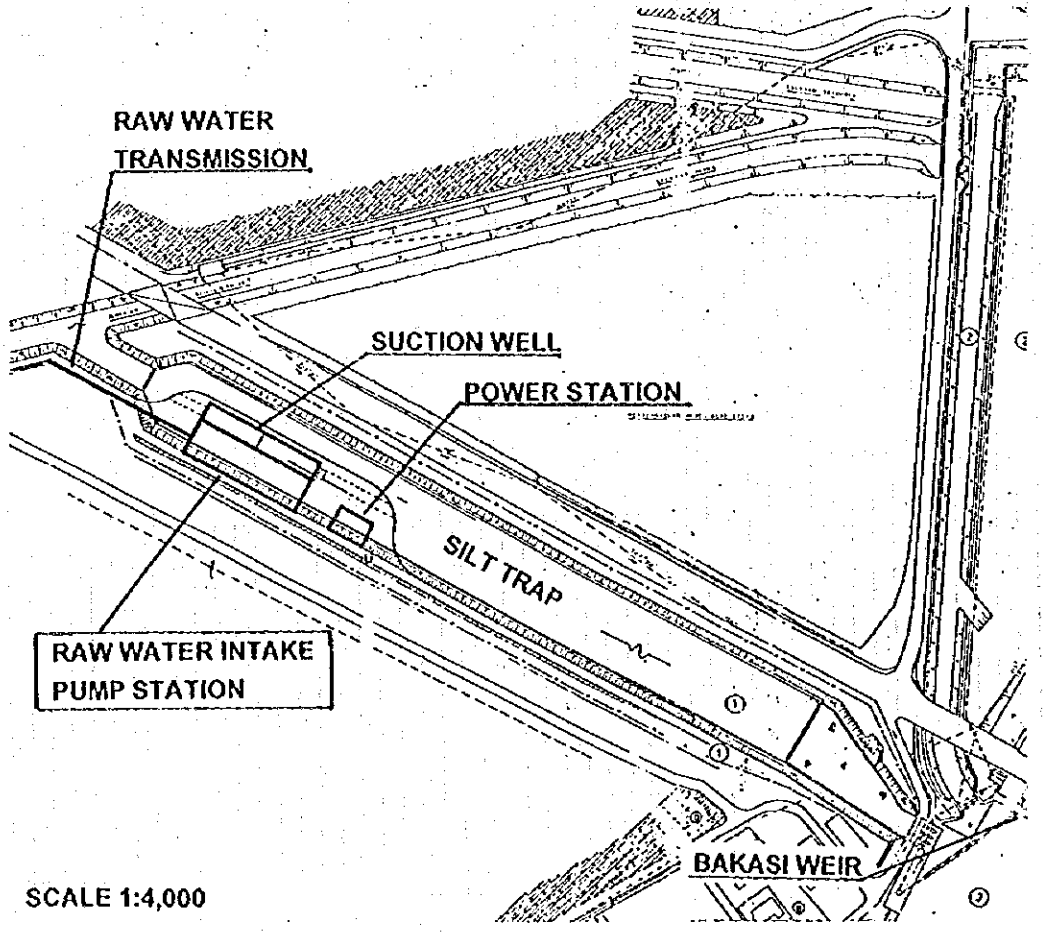
For Jakasampruna case, total length of raw water transmission will be almost same as the another alternative "At Silt Trap". The case of the "At Silt Trap" has great advantages that the land acquisition will not be necessary, in other words, land acquisition cost will not be required.

From the deep consideration of facts found and conditions observed along the WTC, it is finally recommended to construct at the Silt Trap.

Location of the Silt Trap and plan of Silt Trap including the Bekasi Weir are shown on **Figure 2.1**.

Figure 2.1 LOCATION OF RAW WATER PUMP STATION





3. Preliminary Design of Raw Water Transmission Pipeline

3.1 Proposed Pipe Alignment

Proposed route of the raw water transmission pipeline from the Silt Trap to Cipayung Treatment Plant is studied. There are some possible routes, such as along the Jl. Jaka Setia or local road through east side of Kecamatan Jatiasih.

Site investigation along the proposed routes had been conducted and it was found that the local roads mentioned above are too narrow to install large diameter raw water transmission.

Considering these conditions of the local roads, it is recommended to install raw water transmission pipeline along the highway. From the Silt Trap to Cikunir, pipe may be installed along Jakarta-Cikampek Highway. From Cikunir to Pondok Gede, pipe may be installed along planned Outer Ring Highway. From Pondok Gede to Cipayung Treatment Plant, pipe will be installed along Jl. Hnkam Raya.

Proposed route and longitudinal section of raw water transmission pipeline are as shown on **Figures 3.1** and **3.2**, respectively.

3.2 Dimension of Raw Water Transmission Pipeline

Dimensions of raw water transmission pipeline are calculated based on the conditions as follows.

Actual Head : (Difference of Low Water Level at Silt Trap and High Water Level at Cipayung)	53.5 m
Amount of raw water to be transmitted : (Including 5% of treatment loss)	5.25 m3/sec
C-value :	120

Economical diameter which will be minimum diameter for minimum energy cost was calculated as Dia. 1,800 mm. In this case, water head loss will be 32.2 m and total head loss therefore will be 85.7 m (53.5 m + 32.2 m).

To avoid extremely high pressure, it is recommended to boost the raw water pressure on the way to Cipayung at Pondok Gede. Location of the Booster Pump Station is shown on **Figures 3.1** and **3.2**.

Summary of the results of the calculation are shown on **Table 3.1**.

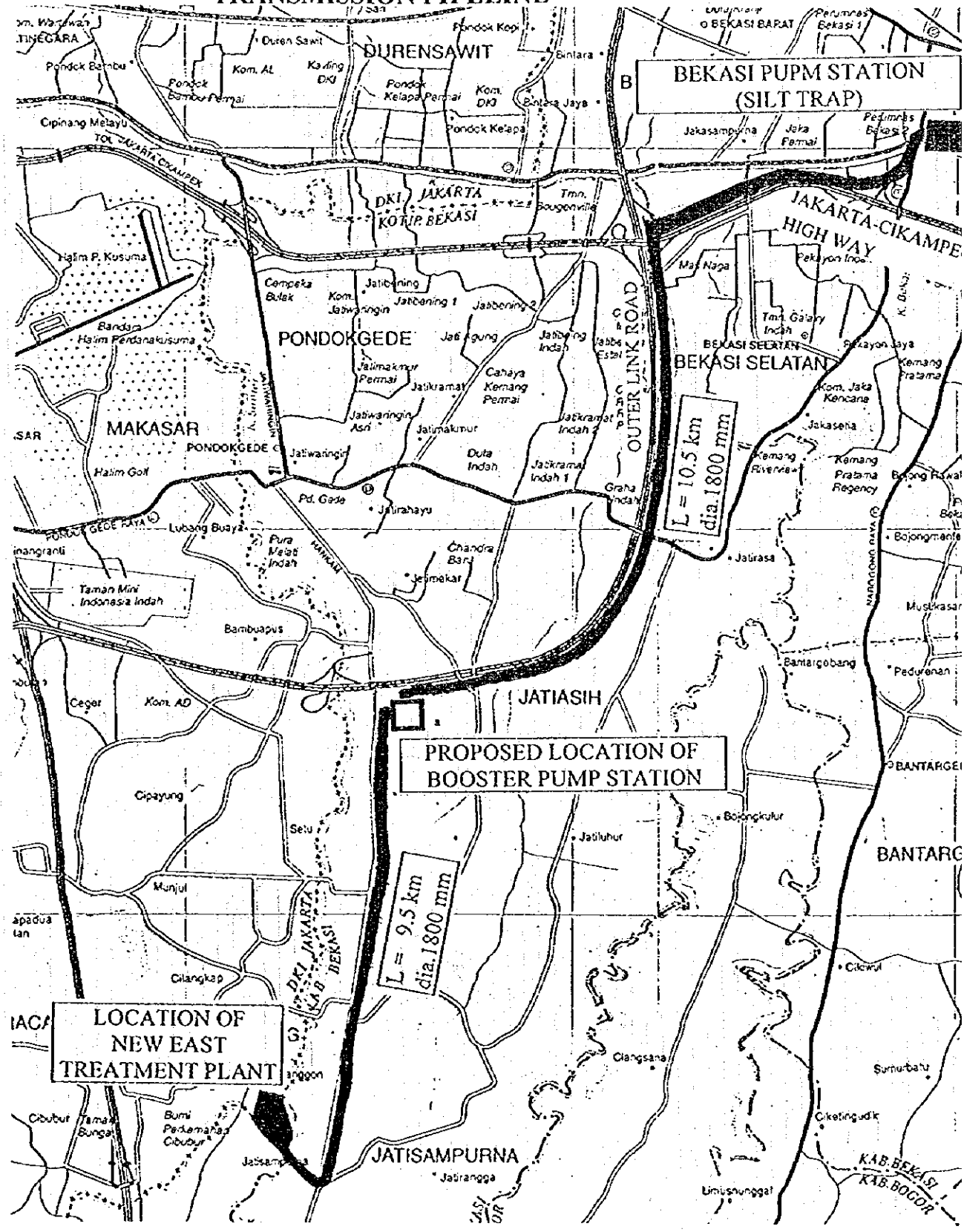
Table 3.1 SUMMARY OF RESULTS OF CALCULATION - RAW WATER TRANSMISSION

	Silt Trap to Booster P. S.	Booster P. S. to Cipayung
Length (km)	10.5	9.5
Flow Rate (m3/sec)	5.25	5.25
Diameter (mm)	1,800	1,800
C value	120	120
Water Head Loss in pipe (m)	19.6	17.7
Flow Velocity (m/sec)	2.06	2.06

	Intake at Silt Trap	Booster P. S.	Cipayung
H. W. Level (m)	18.5	40.0	67.0
L. W. Level (m)	-	35.0	-
Pump Head Required (m)	45.0	53.0	-
Ground Elevation (m)	18.0	38.0	65.0

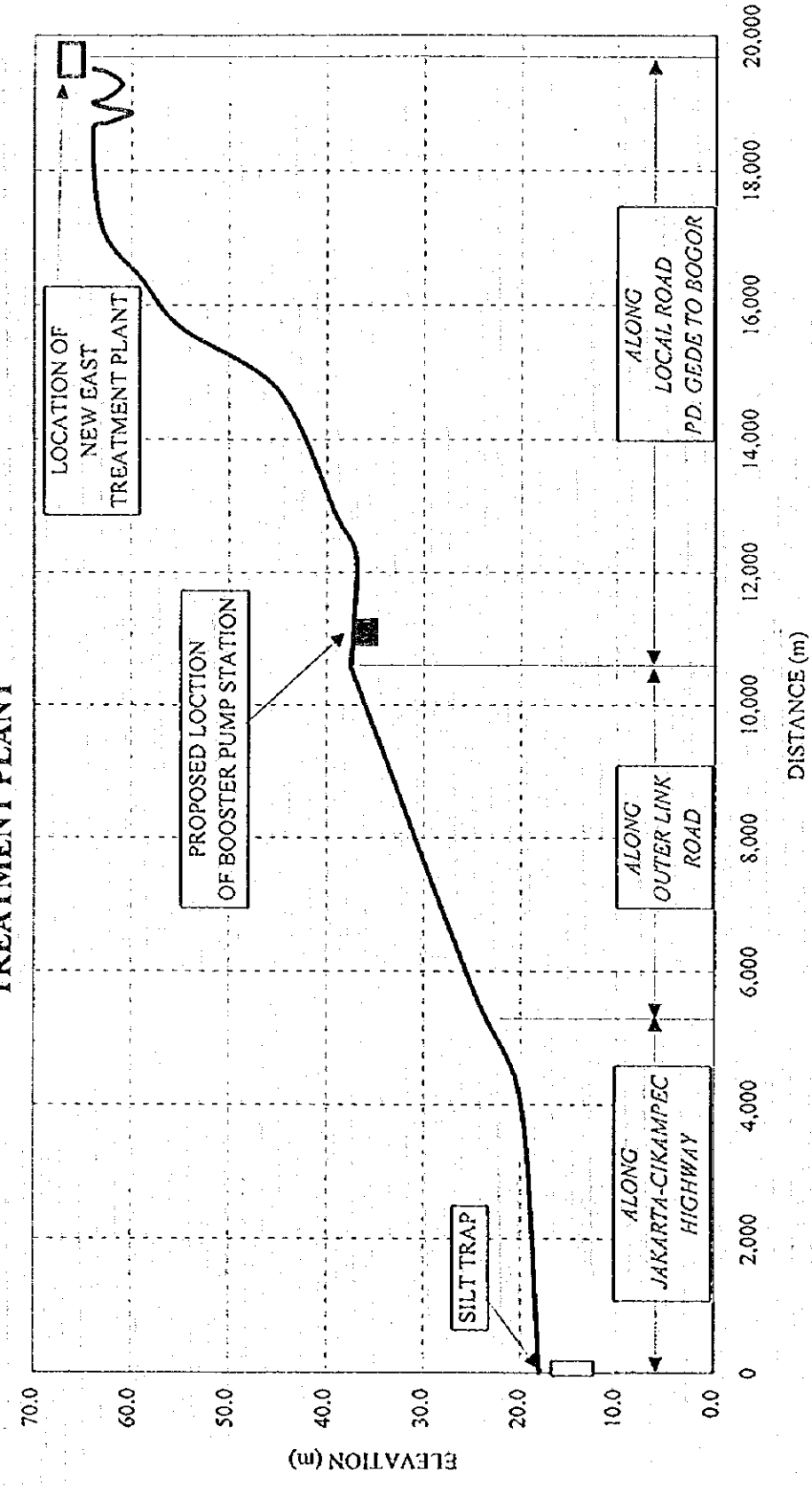
BOOSTER P. S. : Booster Pump Station
H. W. : High Water
L. W. : Low Water

Figure 3.1 PROPOSED ALIGNMENT OF RAW WATER TRANSMISSION PIPELINE



RAWLONG. XLS

Figure 3.2 LONGITUDINAL SECTION OF RAW WATER TRANSMISSION FROM SILT TRAP TO CIPAYUNG TREATMENT PLANT



3.3 Pump Facilities Required

Pump facilities required for raw water intake pump station at the Silt Trap and at Booster Pump Station are studied hereinunder.

(1) Raw Water Intake Pump Station

Intake Well : 1,600 m3 (400 m2 x 4.0 m depth)
Pump Building
Pumps : 5 units (1 unit Stand-by)
Q 79 m3/min x H 47 m x P 780 KW x 5 units
Power Receiving Facilities

(2) Booster Pump Station

Raw Water Reservoir : 18,900 m3 (4,725 m2 x 4.0 m depth)
Pump Building
Pumps : 5 units (1 unit Stand-by)
Q 79 m3/min x H 50 m x P 850 KW x 5 units
Power Receiving Facilities

4. Cost Estimation

4.1 Raw Water Transmission Pipeline, Diameter 1,800 mm

Cost required for the raw water transmission pipeline was calculated as shown on the **Table 4.1**.

Table 4.1 COST REQUIRED FOR RAW WATER TRANSMISSION PIPELINE

	Length (km)	Unit Cost	Cost	Cost Equivalent Million Yen
Material Cost	20.0	283 Million Yen	5,660 Million Yen	5,660
Civil Cost	20.0	1,082 Million Rp.	21,640 Million Rp.	962
Total Cost				6,622

Note : Costs shown above was estimated based on 1996 price. Inland transportation cost, price escalation, value added tax and other additional costs are not included.

ANNEX-44

ALTERNATIVE FOR FLOCCULATION AND SEDIMENTATION

CONTENTS OF ANNEX-44

1. Design Criteria

Various alternative method or system will be available for flocculation and sedimentation basin. These basins are discussed hereunder based on the horizontal shaft flocculator for flocculation basin and tube settler type for sedimentation basin as an alternative method.

(1) Flocculation Basin

Flocculation basin should be consisted of 3 to 4 stages to avoid short-cut flow. Each stage should be separated by the perforated wall. Mixing intensity should be reduced from upstream to downstream accordingly. Each stage should be equipped with suitable desludging facility.

Compartment :	more than 3 stages
G-Value :	40 sec^{-1} in average, range 80 - 10 sec^{-1}
GT-Value :	about 50,000
Detention time :	about 20 minutes

(2) Sedimentation Basin

To increase overflow rate, it is recommend to install tube settler in the upflow type sedimentation basin. Sufficient depth will be required under the tube settler for easy maintenance works and to reserve excess sludge temporarily during high turbidity period. Detention time of the sedimentation basin should be one (1) hour at least to have time allowance for raw water quality accident.

Overflow rate (upflow rate) : 4 m/hour

Hopper type desludging system is recommended for easy maintenance instead of mechanical type desludging system such as link-belt type.

In the case that other alternative type is employed for sedimentation basin other than the upflow type, type, capacity, structure and dimension of the sedimentation basin should be carefully designed in order to achieve same or better performance than the upflow type.

2. Required Facilities

Flocculation Basin

Type : Stirring by horizontal type flocculator

Numbers of units		16	units
Flow Rate		19.7	m^3/min/unit
Compartments		4	
Width	10.0	m	
Length	3.0	m	
Depth	3.5	m	
Volume	105	m^3	
Detention time		21	min
Mixing energy : G Average		40	sec^{-1}
Range	80 - 10	sec^{-1}	
Mixing energy : GT			51,200

Sedimentation Basin

Type : Up-Flow / Tube Settler

Numbers of units		16	units	
Flow Rate		1,181	m^3/hr/unit	
Width	12.0	m		
Length	32.0	m		
Depth	3.5	m		
Surface area		384	m^2	
Effective surface area		80%	307	m^2
Volume	1,344	m^3		
Overflow rate		3.85	m/hr	
	64.09	mm/min		
Detention time		1.1	hr	

Desludge : Hopper

ANNEX-45

TRANSMISSION AND DISTRIBUTION SYSTEM

CONTENTS OF ANNEX-45

1. Zoning Implementation

For planning the implementation of zoning, it is considered to minimize the capacity of new projects by utilizing the capacity of existing facilities fully and not to change boundary of supply zone.

Special facilities, such as distribution center, treated water transmission pipes and distribution pipes, which will not fully used in the future, will be additionally required to complete the zoning implementation before the commencement of Cisadane II water treatment plant in 2009. Considering requirements for such additional facilities and required time for reorganizing distribution pipe system, it is recommended that zoning implementation is executed gradually and the service area is to be divided into five zones instead of seven zones by 2008, the target year of immediate projects as described below.

1.1 Part 1 of 2nd Phase of 2nd Stage (after completion of Buaran III TP)

As shown in **Figure 1.1**, water should be transferred from zone 6 in East private concession area to zone 5 in West concession area across Ciliwung River through not only clear water transmission pipe but also distribution pipes before completion of New East I Treatment Plant in 2006. As for East concession area, water should be transferred from zone 2 to zone 3 through distribution pipes and these two zones make one combined zone. As for West concession area, water should be transferred from zone 1 to zone 4 and these two zones make one combined zone.

1.2 Part 2 of 2nd Phase of 2nd Stage (after completion of New East I TP)

As shown in **Figure 1.2**, all of the water required to be transferred from East concession to West concession can be transmitted through treated water transmission pipes after completion of New East I Treatment Plant in 2006 until 2008. In East concession area zone 2 and zone 3 should still make one combined zone. As for West concession area, water is to be transferred from zone 4 to zone 7. During Second Phase of Second Stage, water demand in zone 7 is still small and zone 4 and zone 7 make one combined zone.

The estimated maximum amount of water to be transferred through distribution pipes are as follows :

Figure-1.1 **ZONING IMPLEMENTATION AS OF 2005**

Target Year of Part 1 Program

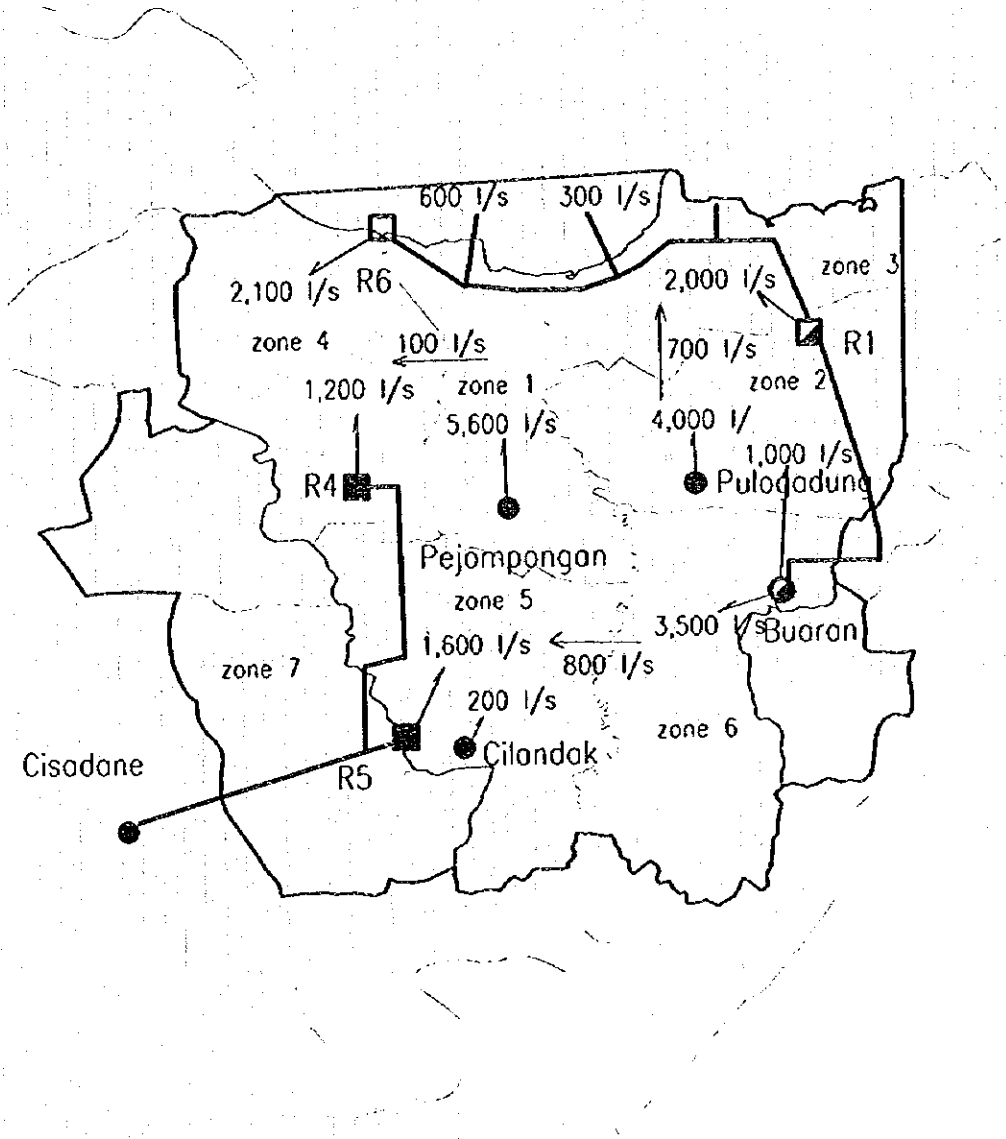
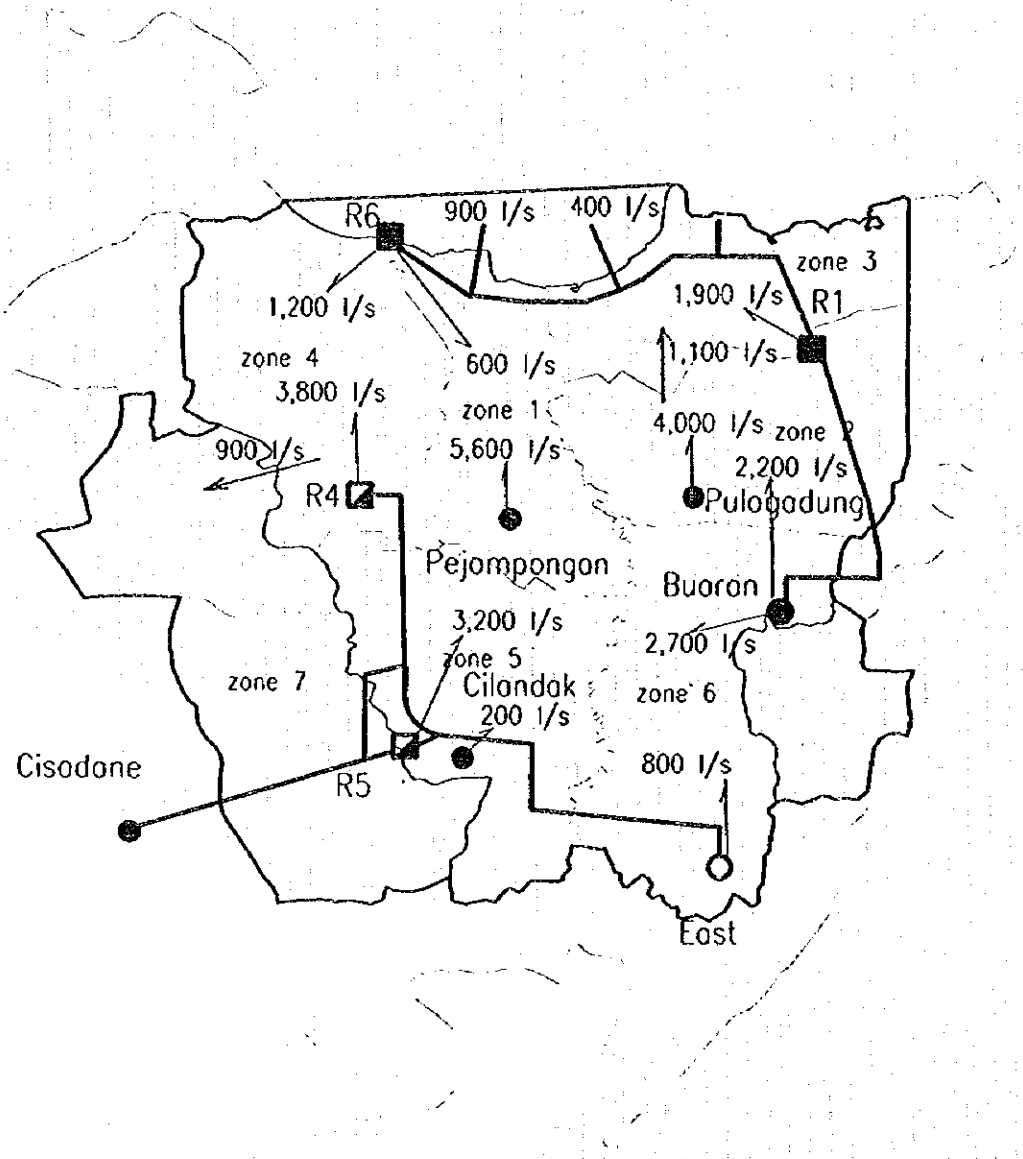


Figure-1.2 **ZONING IMPLEMENTATION AS OF 2008**

Target Year of Part 2 Program



Part 1 of 2nd Phase of 2nd Stage (after completion of Buaran III TP)

From East to West Zone 6	Zone 5	800 l/s	
In the East	Zone 2	Zone 3	700 l/s
In the West	Zone 1	Zone 4	100 l/s
	Zone 4	Zone 7	100 l/s

Part 2 of 2nd Phase of 2nd Stage (after completion of New East I TP)

From East to West	-	-	
In the East	Zone 2	Zone 3	1,100 l/s
In the West	Zone 4	Zone 7	900 l/s

2. CHARACTERISTICS AND MAJOR FEATURE OF PIPE MATERIAL

2.1 DUCTILE IRON PIPE (DIP)

DIP can tolerate much higher bending stresses than other pipe materials. DIP is a strong pipe against internal pressures and external loads. Because of the rather thick wall thickness, deformation of pipe is comparatively small against external loading. Therefore lateral soil bearing support is not a design criteria. Mechanical characteristics of Ductile Iron provide flexibility against non - uniform load around the pipe and disperse the stress trough the pipe wall evenly.

Ductile Iron Pipes have been in use since about 1950 all over the world. Ductile Iron contains about 93 %, iron by weight compared to 99 % in steel pipe. Considering the composition of pipe material on a volume percentage basis, the non ferrous compounds in ductile iron ranges from 17 to 18.5 percent compared to only 1.1 percent in steel. Therefore more than 16 times of the surfaces area is occupied by the non-ferrous compounds which dramatically improves the corrosion resistance properties of ductile iron over steel.

DIP joints can be either lead caulking, flanged, mechanical or push on joint types. The lead joint is the oldest and is not used in new installations but practically used for connections to existing pipe which normally have different outside diameters compared to the presently used new pipes.

The mechanical joint is widely used because of its reliability. Joint angular deflection of a few degrees is possible. This type of joint is easily installed under all conditions and does not require highly skilled labor. The mechanical joint is also practical for any size of pipe and was considered the most suitable for this Project. And added advantages of mechanical joint compared to welded joints of steel pipes is that the pipeline is isolated electrically at each joint which prevents long line corrosion currents from accumulating.

The push on joint is also widely used for straight pipe alignments. It requires more skilled laborers to install especially for large diameter pipelines. The reason is the difficulty of installing the gasket properly. It also permits some joint deflection.

Where thrust forces occur at such points as bends and tees, pipe joints are restrained by supporting with concrete thrust blocks against undisturbed soil.

Cement mortar lining is generally applied to the internal surface by a centrifugal method at the manufacturer's factory to make the lining mortar of high density, uniform in thickness, and tightly adhering to the internal surface. External coatings to reduces corrosion are usually of bituminous materials such as a coal tar epoxy coating. Recently external coatings with zinc coating have been used widely on which bituminous materials are also applied to facilitate more reliable coating. In certain aggressive soils, special protection such as warping of the pipe loosely with thin polyethylene sleeves may be needed.

2.2 STEEL PIPE (SP)

SP has excellent flexibility and elongation characteristic, which allow the normal SP wall thickness to be designed thinner. However this results in deflection of the pipe barrel under the load of backfiring. To avoid bedding, sand compaction between the pipe and trench walls, or concrete bedding up to the spring line of the pipe is required. SP relies on good bedding installation for structural stability. SP is jointed normally by welding. Steel is a material ideally suited to welding, and for large pipes the welded joint is preferred. Flexible joints must be provided at regular intervals to take up thermal expansion and contraction and to isolate valves and branches. Tie-rods and thrust blocks must also be used.

SP is more prone to corrosion and requires a lining and coating to maintain reasonable service life. SP coatings and linings are normally of a bituminous material. SP may have coal tar epoxy interior lining. Materials used for exterior coating may include coal tar enamel with a protective wrap. SP may also have linings of cement mortar.

Although the outside of the pipe barrel is supplied with a bituminous coating applied at the plant, on-loading of the pipelines and handling on the site and in the open-cut trenches often results in damage to this flexible membrane exposing the metal surface to corrosion attack.

Additionally, cathodic protection is sometimes used to prevent corrosion which normally occurs at these pinholes and scratches where the external coating is damaged or imperfect.

Accumulated stray electric currents occurring in the soil will then initiate the corrosion cycle.

Welding work requires highly skilled work performance all around the perimeter of the pipe joint. This is normally required to be done by welders qualified by recognized welding authorities. X-ray inspection should desirably be performed on all welded joints. The quality of SP welding work is greatly hampered by weather conditions such as heavy rains and moisture during the prolonged monsoon season. The welding operation for large diameter mains requires considerable time. Particular attention should be paid to ensure the continuity of lining in pipelines with welded joints.

Bitumen, coal tar and epoxy resins are readily damaged by the heat generated during the welding application and lining have to be repaired which requires very specialized techniques. This applies to large diameter pipes and cannot be done if the pipe is too small to permit access. Therefore sometimes coupling such as dresser type joint is used for connection of smaller sizes of pipes. The materials used for such joint is steel and appreciate coating against corrosion is required recently the coating with vinyl is widely use for corrosion protection. It is difficult to transport hot materials in even moderately sized pipe and to apply them efficiently. Cement mortar linings are commonly used, but are sometimes damaged from transportation and poor handling as well as the welding operation. The repair work for such damage must be undertaken by skilled labor under the supervision of experts from the pipe manufacturer.

Steel pipes have welded seams and joints and at the location of these welded materials, the crystalline and microscopic formation of the material is changed. Because the welds form narrow anode, corrosion will usually occur at these points, if exposed. Also, because of the welded Steel Pipe which results in more serious corrosion potential than in mechanical-joint ductile iron pipes because of the "Longline Current" effect.

In Europe and Japan, surveys of major cities have revealed that the incidence of water pipeline failures primarily caused by corrosion is 10 to 20 times greater with steel than ductile cast iron.

Applying SP to above-ground pipe laying work such as river crossing by pipe bridges, with appropriate coatings, has advantages because of its lighter weight which facilities easier transportation, handling and structural economy.

2.3 Polyvinylchloride Pipe (PVC)

PVC pipe is resistant to chemicals except for some organic solvents, and is immune to soil corrosivity. The pipe interior is smooth so that friction loss is small. Physical strength of this pipe is slightly higher than Asbestos Cement Pipe (ACP) but lower than DIP or SP. Since this materials is a non-conductor of electricity the pipeline is free from electrolytic corrosion.

Solvent welded joints are generally used for smaller sizes of pipes however this joint has no flexibility and may cause failure at fittings. In general, most failure on PVC pipes are concrete on fittings or joints, while the barrel is less damaged. To supplement of this weakness, rubber-gasket joint (push-on type), which with stand the deflection, is applicable for larger size of pipes.

The exposed piping of this materials is subject to vandalism and may be deteriorated by ultraviolet ray and excessive heat. Therefore this pipe should be avoided or carefully protected at the locations where heavy traffic load is expected. Special care for designing may be required for installation work or to choose other pipe materials whenever excessive external load to the pipes are expected such as branches, up and down streams of valves, major road crossing, ditch crossing, etc.

2.4 Galvanized Steel Pipe

This is a steel pipe galvanized with zinc coating, and is used as small sizes of service mains and house connection in the present service area. However this pipe is considered inappropriate for the use especially in the northern part of the service area, since the terrain is corrosive to this material, and machined portion of pipe such as thread tends to form an anode of corrosion cell eventually causing corrosion. Therefore this material is eliminated from the study except for only house connection.

2.5 Asbestos Cement Pipe

Economy of initial investment, being no-conductor of electricity, and being immune to the chemical action of soil are considered advantages in using this pipe. However heavy traffic in the service area will limit the use of ACP since its physical strength fall behind that of DIP and SP. Also non-flexible joint sometimes causes damage to pipe due to differential settlement especially buried under weak soil. From the above consideration, this materials is eliminated.

3.1 THE RESULTS OF PRELIMINARY PIPE NETWORK ANALYSIS (YEAR 2005)

3.1.1 The Results of Preliminary Primary Pipe Network Analysis for Zone 1 (2005)

<<ZONE-1(2005)>>

Node Data

Node-page : 1

NO	Node	Type	Q (l/sec)	HL (m)	GL (m)	EH (m)	Comments
1	1AD1	0	40.560	21.32	0.00	21.32	
2	1BC3	0	40.560	21.33	0.00	21.33	
3	1BC5	0	40.560	21.61	0.00	21.61	
4	1BC4	0	40.560	21.74	0.00	21.74	
5	1BD1	0	40.560	22.12	0.00	22.12	
6	1BD6	0	40.560	21.61	0.00	21.61	
7	1CD1	0	40.560	21.96	0.50	21.46	
8	1CDA	0	40.560	21.96	0.50	21.46	
9	1CD6	0	129.220	22.35	0.30	22.05	
10	1BD2	0	40.560	22.15	0.30	21.85	
11	1BD5	0	40.560	21.34	0.30	21.04	
12	1CD5	0	129.220	23.59	0.10	23.49	
13	1CD9	0	129.220	22.38	1.20	21.18	
14	1CD7	0	163.150	22.20	1.20	21.00	
15	1CD2X	0	0.000	22.02	1.30	20.72	
16	1CD2	0	129.220	21.95	0.00	21.95	
17	1BD3	0	40.560	22.12	0.00	22.12	
18	1BD4	0	40.560	22.14	0.30	21.84	
19	1CD8	0	40.560	21.96	0.50	21.46	
20	1CD4	0	33.930	23.64	1.20	22.44	
21	1DD1	0	33.930	27.80	1.30	26.50	
22	1DD6	0	86.450	25.92	1.10	24.82	
23	1DD5	0	129.220	25.14	0.90	24.24	
24	1DD7	0	86.450	26.54	1.30	25.24	
25	1DE1	0	86.450	26.84	1.80	25.04	
26	1DE5	0	86.450	26.19	1.80	24.39	
27	1DE3	0	86.450	24.98	2.60	22.38	
28	1DE2	0	165.360	21.37	0.70	20.67	
29	1CE7	0	78.910	21.84	1.00	20.84	
30	1CE9	0	78.910	20.18	1.10	19.08	
31	1CE2	0	78.910	21.34	0.30	21.04	
32	1BE1	0	75.790	19.58	0.10	19.48	
33	1BE3	0	75.790	18.87	0.10	18.77	
34	1BE5	0	75.790	18.80	1.00	17.80	
35	1BE2	0	75.790	19.10	1.00	18.10	
36	1BE6	0	75.790	19.09	1.90	17.19	
37	1CF1	0	78.650	19.12	1.00	18.12	
38	1CEA	0	62.790	19.13	0.20	18.93	
39	1CE3	0	78.910	21.36	1.50	19.86	
40	1CE4	0	154.700	19.01	1.50	17.51	
41	1CE5	0	78.910	22.75	1.10	21.65	
42	1CE8	0	78.910	22.99	1.00	21.99	
43	1DE6	0	86.450	24.97	2.60	22.37	
44	1DE4	0	62.790	23.79	3.00	20.79	
45	1DF1	0	62.790	22.05	2.00	20.05	
46	1EF1	0	86.450	29.05	4.80	24.25	
47	1CF2	0	75.790	19.62	2.00	17.62	
48	1DF3	0	78.650	20.58	2.00	18.58	
49	1DF2	0	62.790	20.22	2.00	18.22	
50	1DDC	0	208.130	24.23	0.90	23.33	
51	1DDB	0	86.450	25.98	1.10	24.88	
52	1DDA	0	33.930	27.67	1.30	26.37	
53	1ED5	0	64.220	43.31	8.50	34.81	
54	1FD2	0	64.220	47.77	8.00	39.77	
55	1DD9	0	33.930	37.03	5.10	31.93	
56	1ED3	0	64.220	37.05	6.20	30.85	
57	1ED1	0	64.220	37.60	7.00	30.60	
58	1EE4	0	64.220	29.03	4.70	24.33	
59	1EE5	0	35.750	29.05	4.70	24.35	
60	1EE3	0	40.690	29.01	1.40	27.61	

<<ZONE-1(2005)>>

Node-page : 2

NO	Node	Type	Q (l/sec)	WL (m)	GL (m)	EH (m)	Comments
61	1EE8	0	40.690	29.01	4.80	24.21	
62	1EE2	0	86.450	27.67	1.50	26.17	
63	1EE1	0	86.450	27.82	1.50	26.32	
64	1EEA	0	40.690	29.01	4.80	24.21	
65	1EE8	0	40.690	29.40	3.00	26.40	
66	1EE7	0	40.690	29.12	1.60	27.52	
67	1EEG	0	35.750	29.01	7.60	21.41	
68	1EEK	0	35.750	28.94	7.60	21.34	
69	1EEJ	0	35.750	28.91	5.00	23.91	
70	PEJ2	1	-4,336.151	51.00	1.00	50.00	
71	1FE2	0	40.690	37.90	3.70	34.20	
72	1FE3	0	67.730	37.46	8.10	29.36	
73	1FF1	0	40.690	35.60	11.60	24.00	
74	1FF2	0	40.690	33.80	8.50	25.30	
75	1EF3	0	40.690	33.70	6.00	27.70	
76	1FF3	0	40.690	33.23	8.00	25.23	
77	1FF9	0	40.690	33.29	8.50	24.79	
78	1FFC	0	27.040	36.44	8.30	28.14	
79	1FF5	0	61.100	36.16	8.30	27.86	
80	1FF8	0	43.810	36.65	8.30	28.35	
81	1FF7	0	70.850	37.57	12.80	24.77	
82	1FFA	0	43.810	39.22	12.30	26.92	
83	1GG2	0	43.810	39.26	16.00	23.26	
84	1GFF	0	0.000	42.77	20.50	22.27	
85	1GFC	0	0.000	42.40	20.50	21.90	
86	1GF9	0	43.810	40.32	16.00	24.32	
87	1FFB	0	43.810	40.69	16.30	24.39	
88	1GF8	0	43.810	39.91	12.50	27.41	
89	1GF6	0	43.810	39.72	12.50	27.22	
90	1GFE	0	43.810	40.06	18.00	22.06	
91	1GF4	0	43.810	42.86	17.00	25.86	
92	1GFA	0	0.000	42.79	20.50	22.29	
93	1GFB	0	0.000	42.80	20.50	22.30	
94	1GE5	0	27.040	43.14	14.30	28.84	
95	1GF1	0	27.040	39.85	16.00	23.85	
96	1FE6	0	27.040	39.51	14.00	25.51	
97	1FE1	0	27.040	42.16	9.80	32.36	
98	1FE9	0	35.750	49.03	5.00	44.03	
99	1FE4	0	27.040	41.43	5.80	35.63	
100	1FE7	0	27.040	41.33	6.80	34.53	
101	1GE8	0	27.040	42.95	14.30	28.65	
102	1FE8	0	27.040	44.86	8.50	36.36	
103	1GE9	0	44.330	44.18	11.50	32.68	
104	1FE5	0	34.060	45.12	8.50	36.62	
105	1FDF	0	35.750	47.60	8.00	39.60	
106	1FDE	0	35.750	49.45	5.00	44.45	
107	1FD6	0	61.220	47.81	8.00	39.81	
108	1FD1	0	61.220	47.21	8.50	38.71	
109	1GD1	0	35.750	47.19	14.00	33.19	
110	1FDH	0	35.750	47.56	10.00	37.56	
111	1FDG	0	35.750	47.74	8.00	39.74	
112	1FDA	0	35.750	29.13	7.00	22.13	
113	1FD3	0	35.750	28.66	8.50	20.16	
114	1FD4	0	35.750	36.78	10.00	26.78	
115	1FD5	0	35.750	37.73	12.00	25.73	
116	1GDC	0	69.810	45.50	12.40	33.10	
117	1GDD	0	34.060	40.51	15.00	25.51	
118	1EE6	0	35.750	27.86	7.60	20.26	
119	1EEM	0	35.750	28.56	7.60	20.96	
120	1EEH	0	35.750	28.98	7.60	21.38	

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Node-page : 3

NO	Node	Type	Q (l/sec)	WL (m)	CL (m)	ER (m)	Comments
121	1EEF	0	35.150	28.71	9.00	19.71	
122	DC-R6	0	-130.000	22.13	0.00	22.13	
123	1GFD	0	0.000	40.01	18.00	22.01	
124	1GEA	0	43.810	42.95	14.30	28.65	
125	X001	0	0.000	21.58	0.30	21.28	
126	X002	0	0.000	22.21	0.30	21.91	
127	X003	0	0.000	20.47	1.00	19.47	
128	1DDD	0	33.930	37.89	5.80	32.09	
129	X004	0	0.000	27.15	1.30	25.85	
130	X009	0	0.000	28.94	5.00	23.94	
131	X010	0	0.000	43.11	9.00	34.11	
132	X007	0	0.000	29.01	4.80	24.21	
133	X011	0	0.000	36.78	9.30	27.48	
134	X006	0	0.000	29.03	1.50	27.53	
135	X008	0	0.000	29.13	4.70	24.43	
136	X015	0	0.000	21.96	0.80	21.16	
137	X022	0	0.000	40.77	15.50	25.27	
138	1EC1	0	121.680	46.61	10.50	36.11	
139	1EF2	0	40.690	29.00	4.30	24.70	
140	PEJ11	0	-2,405.000	30.45	5.40	25.05	
141	PEJ12	0	-195.000	43.01	5.00	38.01	
142	X023	0	0.000	46.09	13.95	32.14	
143	1EC2	0	64.220	37.89	6.50	31.39	

<<ZONE-1(2005)>>

Branch Data

Pipe-page : 1

NO	Node(U)	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
1	1BC3	1AD1	0	300	2230	110	0.918	0.013	0.00	0.01	0.00	
2	1BC5	1BC3	0	400	650	110	41.508	0.330	0.43	0.28	0.00	
3	1BC4	1BC5	0	600	730	110	77.487	0.274	0.19	0.13	0.00	
4	1BD1	1BC4	0	600	920	110	118.047	0.418	0.41	0.38	0.00	
5	1BD1	1BD6	0	400	1020	110	45.140	0.359	0.50	0.51	0.00	
6	1BD6	1BC5	0	400	750	110	4.560	0.036	0.01	0.00	0.00	
7	1BD1	1CD1	0	600	1160	110	65.301	0.231	0.14	0.16	0.00	
8	1CD1	1CDA	0	400	230	110	6.593	0.052	0.01	0.00	0.00	
9	1CD6	1BD2	0	400	1030	110	26.932	0.214	0.19	0.20	0.00	
10	1BD2	1AD1	0	400	2110	110	39.612	0.315	0.39	0.83	0.00	
11	1BD2	1BD5	0	250	510	110	24.408	0.497	1.59	0.81	0.00	
12	1CD6	1BD2	0	1350	1040	110	658.646	0.460	0.19	0.20	0.00	
13	1CD5	1CD6	0	1200	1430	110	1092.800	0.966	0.87	1.24	0.00	
14	1CD5	1CD9	0	400	1420	110	60.079	0.478	0.85	1.21	0.00	
15	1CD9	1CD7	0	600	90	110	274.219	0.970	1.96	0.18	0.00	
16	1CD7	1CD2X	0	600	510	110	111.069	0.393	0.37	0.18	0.00	
17	1CD2X	1CD2	0	600	170	110	111.069	0.393	0.37	0.07	0.00	
18	1BD3	1BD1	0	250	190	110	1.754	0.036	0.01	0.00	0.00	
19	1BD4	1BD3	0	350	920	110	5.484	0.057	0.02	0.02	0.00	
20	1BD2	1BD4	0	1350	380	110	235.435	0.164	0.03	0.01	0.00	
21	1BD3	1CD8	0	350	1280	110	15.264	0.159	0.13	0.16	0.00	
22	1CD8	1CDA	0	350	270	110	0.329	0.003	0.00	0.00	0.00	
23	1CD9	1CD8	0	350	1250	110	25.625	0.266	0.34	0.42	0.00	
24	1CD4	1CD9	0	350	490	110	76.743	0.798	2.57	1.26	0.00	
25	1DD1	1CD4	0	350	1530	110	79.169	0.823	2.72	4.16	0.00	
26	1DD1	1DD6	0	300	2170	90	23.254	0.329	0.87	1.88	0.00	
27	1DD6	1DD5	0	1200	580	110	1383.537	1.223	1.34	0.78	0.00	
28	1DD5	1CD5	0	1200	1390	110	1254.317	1.109	1.12	1.55	0.00	
29	1DD7	1DD6	0	1350	710	110	1498.925	1.047	0.87	0.62	0.00	
30	1DE1	1DD7	0	1350	340	110	1515.581	1.059	0.89	0.30	0.00	
31	1DE1	1DE5	0	600	230	90	274.121	0.970	2.84	0.65	0.00	
32	1DE5	1DE3	0	600	880	90	187.671	0.664	1.41	1.21	0.00	
33	1DE3	1DE2	0	350	880	90	80.951	0.841	4.10	3.61	0.00	
34	1CE7	1DE2	0	350	230	90	55.972	0.582	2.07	0.47	0.00	
35	1CE7	1CE9	0	350	1060	90	48.086	0.500	1.57	1.66	0.00	
36	1CE2	1CE9	0	350	1680	90	30.824	0.320	0.69	1.16	0.00	
37	1BD2	1BD5	0	700	570	110	345.584	0.898	1.42	0.81	0.00	
38	1BD5	1BE1	0	300	1750	110	30.878	0.437	1.01	1.76	0.00	
39	1BD5	1BE1	0	700	1630	110	298.534	0.776	1.03	1.76	0.00	
40	1BE1	1BE3	0	400	380	110	91.837	0.731	1.87	0.71	0.00	
41	1BE3	1BE5	0	400	910	110	16.047	0.128	0.07	0.07	0.00	
42	1BE2	1BE5	0	400	350	110	59.743	0.475	0.84	0.30	0.00	
43	1BE1	1BE2	0	400	950	110	45.405	0.361	0.51	0.48	0.00	
44	1CE2	1BE1	0	400	1310	110	76.866	0.612	1.34	1.76	0.00	
45	1CF1	1BE6	0	600	590	110	35.007	0.124	0.04	0.03	0.00	
46	1CEA	1CF1	0	400	280	110	11.539	0.092	0.04	0.01	0.00	
47	1CE3	1CEA	0	400	1770	110	74.329	0.591	1.26	2.23	0.00	
48	1CE3	1CE2	0	600	560	110	34.603	0.122	0.04	0.02	0.00	
49	1CE5	1CE3	0	600	1430	110	187.842	0.664	0.97	1.39	0.00	
50	1CE8	1CE5	0	800	760	110	218.117	0.434	0.32	0.24	0.00	
51	1CE8	1CE7	0	350	90	110	182.968	1.902	12.80	1.15	0.00	
52	1DE6	1CE8	0	800	1450	110	479.995	0.955	1.36	1.98	0.00	
53	1DE3	1DE6	0	800	360	110	59.625	0.119	0.03	0.01	0.00	
54	1DE3	1DE4	0	400	1120	90	55.346	0.440	1.06	1.19	0.00	
55	1DE4	1DF1	0	400	830	90	79.968	0.636	2.09	1.74	0.00	
56	1EF1	1DE4	0	600	1570	110	366.203	1.295	3.35	5.26	0.00	
57	1CD5	1CE5	0	400	1450	110	48.635	0.387	0.58	0.84	0.00	
58	1CF2	1CF1	0	600	1580	110	102.118	0.361	0.32	0.50	0.00	
59	1DF3	1CF2	0	600	1100	110	177.908	0.629	0.88	0.96	0.00	
60	1DF3	1DF2	0	300	230	110	39.412	0.558	1.58	0.36	0.00	

<< ZONE-1(2005)>>

Pipe-page : 2

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
61	1DE2		1DF2	0	300	1900	110	23.378	0.331	0.60	1.15	0.00	
62	1DDC		1DE2	0	300	1090	110	51.815	0.733	2.63	2.86	0.00	
63	1DD6		1DDC	0	600	589	110	336.362	1.190	2.86	1.69	0.00	
64	1DDC		1CD5	0	500	1430	110	76.417	0.389	0.45	0.64	0.00	
65	1DDB		1DD6	0	600	220	110	94.176	0.333	0.27	0.06	0.00	
66	1DDA		1DDB	0	600	1870	110	180.626	0.639	0.91	1.69	0.00	
67	1FD2		1EB5	0	800	1310	110	778.399	1.549	3.33	4.46	0.00	
68	1DD9		1DD1	0	500	1250	110	317.657	1.771	7.39	9.23	0.00	
69	1DD9		1DD1	0	500	1400	110	326.999	1.665	6.60	9.23	0.00	
70	1ED3		1DD9	0	600	550	110	28.284	0.100	0.03	0.02	0.00	
71	1ED3		1DD7	0	300	1590	90	69.794	0.987	6.61	10.51	0.00	
72	1ED4		1ED3	0	600	750	110	162.298	0.574	0.74	0.55	0.00	
73	1ED4		1EE4	0	300	1640	110	75.148	1.063	5.23	8.57	0.00	
74	1EE5		1EE4	0	900	110	110	179.391	0.282	0.12	0.02	0.00	
75	1EF1		1EEB	0	450	110	110	46.382	0.292	0.30	0.01	0.00	
76	1EF1		1EE2	0	450	1900	90	61.362	0.386	0.72	1.38	0.00	
77	1EE1		1EE2	0	600	300	90	107.319	0.380	0.50	0.15	0.00	
78	1EE1		1DE1	0	600	1230	110	168.577	0.596	0.80	0.98	0.00	
79	1EE4		1EE1	0	1500	1080	110	2259.915	1.279	1.12	1.21	0.00	
80	1EEA		1DE6	0	800	2690	110	506.820	1.008	1.50	4.04	0.00	
81	1EEA		1EEB	0	900	250	110	26.925	0.042	0.00	0.00	0.00	
82	1EE8		1EEA	0	900	360	110	574.435	0.903	1.07	0.39	0.00	
83	1EE8		1EE7	0	900	840	110	303.410	0.477	0.33	0.28	0.00	
84	1EE7		1EEG	0	1000	760	110	262.720	0.335	0.15	0.11	0.00	
85	1DE1		1DD6	0	600	930	110	189.993	0.672	0.99	0.92	0.00	
86	1FE2		1EE8	0	800	1880	110	918.535	1.827	4.52	8.50	0.00	
87	1FE2		1FE3	0	800	260	110	535.835	1.066	1.67	0.44	0.00	
88	1FF1		1FF2	0	400	950	110	92.661	0.737	1.90	1.80	0.00	
89	1FF2		1EF3	0	500	680	110	40.690	0.207	0.14	0.10	0.00	
90	1FF9		1FF3	0	600	690	90	40.690	0.144	0.08	0.06	0.00	
91	1FF2		1FF9	0	400	170	110	118.736	0.945	3.00	0.51	0.00	
92	1FF9		1EF1	0	800	2340	110	560.397	1.115	1.81	4.24	0.00	
93	1FFC		1FF5	0	600	190	110	233.090	0.824	1.45	0.28	0.00	
94	1FF5		1FF1	0	600	680	110	171.990	0.608	0.83	0.56	0.00	
95	1FF8		1FFC	0	400	170	110	73.703	0.587	1.24	0.21	0.00	
96	1FF7		1FF8	0	400	680	110	77.317	0.615	1.36	0.92	0.00	
97	1FFA		1FF7	0	400	930	110	89.251	0.710	1.77	1.65	0.00	
98	1GG2		1FFA	0	400	880	110	12.064	0.096	0.04	0.04	0.00	
99	1GFF		1GFC	0	300	180	110	44.923	0.636	2.02	0.37	0.00	
100	1GFC		1GF9	0	300	1030	110	44.923	0.636	2.02	2.08	0.00	
101	1GF9		1FF7	0	300	1920	110	37.346	0.528	1.43	2.75	0.00	
102	1FFB		1FFA	0	400	880	110	86.567	0.689	1.67	1.47	0.00	
103	1FFB		1GF9	0	400	240	110	82.287	0.655	1.52	0.37	0.00	
104	1GF9		1GF8	0	400	800	110	46.054	0.366	0.52	0.41	0.00	
105	1GF8		1GF6	0	400	620	110	31.611	0.275	0.31	0.19	0.00	
106	1GF6		1GG2	0	600	1860	110	89.725	0.317	0.25	0.46	0.00	
107	1GFF		1GFE	0	400	440	110	175.101	1.393	6.16	2.71	0.00	
108	1GF4		1FF8	0	600	1770	110	212.664	0.752	1.22	2.17	0.00	
109	1GF4		1GFA	0	400	630	110	18.963	0.151	0.10	0.07	0.00	
110	1GFA		1GFF	0	400	280	110	18.963	0.151	0.10	0.02	0.00	
111	1GFB		1GFF	0	1000	350	110	201.061	0.256	0.09	0.03	0.00	
112	1GF4		1GFB	0	1000	650	110	201.061	0.256	0.09	0.06	0.00	
113	1GE5		1GF4	0	400	1030	110	32.822	0.261	0.28	0.28	0.00	
114	1GE5		1GF4	0	600	910	110	100.271	0.355	0.30	0.28	0.00	
115	1GF1		1FE6	0	600	530	110	150.792	0.533	0.65	0.34	0.00	
116	1FE6		1FE3	0	500	1870	110	123.752	0.630	1.09	2.05	0.00	
117	1FE1		1FE2	0	900	680	110	1495.060	2.350	6.27	4.26	0.00	
118	PEJ2		1FE9	0	1000	380	110	1777.684	2.263	5.17	1.97	0.00	
119	PEJ12		1FE4	0	600	1060	90	195.000	0.690	1.51	1.61	0.00	
120	1FE4		1FE7	0	300	250	110	19.501	0.276	0.43	0.10	0.00	

<<ZONE-1(2005)>>

Pipe-page : 3

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
121	1FE1		1FE7	0	300	1560	110	21.926	0.310	0.51	0.83	0.00	
122	1FE7		1GF1	0	800	2210	110	326.694	0.650	0.67	1.48	0.00	
123	1GF1		1FFA	0	800	1570	110	248.772	0.495	0.40	0.63	0.00	
124	1FE8		1GE8	0	300	2050	110	29.581	0.418	0.93	1.91	0.00	
125	1GE9		1GE5	0	1000	1310	110	644.717	0.821	0.79	1.04	0.00	
126	1FE5		1GE9	0	1000	1050	110	689.047	0.877	0.90	0.94	0.00	
127	1FDF		1FE5	0	1000	2200	110	779.728	0.993	1.13	2.48	0.00	
128	1FD2		1FDF	0	1000	140	110	815.478	1.038	1.22	0.17	0.00	
129	1FDE		1FD2	0	1000	490	110	1425.030	1.814	3.41	1.68	0.00	
130	PEJ2		1FDE	0	1000	430	110	1460.781	1.860	3.60	1.55	0.00	
131	PEJ2		1FD6	0	900	1040	110	1016.398	1.598	3.07	3.19	0.00	
132	1FD6		1FD1	0	800	440	110	479.496	0.954	1.36	0.60	0.00	
133	1FDH		1GD1	0	800	1900	110	167.915	0.334	0.19	0.37	0.00	
134	1FDG		1FDH	0	800	650	110	203.865	0.405	0.28	0.18	0.00	
135	1FD6		1FDG	0	800	170	110	239.415	0.476	0.38	0.07	0.00	
136	1FDA		1FD3	0	350	750	110	35.750	0.372	0.62	0.47	0.00	
137	1FD5		1FD4	0	300	720	110	35.750	0.506	1.32	0.95	0.00	
138	1GDC		1FD5	0	250	670	110	71.500	1.457	11.59	7.77	0.00	
139	PEJ2		1GDC	0	400	2550	90	81.283	0.647	2.16	5.50	0.00	
140	1FE4		1GDD	0	400	2140	90	34.060	0.271	0.43	0.92	0.00	
141	1EE5		1EE4	0	900	110	110	179.391	0.282	0.12	0.02	0.00	
142	1EE6		1EE2	0	300	670	90	12.470	0.176	0.27	0.19	0.00	
143	1EEM		1EE6	0	300	210	90	48.220	0.682	3.33	0.70	0.00	
144	1EEH		1EEM	0	300	80	110	76.105	1.077	5.35	0.42	0.00	
145	1EEF		1EEM	0	300	1350	90	7.865	0.111	0.12	0.15	0.00	
146	1EEG		1EEH	0	1000	220	110	226.970	0.289	0.11	0.03	0.00	
147	1EEH		1EEK	0	1000	1390	110	115.115	0.147	0.03	0.04	0.00	
148	DC-R6		1BD1	0	1600	2250	110	130.000	0.065	0.00	0.01	0.00	
149	1BE2		1BE6	0	600	90	110	40.783	0.144	0.06	0.01	0.00	
150	1FD1		1ED4	0	500	1690	110	301.666	1.536	5.68	9.61	0.00	
151	1GFD		1GF8	0	400	310	110	35.658	0.284	0.32	0.10	0.00	
152	1GFE		1GFD	0	400	130	110	38.181	0.304	0.37	0.05	0.00	
153	1GE5		1GEA	0	300	110	110	41.269	0.584	1.72	0.19	0.00	
154	1GE8		1GEA	0	300	110	110	2.541	0.036	0.01	0.00	0.00	
155	1EE2		1DE3	0	450	1670	90	91.702	0.595	1.61	2.69	0.00	
156	X001		1CE2	0	600	150	110	244.363	0.864	1.58	0.24	0.00	
157	1CD6		X001	0	600	490	110	244.363	0.861	1.58	0.77	0.00	
158	X002		1CDA	0	400	860	110	33.638	0.268	0.29	0.25	0.00	
159	1CD6		X002	0	400	490	110	33.638	0.268	0.29	0.14	0.00	
160	1CE2		X003	0	400	460	110	92.356	0.735	1.89	0.87	0.00	
161	X003		1CE4	0	400	760	110	92.366	0.735	1.89	1.43	0.00	
162	1ED5		1DDD	0	800	1910	110	714.379	1.421	2.84	5.42	0.00	
163	1EE1		X004	0	1500	830	110	1897.568	1.074	0.81	0.67	0.00	
164	X004		1DE1	0	1500	380	110	1897.568	1.074	0.81	0.31	0.00	
165	1EEK		X009	0	1000	380	110	35.750	0.016	0.00	0.00	0.00	
166	X009		1EEJ	0	1000	260	110	35.750	0.016	0.00	0.00	0.00	
167	X010		1FE1	0	1000	190	110	1741.934	2.218	4.98	0.95	0.00	
168	1FE9		X010	0	1000	1190	110	1741.934	2.218	4.98	5.92	0.00	
169	1EE3		X007	0	900	960	90	8.073	0.013	0.00	0.00	0.00	
170	X007		1EEB	0	900	330	90	8.073	0.013	0.00	0.00	0.00	
171	1FE3		X011	0	800	340	110	591.857	1.177	2.00	0.68	0.00	
172	X011		1FF1	0	800	590	110	591.857	1.177	2.00	1.18	0.00	
173	1EE5		X006	0	900	980	90	48.763	0.077	0.02	0.02	0.00	
174	X006		1EE3	0	900	940	90	48.763	0.077	0.02	0.02	0.00	
175	X008		1EE4	0	1500	120	110	1890.205	1.070	0.80	0.10	0.00	
176	X015		1CD2	0	600	160	110	18.151	0.064	0.01	0.01	0.00	
177	1CD1		X015	0	600	510	110	18.151	0.064	0.01	0.00	0.00	
178	1GE5		X022	0	400	1090	110	99.910	0.795	2.18	2.37	0.00	
179	X022		1GF1	0	400	420	110	99.911	0.795	2.18	0.92	0.00	
180	1FD1		1EC1	0	600	1570	110	113.611	0.402	0.38	0.60	0.00	

(:ZONE-1(2005):)

Pipe-page : 4

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
181	1EE8		1EF2	0	800	570	90	40.690	0.081	0.02	0.01	0.00	
182	PEJ11		1FDA	0	350	590	110	71.500	0.743	2.25	1.32	0.00	
183	PEJ11		1EE5	0	900	1470	90	443.295	0.697	0.96	1.40	0.00	
184	PEJ11		X008	0	1500	1650	110	1890.205	1.070	0.80	1.32	0.00	
185	1DF1		1DF3	0	600	650	110	295.969	1.047	2.26	1.47	0.00	
186	X023		1GDC	0	400	480	90	60.022	0.478	1.23	0.59	0.00	
187	1GD1		X023	0	300	320	110	60.022	0.849	3.45	1.10	0.00	
188	1GD1		1EC1	0	600	3530	110	72.143	0.255	0.17	0.58	0.00	
189	1EC1		1EC2	0	300	2240	110	61.073	0.906	3.89	8.72	0.00	
190	1DDD		1EC2	0	300	1760	110	0.147	0.002	0.00	0.00	0.00	
191	1DDD		1DD9	0	800	330	110	680.302	1.353	2.59	0.86	0.00	
192	1BD3		1BD1	0	1350	220	110	137.297	0.096	0.01	0.00	0.00	
193	1BD4		1BD3	0	1350	940	110	189.391	0.132	0.02	0.02	0.00	
194	1CD4		1CD9	0	600	570	110	292.243	1.034	2.21	1.26	0.00	
195	1DD1		1CD4	0	600	1550	110	323.746	1.145	2.67	4.16	0.00	
196	1DE4		1DF1	0	600	850	110	278.791	0.986	2.02	1.74	0.00	
197	1FF2		1FF9	0	800	320	110	523.041	1.011	1.59	0.51	0.00	
198	1FF1		1FF2	0	800	800	110	630.496	1.254	2.25	1.80	0.00	
199	1FF8		1FFC	0	600	220	110	186.427	0.659	0.96	0.21	0.00	
200	1FF7		1FF8	0	600	670	110	226.623	0.802	1.38	0.92	0.00	
201	1FFA		1FF7	0	600	1010	110	248.193	0.878	1.63	1.65	0.00	
202	1GG2		1FFA	0	600	940	110	33.851	0.120	0.04	0.04	0.00	
203	1GE5		1GF4	0	1000	1160	110	343.406	0.437	0.25	0.28	0.00	
204	1GFE		1GFD	0	600	180	110	93.110	0.329	0.27	0.05	0.00	
205	1GFD		1GF8	0	600	360	110	95.633	0.338	0.28	0.10	0.00	
206	1GF8		1GF6	0	600	640	110	98.925	0.350	0.30	0.19	0.00	
207	1BE1		1BE2	0	600	965	110	130.912	0.463	0.50	0.48	0.00	
208	1FE1		1FE7	0	700	1650	110	197.908	0.514	0.51	0.83	0.00	
209	1FE5		1FE8	0	300	83	110	56.621	0.801	3.10	0.26	0.00	
210	1EEK		1EEF	0	300	118	110	43.615	0.617	1.91	0.23	0.00	
211	1FE4		1FE7	0	600	277	110	114.399	0.405	0.39	0.10	0.00	
212	1DD1		1DDA	0	600	100	110	214.556	0.759	1.25	0.13	0.00	
213	1FD6		1FD2	0	800	100	110	233.267	0.464	0.36	0.01	0.00	
214	1BE1		1CE4	0	400	595	110	62.334	0.496	0.91	0.54	0.00	

3.1.2 The Results of Preliminary Primary Pipe Network Analysis for Zone 2 and Zone 3 (2005)

((ZONE-2_3(2005))

Node Data

Node-page : 1

NO	Node	Type	Q (l/sec)	HL (m)	GL (m)	EH (m)	Comments
1	3BF1	0	15.860	32.34	0.50	31.84	
2	3BG1	0	15.860	32.43	0.50	31.93	
3	3BG2	0	15.860	32.44	0.50	31.94	
4	3BF2	0	15.860	32.53	0.50	32.03	
5	3BE4	0	20.930	32.31	1.90	30.41	
6	2DF6	0	41.860	35.08	2.00	33.08	
7	2DF5	0	34.450	36.11	4.00	32.11	
8	3CF4	0	36.790	32.29	0.80	31.49	
9	3CFA	0	36.790	32.35	2.00	30.35	
10	3DF3	0	15.340	32.98	2.00	30.98	
11	3DF4	0	15.340	33.01	1.90	31.11	
12	3CF9	0	36.790	32.59	2.00	30.59	
13	3CF2	0	20.930	32.09	0.80	31.29	
14	3CF3	0	36.790	31.67	2.00	29.67	
15	2DFC	0	41.860	35.96	2.50	33.46	
16	2DF7	0	41.860	35.98	3.50	32.48	
17	2EF5	0	34.450	36.13	4.00	32.13	
18	2EFC	0	34.450	36.31	4.50	31.81	
19	2EF6	0	34.450	37.35	6.00	31.35	
20	2EF4	0	34.450	37.35	6.00	31.35	
21	2EG4	0	62.790	37.37	6.00	31.37	
22	2EG6	0	60.840	37.75	6.00	31.75	
23	2EG7	0	37.310	40.41	5.00	35.41	
24	2EG3	0	37.310	36.60	3.50	33.10	
25	2EG2	0	37.310	36.32	3.50	32.82	
26	2EG1	0	37.310	35.92	4.00	31.92	
27	2DG8	0	37.310	35.95	4.00	31.95	
28	2DG6	0	37.310	36.34	4.00	32.34	
29	2DG7	0	35.620	35.48	1.20	34.28	
30	3CGD	0	15.340	35.48	2.10	33.38	
31	3CG5	0	41.600	35.09	2.20	32.89	
32	SNTER	0	0.000	35.09	1.00	34.09	
33	3CHA	0	41.600	31.90	1.00	30.90	
34	3BH4	0	41.600	31.62	1.00	30.62	
35	3BH1	0	41.600	30.36	2.00	28.36	
36	3BHB	0	41.600	28.75	0.50	28.25	
37	3AH1	0	41.600	28.43	0.50	27.93	
38	3AH6	0	41.600	28.37	0.50	27.87	
39	3BG6	0	41.600	28.37	2.00	26.37	
40	3BG7	0	41.600	29.25	0.50	28.75	
41	3BG4	0	41.600	29.35	1.00	28.35	
42	3BG5	0	41.600	28.95	1.50	27.45	
43	3BH7	0	41.600	32.03	2.00	30.03	
44	3BH2	0	41.600	31.41	2.00	29.41	
45	3AH2	0	41.600	30.81	0.50	30.31	
46	3BH3	0	41.600	31.55	2.00	29.55	
47	3BH8	0	41.600	34.54	2.00	32.54	
48	3CG8	0	41.600	34.37	2.60	31.77	
49	3CH4	0	41.600	34.68	1.00	33.68	
50	3CG2	0	41.600	34.71	1.00	33.71	
51	3DG1	0	41.600	35.11	1.50	33.61	
52	2DG2	0	35.620	35.64	1.20	34.44	
53	2DG4	0	35.620	36.81	4.00	32.81	
54	2DH3	0	35.620	39.54	1.50	38.04	
55	3DH5	0	41.600	39.48	3.00	36.48	
56	3CGC	0	0.000	35.68	3.00	32.68	
57	3CG3	0	15.340	34.83	2.00	32.83	
58	3CGB	0	41.600	34.84	1.50	33.34	
59	3CG1	0	15.340	34.86	2.60	32.26	
60	3CGA	0	41.600	35.47	1.00	34.47	

<<ZONE-2_3(2005)>>

Node-page : 2

NO	Node	Type	Q (l/sec)	WL (m)	CL (m)	EH (m)	Comments
61	3CH9	0	41.600	36.11	1.50	34.61	
62	3CH6	0	41.600	36.41	2.80	33.61	
63	3CH5	0	41.600	36.76	1.50	35.26	
64	3CH8	0	41.600	36.36	1.50	34.86	
65	3CHB	0	41.600	35.73	1.00	34.73	
66	3CC9	0	41.600	34.70	1.00	33.70	
67	3CF7	0	199.980	19.58	1.50	18.08	
68	3BF3	0	15.860	32.62	1.50	31.12	
69	3BC8	0	15.860	32.85	0.50	32.35	
70	3BC3	0	15.860	32.73	0.50	32.23	
71	3CC7	0	41.600	34.37	2.30	32.07	
72	3DF1	0	0.000	34.66	2.50	32.16	
73	3DF2	0	41.600	34.00	2.50	31.50	
74	3CF5	0	0.000	33.66	1.70	31.96	
75	2DFD	0	35.620	34.78	2.50	32.28	
76	2DF4	0	62.790	35.65	3.00	32.65	
77	2DFA	0	34.450	35.81	3.50	32.31	
78	2DFB	0	62.790	35.80	3.50	32.30	
79	2EFB	0	34.450	36.32	4.50	31.82	
80	2EF9	0	34.450	37.32	6.00	31.32	
81	2DH2	0	55.120	40.26	1.50	38.76	
82	2DH5	0	37.310	40.23	1.50	38.73	
83	3DH6	0	13.260	40.01	0.80	39.21	
84	3CH2	0	13.260	37.96	1.00	36.96	
85	3CHC	0	41.600	36.26	1.00	35.26	
86	3CH1	0	41.600	35.95	1.50	34.45	
87	3CH3	0	41.600	35.56	1.00	34.56	
88	3BHA	0	41.600	34.71	2.00	32.71	
89	3CH7	0	13.260	35.85	1.50	34.35	
90	3BH9	0	46.670	35.20	2.00	33.20	
91	3CJ1	0	13.260	38.00	1.00	37.00	
92	3CJ5	0	13.260	38.26	2.00	36.26	
93	3CJ2	0	46.670	38.92	3.00	35.92	
94	3CJ6	0	13.260	39.13	3.00	36.13	
95	3AH5	0	46.670	31.06	1.00	30.06	
96	3AH3	0	46.670	30.85	2.00	28.85	
97	3AH4	0	46.670	30.85	1.00	29.85	
98	3AJ1	0	80.340	30.99	1.30	29.69	
99	3AJ2	0	26.910	32.71	0.60	32.11	
100	3AJ3	0	26.910	34.71	3.00	31.71	
101	3BJ5	0	26.910	35.43	2.80	32.63	
102	3BK1	0	26.910	37.18	2.50	34.68	
103	3AK2	0	26.910	32.00	1.00	31.00	
104	3AK1	0	26.910	31.21	0.50	30.71	
105	3AK3	0	26.910	31.20	0.50	30.70	
106	3CK4	0	26.910	39.31	2.90	36.41	
107	3CK1	0	26.910	38.91	2.70	36.21	
108	3BJ3	0	46.670	37.17	2.00	35.17	
109	3BJ2	0	46.670	32.46	1.00	31.46	
110	3BJ8	0	46.670	36.58	2.00	34.58	
111	3BJ4	0	46.670	35.65	2.00	33.65	
112	3BHC	0	46.670	34.72	2.00	32.72	
113	3BH5	0	46.670	31.73	0.50	31.23	
114	3BH8	0	46.670	31.25	2.00	29.25	
115	3BJ6	0	46.670	31.98	2.00	29.98	
116	3BJ9	0	46.670	37.94	3.00	34.94	
117	3BJ7	0	26.910	38.23	3.00	35.23	
118	3CJ3	0	26.910	39.42	3.00	36.42	
119	3CK2	0	26.910	40.35	3.00	37.35	
120	DC-R1	0	-2,600.000	40.55	2.00	38.55	

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NO	Node	Type	Q (1/sec)	WL (m)	CL (m)	ER (m)	Comments
121	2CK3	0	33.670	40.37	3.00	37.37	
122	2DK3	0	33.670	40.61	3.00	37.61	
123	2EK3	0	73.710	43.75	3.50	40.25	
124	2EL1	0	73.710	44.26	3.50	40.76	
125	2FK2	0	73.710	46.63	10.00	36.63	
126	2FK4	0	73.710	46.14	10.00	36.14	
127	2FK3	0	73.710	45.67	10.00	35.67	
128	2EK1	0	73.710	44.67	3.50	41.17	
129	2EK2	0	73.710	44.36	3.50	40.86	
130	2DK5	0	0.000	40.09	3.00	37.09	
131	2DK4	0	33.670	39.92	3.00	36.92	
132	2CJ1	0	33.670	40.05	3.00	37.05	
133	2CJ7	0	55.120	40.19	3.00	37.19	
134	2CJ4	0	0.000	41.71	3.00	38.71	
135	2CJ3	0	0.000	41.98	3.00	38.98	
136	2DJ2	0	55.120	43.76	2.00	41.76	
137	2DJ1	0	55.120	42.24	3.50	38.74	
138	2EJA	0	55.120	45.39	3.50	41.89	
139	2EJ6	0	73.710	45.68	3.50	42.18	
140	2EJ4	0	73.710	45.93	6.00	39.93	
141	2FJ3	0	73.710	46.18	11.00	35.18	
142	2FK1	0	73.710	46.27	11.00	35.27	
143	2EJ1	0	55.120	45.91	3.50	42.41	
144	2EH1	0	55.120	42.78	3.00	39.78	
145	2DH4	0	55.120	42.22	3.00	39.22	
146	2DH6	0	55.120	40.74	2.00	38.74	
147	2EJ3	0	73.710	48.46	4.60	43.86	
148	2EJ2	0	49.010	48.17	4.60	43.57	
149	2EH4	0	49.010	47.36	5.00	42.36	
150	2EH7	0	49.010	47.61	5.40	42.21	
151	2EH5	0	49.010	48.06	5.00	43.06	
152	2EJ7	0	73.710	50.16	4.60	45.56	
153	2EJ8	0	73.710	48.13	4.00	44.13	
154	2EG5	0	72.540	42.21	5.00	37.21	
155	2EH6	0	49.010	44.07	4.50	39.57	
156	2EH3	0	49.010	45.25	6.00	39.25	
157	2EH2	0	55.120	40.71	4.50	36.21	
158	2EH9	0	49.010	38.86	4.00	34.86	
159	2EH8	0	49.010	38.79	6.00	32.79	
160	2DG5	0	37.310	40.81	5.20	35.61	
161	2FH1	0	49.010	51.54	7.00	44.54	
162	2FH4	0	49.010	43.10	10.00	33.10	
163	2FH3	0	49.010	43.39	11.00	32.39	
164	2FG9	0	23.530	38.50	7.00	31.50	
165	2FG2	0	23.530	38.84	6.50	32.34	
166	2FGD	0	23.530	39.19	11.00	28.19	
167	2FG4	0	23.530	39.31	10.00	29.31	
168	2FG8	0	23.530	40.53	16.00	24.53	
169	2FGC	0	23.530	40.07	11.00	29.07	
170	2FGB	0	23.530	38.57	7.00	31.57	
171	2EFD	0	23.530	38.24	6.50	31.74	
172	2FF4	0	23.530	38.23	7.00	31.23	
173	2FG5	0	23.530	42.21	9.00	33.21	
174	2FGA	0	23.530	39.70	7.00	32.70	
175	2EFA	0	57.980	38.21	7.00	31.21	
176	2FG1	0	23.530	38.85	6.50	32.35	
177	2FG3	0	23.530	38.80	6.50	32.30	
178	2FF7	0	23.530	38.72	6.50	32.22	
179	2FG7	0	23.530	41.83	14.20	27.63	
180	2FG6	0	72.540	42.27	16.00	26.27	

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NO	Node	Type	Q (l/sec)	WL (m)	GL (m)	EH (m)	Comments
181	2FH6	0	49.010	41.72	12.50	32.22	
182	2FH2	0	49.010	45.73	13.00	32.73	
183	2FJ5	0	73.710	46.80	12.00	34.80	
184	2FJ2	0	73.710	48.50	9.00	39.50	
185	2FJ1	0	73.710	52.24	7.00	45.24	
186	2FJ4	0	73.710	46.17	11.00	35.17	
187	2FH5	0	49.010	47.75	10.00	37.75	
188	2FH8	0	49.010	53.06	4.00	49.06	
189	2FH9	0	0.000	53.70	4.50	49.20	
190	2FH7	0	49.010	52.73	4.00	48.73	
191	PULOG	1	-4,612.140	55.00	1.00	54.00	
192	3CG1	0	41.600	35.05	1.00	34.05	
193	2FGE	0	0.000	42.69	15.30	27.39	
194	X012	0	0.000	42.22	10.80	31.42	
195	2FGF	0	0.000	41.57	14.20	27.37	
196	2DG3	0	35.620	35.77	1.20	34.57	
197	X021	0	0.000	37.46	6.00	31.46	
198	X020	0	0.000	42.75	4.90	37.85	
199	X019	0	0.000	45.78	3.50	42.28	
200	3BE7	0	0.000	32.32	1.00	31.32	
201	X018	0	0.000	34.68	1.00	33.68	
202	3AJ4	0	26.910	34.26	0.50	33.76	
203	3AL1	0	26.910	29.15	0.50	28.65	
204	2CK1	0	33.670	38.31	2.50	35.81	
205	2DK2	0	73.710	40.93	3.50	37.43	
206	2DK1	0	73.710	41.28	3.50	37.78	
207	2CJ9	0	33.670	40.05	3.00	37.05	
208	2CH1	0	55.120	38.80	1.10	37.70	
209	2CH2	0	55.120	38.80	1.10	37.70	
210	2FK5	0	73.710	45.58	13.00	32.58	
211	2CK2	0	33.670	38.38	3.00	35.38	
212	BRN3	0	-1,300.000	47.28	8.00	39.28	

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Branch Data

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NO	Node(U) ->	Node(D)	Type	Dia (mm)	Lea (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
1	3BG1	3BF1	0	600	1760	110	38.956	0.138	0.05	0.09	0.00	
2	3BG2	3BG1	0	600	80	110	51.816	0.191	0.10	0.01	0.00	
3	3BF2	3BG2	0	250	1780	110	3.780	0.077	0.05	0.09	0.00	
4	3BF2	3BE4	0	250	1300	110	7.173	0.146	0.16	0.22	0.00	
5	2DF5	2DF6	0	400	1630	90	41.869	0.333	0.63	1.03	0.00	
6	3BE4	3CF4	0	400	730	110	9.339	0.074	0.03	0.02	0.00	
7	3CFA	3CF4	0	400	1430	110	11.759	0.094	0.01	0.06	0.00	
8	3DF3	3CFA	0	400	1100	110	48.549	0.386	0.57	0.63	0.00	
9	3DF4	3DF3	0	600	170	110	63.889	0.226	0.13	0.03	0.00	
10	3DF4	3CF9	0	600	2020	110	81.765	0.289	0.21	0.42	0.00	
11	3CF9	3CF4	0	500	700	110	73.412	0.374	0.42	0.30	0.00	
12	3CF4	3CF2	0	400	260	110	57.720	0.459	0.79	0.20	0.00	
13	3CF2	3CF3	0	300	300	110	36.790	0.520	1.39	0.42	0.00	
14	2DF7	2DFC	0	600	310	110	41.860	0.148	0.06	0.02	0.00	
15	2EF5	2DF7	0	600	710	110	83.720	0.296	0.22	0.15	0.00	
16	2EFC	2EF5	0	800	370	110	279.057	0.555	0.50	0.18	0.00	
17	2EF6	2EFC	0	800	1700	110	311.161	0.619	0.61	1.04	0.00	
18	2EF6	2EF4	0	500	180	110	15.887	0.081	0.02	0.00	0.00	
19	2EG4	2EF4	0	500	820	110	18.563	0.095	0.03	0.02	0.00	
20	2EG7	2EG6	0	500	1530	110	158.987	0.810	1.74	2.66	0.00	
21	2EG7	2EG3	0	250	1090	110	37.422	0.762	3.50	3.81	0.00	
22	2EG3	2EG2	0	350	150	110	63.814	0.663	1.82	0.28	0.00	
23	2EG2	2EG1	0	350	1130	110	26.501	0.275	0.36	0.40	0.00	
24	2DG8	2EG1	0	250	510	110	4.191	0.085	0.06	0.03	0.00	
25	2DG6	2DG8	0	250	310	110	20.479	0.417	1.15	0.39	0.00	
26	2DG6	2DG7	0	350	900	90	36.919	0.384	0.96	0.86	0.00	
27	2DG7	3CGD	0	350	940	90	1.299	0.013	0.00	0.00	0.00	
28	3CG5	SNTER	0	500	270	110	0.000	0.000	0.00	0.00	0.00	
29	3CG5	3CHA	0	350	1460	90	57.567	0.598	2.18	3.19	0.00	
30	3CHA	3BH4	0	350	1390	90	15.967	0.166	0.20	0.28	0.00	
31	3BH4	3BH1	0	350	1340	90	36.454	0.379	0.94	1.26	0.00	
32	3BH1	3BHB	0	350	400	90	79.993	0.831	4.01	1.61	0.00	
33	3BHB	3AH1	0	350	310	90	38.393	0.399	1.03	0.32	0.00	
34	3AH1	3AH6	0	250	210	110	10.259	0.209	0.32	0.06	0.00	
35	3BG6	3AH6	0	250	1530	110	1.079	0.022	0.00	0.00	0.00	
36	3BG7	3BG6	0	250	720	110	21.114	0.430	1.21	0.88	0.00	
37	3BG2	3BG7	0	250	460	110	54.178	1.104	6.93	3.19	0.00	
38	3BG4	3BG7	0	300	1100	110	8.536	0.121	0.09	0.10	0.00	
39	3BG4	3BG5	0	300	740	110	22.197	0.314	0.55	0.40	0.00	
40	3BG5	3BG6	0	300	1100	110	21.565	0.305	0.52	0.58	0.00	
41	3BH1	3BG5	0	300	1570	110	40.968	0.580	1.70	2.67	0.00	
42	3BH7	3BH4	0	300	130	110	57.500	0.813	3.19	0.41	0.00	
43	3BH7	3BH2	0	600	1110	90	113.505	0.401	0.56	0.62	0.00	
44	3BH2	3AH2	0	400	620	90	52.751	0.420	0.97	0.60	0.00	
45	3AH2	3AH1	0	250	510	110	43.728	0.891	4.67	2.38	0.00	
46	3BH2	3BH1	0	400	650	110	85.138	0.678	1.62	1.05	0.00	
47	3BH3	3BH2	0	600	950	110	65.984	0.233	0.14	0.14	0.00	
48	3BH8	3BH3	0	400	1510	110	91.890	0.755	1.98	2.99	0.00	
49	3BH8	3BH7	0	300	970	110	51.392	0.727	2.59	2.51	0.00	
50	3BH7	3BH4	0	300	200	110	45.556	0.644	2.07	0.41	0.00	
51	3CG8	3BG4	0	300	1030	110	72.353	1.023	4.87	5.02	0.00	
52	3CH4	3CG8	0	600	820	110	112.558	0.398	0.38	0.31	0.00	
53	3DG1	3CG2	0	600	1750	90	70.824	0.250	0.23	0.40	0.00	
54	2DG2	3DG1	0	600	970	90	112.424	0.398	0.55	0.53	0.00	
55	2DH3	2DG4	0	800	1810	110	507.137	1.009	1.51	2.73	0.00	
56	2DH3	3DH5	0	400	590	110	19.128	0.152	0.10	0.06	0.00	
57	3DH5	3CGC	0	400	1550	110	107.143	0.853	2.48	3.80	0.00	
58	3CGC	3CGD	0	350	270	110	39.495	0.411	0.75	0.20	0.00	
59	3CGC	3CG3	0	400	800	110	67.648	0.538	1.06	0.85	0.00	
60	3CG8	3CG3	0	600	750	110	17.937	0.063	0.01	0.01	0.00	

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NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
61	3CG1		3CG8	0	600	210	110	59.537	0.211	0.12	0.02	0.00	
62	3CGA		3CG1	0	900	1490	110	341.757	0.537	0.41	0.61	0.00	
63	3CGA		3CG5	0	500	400	110	115.312	0.587	0.96	0.38	0.00	
64	3CH9		3CGA	0	1000	1290	110	498.669	0.635	0.49	0.64	0.00	
65	3CH6		3CH9	0	1000	520	110	540.269	0.688	0.57	0.30	0.00	
66	3CH5		3CH6	0	1200	430	110	1070.326	0.946	0.83	0.35	0.00	
67	3CH5		3CH8	0	900	320	110	624.780	0.982	1.25	0.40	0.00	
68	3CH8		3CHB	0	900	580	110	583.180	0.917	1.10	0.63	0.00	
69	3CHB		3CG9	0	900	1070	110	541.580	0.851	0.96	1.03	0.00	
70	3CG9		3CF7	0	600	2540	110	499.980	1.768	5.96	15.12	0.00	
71	3BF3		3BF2	0	400	490	110	26.813	0.213	0.19	0.09	0.00	
72	3BF3		3CF9	0	600	1230	110	28.437	0.101	0.03	0.03	0.00	
73	3BG8		3BF3	0	600	1390	110	71.110	0.252	0.16	0.23	0.00	
74	3BG8		3BG3	0	600	210	110	136.935	0.484	0.54	0.12	0.00	
75	3BG3		3BG2	0	600	680	110	121.075	0.428	0.43	0.29	0.00	
76	3CG7		3BG8	0	600	1130	110	223.905	0.792	1.35	1.52	0.00	
77	3CG7		3CG8	0	600	1680	110	1.375	0.005	0.00	0.00	0.00	
78	3CG1		3CG7	0	800	1080	110	266.880	0.531	0.46	0.49	0.00	
79	3CG3		3DF1	0	600	1060	110	70.245	0.248	0.16	0.17	0.00	
80	3DF1		3DF2	0	600	590	110	202.594	0.717	1.12	0.66	0.00	
81	3DF2		3CF5	0	600	470	110	160.994	0.569	0.73	0.34	0.00	
82	3CF5		3DF4	0	600	890	110	160.994	0.569	0.73	0.65	0.00	
83	2DFD		3DF1	0	600	220	110	132.349	0.468	0.51	0.12	0.00	
84	2DF4		2DFD	0	600	1100	110	167.969	0.594	0.79	0.87	0.00	
85	2DG4		2DF4	0	600	1080	90	162.423	0.574	1.08	1.16	0.00	
86	2DG6		2DFA	0	350	1740	90	19.879	0.207	0.31	0.53	0.00	
87	2DF5		2DFA	0	350	480	90	29.189	0.303	0.62	0.30	0.00	
88	2DFB		2DF4	0	600	700	90	68.336	0.242	0.22	0.15	0.00	
89	2EF5		2DFB	0	600	570	90	116.508	0.412	0.58	0.33	0.00	
90	2EFB		2DF5	0	500	480	90	61.119	0.311	0.43	0.21	0.00	
91	2EF9		2EFB	0	550	1560	90	97.916	0.412	0.65	1.00	0.00	
92	2DH2		2DH3	0	800	400	110	561.885	1.118	1.82	0.72	0.00	
93	2DH2		2DH5	0	800	340	110	125.864	0.250	0.11	0.03	0.00	
94	2DH5		3DH6	0	800	280	110	357.001	0.710	0.79	0.22	0.00	
95	3DH6		3CH2	0	600	1650	110	214.129	0.757	1.24	2.05	0.00	
96	3CH2		3CHC	0	600	710	110	305.727	1.081	2.40	1.70	0.00	
97	3CHC		3CH1	0	600	170	110	264.127	0.934	1.83	0.31	0.00	
98	3CH6		3CH1	0	800	660	110	156.754	0.554	0.70	0.46	0.00	
99	3CH1		3CH3	0	600	310	110	215.247	0.761	1.25	0.39	0.00	
100	3CH3		3BHA	0	600	1010	110	173.647	0.614	0.84	0.85	0.00	
101	3CH1		3CH7	0	600	130	110	164.034	0.580	0.76	0.10	0.00	
102	3CH7		3BH9	0	600	1000	110	150.774	0.533	0.65	0.65	0.00	
103	3CJ1		3CH5	0	1350	1080	110	1736.706	1.213	1.15	1.24	0.00	
104	3CJ5		3CJ1	0	1650	580	110	1749.966	0.818	0.44	0.26	0.00	
105	3CJ2		3CJ5	0	1650	1480	110	1763.226	0.825	0.44	0.66	0.00	
106	3CJ6		3CJ2	0	1650	300	110	2249.622	1.052	0.70	0.21	0.00	
107	3AH1		3AH6	0	400	280	110	30.262	0.241	0.24	0.06	0.00	
108	3AH5		3AH2	0	400	890	110	32.577	0.259	0.27	0.25	0.00	
109	3BH3		3AH5	0	400	520	110	63.524	0.506	0.91	0.49	0.00	
110	3AH5		3AH3	0	400	430	110	44.725	0.356	0.49	0.21	0.00	
111	3AH4		3AH3	0	400	780	110	1.945	0.015	0.00	0.00	0.00	
112	3AJ1		3AH4	0	400	890	110	24.811	0.197	0.17	0.14	0.00	
113	3AJ2		3AJ1	0	400	1020	110	86.853	0.691	1.68	1.72	0.00	
114	3AJ3		3AJ2	0	400	600	110	125.480	0.999	3.32	2.00	0.00	
115	3BJ5		3AJ3	0	600	499	110	235.315	0.832	1.48	0.72	0.00	
116	3BK1		3BJ5	0	600	970	110	262.225	0.927	1.80	1.75	0.00	
117	3AJ3		3AK2	0	300	890	110	56.015	0.792	3.04	2.71	0.00	
118	3AK2		3AK1	0	300	880	110	29.105	0.412	0.90	0.79	0.00	
119	3AK1		3AK3	0	300	770	110	2.195	0.031	0.01	0.01	0.00	
120	3CK4		3CK1	0	800	440	110	389.668	0.775	0.93	0.40	0.00	

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NO	Node(U)	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
121	3CK1	3BK1	0	800	2130	110	362.756	0.722	0.81	1.73	0.00	
122	3BK1	3AK3	0	300	2290	110	51.625	0.730	2.61	5.98	0.00	
123	3BK1	3BJ3	0	800	1300	110	21.995	0.044	0.00	0.01	0.00	
124	3BJ3	3BJ2	0	250	1530	110	34.953	0.712	3.08	4.71	0.00	
125	3AJ2	3BJ2	0	250	620	110	11.717	0.239	0.41	0.25	0.00	
126	3BJ3	3BJ8	0	800	580	110	410.519	0.817	1.02	0.59	0.00	
127	3BJ8	3BJ4	0	800	1140	110	363.849	0.724	0.81	0.93	0.00	
128	3BJ4	3BH9	0	800	1100	110	252.210	0.502	0.41	0.45	0.00	
129	3BH9	3BHC	0	600	150	110	356.314	1.260	3.18	0.48	0.00	
130	3BHC	3BHA	0	600	140	110	55.834	0.197	0.10	0.01	0.00	
131	3BHA	3BH8	0	600	170	110	187.882	0.664	0.97	0.17	0.00	
132	3BHC	3BH5	0	600	1760	110	253.810	0.898	1.70	2.99	0.00	
133	3BH5	3BH3	0	600	340	110	136.667	0.483	0.54	0.18	0.00	
134	3BH5	3BH6	0	400	420	110	70.473	0.561	1.14	0.48	0.00	
135	3BH6	3AH4	0	300	650	110	23.803	0.337	0.62	0.40	0.00	
136	3BH3	3AH5	0	400	570	110	60.448	0.481	0.86	0.49	0.00	
137	3BJ6	3AJ1	0	250	1060	110	18.298	0.373	0.93	0.99	0.00	
138	3BJ4	3BJ6	0	250	1340	110	32.806	0.668	2.74	3.67	0.00	
139	3BJ4	3BJ6	0	250	1390	110	32.163	0.655	2.64	3.67	0.00	
140	3BJ9	3BJ3	0	800	820	110	393.056	0.782	0.94	0.77	0.00	
141	3CJ2	3BJ9	0	800	840	110	439.726	0.875	1.16	0.98	0.00	
142	3BJ7	3BJ3	0	250	1190	110	17.816	0.363	0.89	1.06	0.00	
143	3CJ3	3BJ7	0	250	800	110	23.634	0.481	1.49	1.19	0.00	
144	3CJ3	3BJ7	0	400	820	110	80.366	0.640	1.46	1.19	0.00	
145	3BJ7	3BJ3	0	400	1270	110	59.274	0.472	0.83	1.06	0.00	
146	3CJ3	3CJ6	0	1800	680	110	2200.686	0.865	0.44	0.29	0.00	
147	3CK2	3CJ3	0	1800	2010	110	2259.022	0.888	0.46	0.93	0.00	
148	3CK2	3CK4	0	800	990	110	416.576	0.829	1.05	1.04	0.00	
149	DC-R1	3CK2	0	1800	340	110	2600.000	1.022	0.60	0.20	0.00	
150	2CK3	3CK2	0	800	210	110	102.507	0.204	0.08	0.02	0.00	
151	2DK3	2CK3	0	800	600	110	248.740	0.495	0.40	0.24	0.00	
152	2EL1	2EK3	0	300	2410	110	13.322	0.188	0.21	0.51	0.00	
153	2FK2	2FK4	0	200	500	110	10.457	0.333	0.98	0.49	0.00	
154	2FK4	2FK3	0	250	680	110	15.622	0.318	0.69	0.47	0.00	
155	2FK3	2EK1	0	300	2580	110	18.444	0.261	0.39	1.00	0.00	
156	2EK1	2EK2	0	800	260	110	441.156	0.878	1.16	0.31	0.00	
157	2EK2	2EK3	0	800	830	110	345.214	0.687	0.74	0.61	0.00	
158	2EK2	2DK5	0	250	3200	110	22.232	0.453	1.33	4.27	0.00	
159	2DK5	2DK4	0	250	130	110	22.232	0.453	1.33	0.17	0.00	
160	2CJ1	2DK4	0	250	1210	110	5.707	0.116	0.11	0.13	0.00	
161	2CJ1	3CJ3	0	250	180	110	37.321	0.760	3.48	0.63	0.00	
162	2CJ7	3CJ6	0	300	290	110	62.196	0.880	3.68	1.06	0.00	
163	2CJ4	2CJ7	0	600	840	110	262.236	0.927	1.80	1.52	0.00	
164	2CJ3	2CJ4	0	600	150	110	262.236	0.927	1.80	0.27	0.00	
165	2DJ2	2CJ3	0	300	1230	110	37.500	0.531	1.44	1.78	0.00	
166	2DJ2	2DJ1	0	200	1150	110	12.270	0.391	1.32	1.52	0.00	
167	2EJA	2DJ1	0	250	700	110	42.850	0.873	4.49	3.15	0.00	
168	2EJA	2EK1	0	800	1720	110	254.060	0.505	0.42	0.72	0.00	
169	2EJ6	2EJA	0	800	100	110	726.151	1.445	2.93	0.29	0.00	
170	2EJ4	2EJ6	0	300	910	110	14.941	0.211	0.26	0.25	0.00	
171	2FJ3	2EJ4	0	1200	2620	110	332.552	0.294	0.10	0.25	0.00	
172	2FK1	2FJ3	0	200	610	110	3.868	0.123	0.16	0.09	0.00	
173	2EJ1	2EH1	0	1000	1790	110	988.566	1.259	1.75	3.13	0.00	
174	2EH1	2DH1	0	400	380	110	80.831	0.643	1.47	0.56	0.00	
175	2DH1	2DH6	0	250	1800	110	17.088	0.348	0.82	1.48	0.00	
176	2DJ2	2DH6	0	300	1520	110	44.491	0.629	1.98	3.02	0.00	
177	2EJA	2DJ2	0	800	1900	110	374.120	0.744	0.86	1.63	0.00	
178	2EJ4	2EJ6	0	1200	990	110	558.590	0.494	0.25	0.25	0.00	
179	2EJ3	2EJ4	0	600	1000	110	314.689	1.113	2.53	2.53	0.00	
180	2EJ3	2EJ2	0	500	160	110	161.716	0.824	1.79	0.29	0.00	

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NO	Node(U)	-	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
181	2EJ2		2EH1	0	500	880	110	112.706	0.574	0.92	0.81	0.00	
182	2EH7		2EH1	0	500	190	110	131.813	0.702	1.33	0.25	0.00	
183	2EH5		2EH7	0	500	190	110	186.823	0.951	2.34	0.45	0.00	
184	2EJ7		2EH5	0	500	790	110	200.228	1.020	2.66	2.10	0.00	
185	2EJ7		2EJ8	0	1000	660	110	1343.725	1.711	3.08	2.03	0.00	
186	2EJ8		2EJ1	0	1000	800	110	1270.015	1.617	2.78	2.22	0.00	
187	2EH4		2EG7	0	500	2580	110	201.509	1.026	2.69	6.95	0.00	
188	2EG5		2EG7	0	250	90	110	95.912	1.954	19.95	1.80	0.00	
189	2EH3		2EH6	0	800	600	110	583.393	1.161	1.95	1.18	0.00	
190	2EH5		2EH3	0	800	860	110	771.300	1.531	3.27	2.81	0.00	
191	2EH3		2EH2	0	300	1050	110	67.790	0.959	4.32	4.51	0.00	
192	2EH2		2EH9	0	300	550	110	59.250	0.838	3.37	1.85	0.00	
193	2EH9		2EH8	0	300	490	110	10.240	0.145	0.13	0.07	0.00	
194	2DG5		2EH8	0	300	1310	110	38.770	0.548	1.54	2.02	0.00	
195	2DG5		2DH5	0	800	1250	110	268.451	0.534	0.46	0.58	0.00	
196	2EH1		2DH2	0	1000	1940	110	811.688	1.072	1.30	2.52	0.00	
197	2EH1		2DH4	0	300	430	110	35.434	0.502	1.30	0.56	0.00	
198	2DH4		2DH6	0	300	1840	110	27.288	0.386	0.80	1.48	0.00	
199	2DH4		2DH6	0	250	1860	110	16.788	0.342	0.79	1.48	0.00	
200	2FH1		2EH5	0	800	980	110	806.905	1.605	3.56	3.48	0.00	
201	2EH6		2FH4	0	300	1440	110	24.825	0.351	0.67	0.97	0.00	
202	2FH3		2FH4	0	300	450	110	24.185	0.342	0.64	0.29	0.00	
203	2EG7		2EG3	0	300	990	110	63.702	0.901	3.85	3.81	0.00	
204	3CH6		3CH4	0	600	620	110	331.703	1.173	2.79	1.73	0.00	
205	2FG9		2EF6	0	800	1420	110	361.498	0.719	0.81	1.15	0.00	
206	2FG2		2FG9	0	800	450	110	350.821	0.698	0.76	0.34	0.00	
207	2FGD		2FG2	0	800	430	110	362.811	0.722	0.81	0.35	0.00	
208	2FG4		2FGD	0	800	140	110	386.341	0.769	0.91	0.12	0.00	
209	2FG8		2FG4	0	800	600	110	595.407	1.185	2.03	1.22	0.00	
210	2FGC		2FGB	0	600	1470	90	157.530	0.557	1.02	1.50	0.00	
211	2FGB		2EFD	0	600	430	90	134.000	0.474	0.76	0.33	0.00	
212	2EFD		2FF4	0	600	390	90	23.530	0.083	0.03	0.01	0.00	
213	2DG1		2DG8	0	250	430	110	27.635	0.563	2.00	0.86	0.00	
214	2EG6		2DG1	0	300	2880	110	16.794	0.238	0.33	0.94	0.00	
215	2FG5		2EG5	0	800	1250	110	3.426	0.007	0.00	0.00	0.00	
216	2FG5		2FGA	0	300	780	110	57.737	0.817	3.21	2.51	0.00	
217	2FGA		2FG9	0	300	990	110	34.207	0.484	1.22	1.20	0.00	
218	2EFA		2EF9	0	550	790	90	152.366	0.557	1.13	0.89	0.00	
219	2FG1		2EFA	0	600	1350	90	103.406	0.366	0.47	0.64	0.00	
220	2FG4		2FG1	0	600	340	90	185.536	0.656	1.38	0.46	0.00	
221	2FG1		2FG3	0	400	260	110	24.679	0.196	0.16	0.05	0.00	
222	2FG2		2FG3	0	400	260	110	22.381	0.178	0.14	0.01	0.00	
223	2FG3		2FF7	0	400	570	110	23.530	0.187	0.15	0.08	0.00	
224	2FG6		2FG7	0	800	120	110	823.527	1.638	3.69	0.44	0.00	
225	2FH2		2FH6	0	1000	510	110	1029.769	1.311	1.88	1.01	0.00	
226	2FK2		2FK1	0	200	1830	110	4.378	0.139	0.20	0.36	0.00	
227	2FK2		2FK4	0	800	510	110	397.768	0.791	0.96	0.49	0.00	
228	2FJ2		2FJ5	0	300	100	110	142.022	2.009	16.97	1.70	0.00	
229	2FJ1		2FJ2	0	1000	1100	110	1416.716	1.804	3.40	3.74	0.00	
230	2FJ1		2EJ7	0	1350	1200	110	2167.778	1.514	1.73	2.08	0.00	
231	2EJ7		2EJ3	0	600	240	110	550.115	1.946	7.11	1.70	0.00	
232	2FJ3		2FJ4	0	200	1130	110	0.755	0.024	0.01	0.01	0.00	
233	2FJ5		2FJ4	0	200	740	110	9.722	0.309	0.86	0.63	0.00	
234	2FK3		2EK1	0	800	2610	110	242.362	0.482	0.38	1.00	0.00	
235	2FK4		2FK3	0	800	740	110	318.891	0.634	0.61	0.47	0.00	
236	2FJ2		2FH5	0	1000	300	110	1200.984	1.529	2.50	0.75	0.00	
237	2FH5		2FH2	0	1000	870	110	1151.974	1.467	2.32	2.02	0.00	
238	2FH2		2FH3	0	300	470	110	73.195	1.035	4.98	2.34	0.00	
239	2FH8		2FJ1	0	1500	300	110	3658.205	2.070	2.73	0.82	0.00	
240	2FH9		2FH8	0	1500	230	110	3707.215	2.098	2.80	0.64	0.00	

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NO	Node(U)	-> Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
241	2FH9	2FH7	0	800	220	110	904.925	1.800	4.40	0.97	0.00	
242	2FH7	2FH1	0	800	300	110	855.915	1.703	3.97	1.19	0.00	
243	PULOG	2FH9	0	1500	310	110	4612.140	2.610	4.19	1.30	0.00	
244	2EH1	2EH2	0	300	960	110	46.580	0.659	2.16	2.07	0.00	
245	2EH3	2EH1	0	400	2120	110	71.107	0.566	1.16	2.47	0.00	
246	3CH4	3BH7	0	600	1570	90	206.769	0.731	1.69	2.65	0.00	
247	3CGD	3CG1	0	350	850	90	25.454	0.265	0.48	0.43	0.00	
248	3CG5	3CG1	0	350	210	90	16.146	0.168	0.21	0.04	0.00	
249	2EG5	2DG5	0	800	1900	110	314.531	0.685	0.74	1.40	0.00	
250	2FK1	2FJ3	0	1200	680	110	407.791	0.361	0.14	0.09	0.00	
251	2FGE	2FG6	0	1000	240	110	980.759	1.249	1.72	0.42	0.00	
252	2FH6	2FGE	0	1000	1180	110	980.759	1.249	1.72	2.03	0.00	
253	2FG6	X012	0	800	910	110	84.692	0.168	0.05	0.05	0.00	
254	X012	2FG5	0	800	300	110	84.692	0.168	0.05	0.01	0.00	
255	2FGF	2FG8	0	800	600	110	546.958	1.088	1.73	1.04	0.00	
256	2FG7	2FGF	0	800	150	110	546.958	1.088	1.73	0.26	0.00	
257	2DG3	2DG2	0	600	140	90	148.044	0.524	0.91	0.13	0.00	
258	2DG4	2DG3	0	600	770	90	183.664	0.650	1.35	1.04	0.00	
259	X021	2EG4	0	500	160	110	81.353	0.414	0.50	0.09	0.00	
260	2EG6	X021	0	500	590	110	81.353	0.414	0.50	0.29	0.00	
261	X020	2EG5	0	800	360	110	509.557	1.014	1.52	0.54	0.00	
262	2EH6	X020	0	800	870	110	509.557	1.014	1.52	1.32	0.00	
263	X019	2EJ6	0	800	290	110	226.330	0.450	0.34	0.10	0.00	
264	2EJ1	X019	0	800	380	110	226.330	0.450	0.34	0.13	0.00	
265	3BF1	3BE7	0	600	1070	110	23.096	0.082	0.02	0.02	0.00	
266	X018	3CH4	0	600	150	90	29.224	0.103	0.05	0.00	0.00	
267	3CG2	X018	0	600	480	90	29.224	0.103	0.05	0.03	0.00	
268	3AJ3	3AJ4	0	300	570	110	26.910	0.381	0.78	0.45	0.00	
269	3AK3	3AL1	0	300	2630	110	26.910	0.381	0.78	2.05	0.00	
270	2DK1	2DK2	0	600	1150	110	100.660	0.356	0.31	0.35	0.00	
271	2DK2	2CK1	0	300	3340	110	26.950	0.381	0.78	2.62	0.00	
272	2DK1	2DK3	0	800	1320	110	282.410	0.562	0.51	0.67	0.00	
273	2EK3	2DK1	0	800	1990	110	456.779	0.909	1.24	2.47	0.00	
274	2CJ9	3CJ3	0	250	200	110	35.254	0.718	3.13	0.63	0.00	
275	2CJ9	2DK4	0	250	1200	110	5.732	0.117	0.11	0.13	0.00	
276	2DH6	2CH1	0	250	1870	110	19.425	0.396	1.04	1.94	0.00	
277	2CH1	3CH2	0	250	200	110	41.350	0.842	4.21	0.84	0.00	
278	2DH6	2CH2	0	300	1900	110	31.113	0.440	1.02	1.94	0.00	
279	2CH2	3CH2	0	300	220	110	63.508	0.898	3.83	0.84	0.00	
280	2FK5	2EL1	0	800	3020	110	258.985	0.515	0.43	1.32	0.00	
281	2CK2	2CK1	0	300	1130	110	6.720	0.095	0.06	0.07	0.00	
282	2CK3	2CK2	0	300	1200	110	40.390	0.571	1.66	1.99	0.00	
283	2CK3	2CJ9	0	600	1900	110	72.172	0.255	0.17	0.32	0.00	
284	2CJ1	2CJ9	0	600	70	110	2.484	0.009	0.00	0.00	0.00	
285	2DH2	2CH2	0	500	2030	110	98.820	0.503	0.72	1.46	0.00	
286	2CH2	2CH1	0	500	80	110	11.305	0.058	0.01	0.00	0.00	
287	2CJ7	2CH1	0	500	4110	110	65.739	0.335	0.34	1.39	0.00	
288	2CJ7	2CJ1	0	600	730	110	79.181	0.280	0.20	0.14	0.00	
289	3BE7	3BE4	0	600	80	110	23.096	0.082	0.02	0.01	0.00	
290	2FG8	2FGC	0	600	510	110	181.060	0.640	0.91	0.46	0.00	
291	2FK2	2FK5	0	800	1530	110	332.695	0.662	0.69	1.05	0.00	
292	3DH6	3DH5	0	400	150	110	129.615	1.031	3.53	0.53	0.00	
293	2DJ2	2CJ3	0	600	1310	110	224.737	0.795	1.36	1.78	0.00	
294	2EL1	2EK3	0	800	2520	110	171.954	0.342	0.20	0.51	0.00	
295	2FK2	2FK1	0	1200	1890	110	480.991	0.425	0.19	0.36	0.00	
296	2EF5	2DF5	0	500	132	110	41.379	0.226	0.16	0.02	0.00	
297	2EFB	2EFC	0	550	77	110	2.317	0.010	0.00	0.01	0.00	
298	2DFA	2DFB	0	350	103	110	14.618	0.152	0.12	0.01	0.00	
299	2DG1	2DG6	0	350	87	110	114.587	1.191	5.39	0.47	0.00	
300	2DG8	2EG1	0	300	564	110	6.615	0.094	0.06	0.03	0.00	

<<ZONE-2 3(2005)>>

Pipe-page : 6

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
301	2FG1		2FG2	0	600	172	110	33.921	0.120	0.01	0.01	0.00	
302	2FG7		2FG8	0	600	769	110	253.039	0.895	1.69	1.30	0.00	
303	2EFD		2EFA	0	600	127	110	86.940	0.307	0.23	0.03	0.00	
304	2FJ5		2FJ4	0	400	780	110	58.591	0.466	0.81	0.63	0.00	
305	2FJ3		2FJ4	0	400	1149	110	4.642	0.037	0.01	0.01	0.00	
306	BRN3		2FK2	0	1800	5934	110	1300.000	0.511	0.17	0.65	0.00	

3.1.3 The Results of Preliminary Primary Pipe Network Analysis for Zone 4 (2005)

<<ZONE-4 (2005)>>

Node Data

Node-page : 1

NO	Node	Type	Q (l/sec)	WL (m)	GL (m)	EH (m)	Comments
1	4BX1	0	79.950	34.43	2.00	32.43	
2	4CX1	0	79.950	34.70	7.00	27.70	
3	4CA1	0	169.130	34.95	7.00	27.95	
4	4DX1	0	79.950	35.43	13.00	22.43	
5	4EA6	0	0.000	36.16	15.00	21.16	
6	4DD8	0	67.860	34.50	1.30	33.20	
7	4DC2	0	45.240	35.73	4.00	31.73	
8	4CD3	0	67.860	34.47	1.20	33.27	
9	4DD4	0	0.000	34.54	5.10	29.44	
10	4EC8	0	45.240	35.53	10.90	24.63	
11	4FC4	0	64.350	35.58	10.80	24.78	
12	4CC5	0	19.110	35.63	12.00	23.63	
13	4EA1	0	71.110	36.69	7.00	29.69	
14	4FA1	0	71.110	36.40	10.00	26.40	
15	4FB1	0	71.110	36.41	10.00	26.41	
16	4EB2	0	71.110	37.13	8.00	29.13	
17	4EB3	0	71.110	37.07	7.00	30.07	
18	4EB1	0	45.240	37.07	6.00	31.07	
19	4DB2	0	45.240	37.06	5.00	32.06	
20	4DB1	0	89.180	37.10	3.00	34.10	
21	4DA1	0	89.180	36.27	3.00	33.27	
22	4BA1	0	89.180	35.77	1.00	34.77	
23	4CA2	0	89.180	35.52	2.10	33.42	
24	4BB1	0	175.630	35.77	0.50	35.27	
25	4BB2	0	175.630	37.38	1.00	36.38	
26	4BC2	0	175.630	43.33	1.00	42.33	
27	4CC2	0	89.180	49.77	1.00	48.77	
28	4CC1	0	157.040	37.50	4.00	33.50	
29	4GC4	0	19.110	35.88	18.00	17.88	
30	DC-R6	1	-2,451.930	50.00	0.00	50.00	
31	4CC4	0	89.180	42.83	4.00	38.83	
32	4CB1	0	89.180	38.60	1.00	37.60	
33	4DC1	0	45.240	37.23	2.00	35.23	
34	4EC2	0	45.240	37.07	10.00	27.07	
35	4EC3	0	45.240	37.24	10.00	27.24	
36	4EC1	0	45.240	36.20	4.00	32.20	
37	4EC6	0	45.240	35.12	7.00	28.12	
38	4EC7	0	67.860	34.82	6.00	28.82	
39	4ED1	0	67.860	34.73	6.00	28.73	
40	4EC5	0	45.240	35.56	11.00	24.56	
41	4EC4	0	45.240	37.26	10.00	27.26	
42	4FC1	0	45.240	37.31	10.00	27.31	
43	DC-R4	0	-1,560.000	37.40	2.00	35.40	
44	4FC3	0	45.240	36.29	14.00	22.29	
45	4FC2	0	45.240	36.25	11.00	25.25	
46	4CC3	0	45.240	35.99	4.00	31.99	
47	4DA2	0	169.130	35.51	3.00	32.51	
48	4BA3	0	169.130	34.87	1.00	33.87	
49	4BA2	0	169.130	34.84	3.00	31.84	
50	4AA1	0	79.950	34.44	0.50	33.94	
51	4EA2	0	160.290	36.61	6.60	30.01	
52	4CD1	0	67.860	34.48	1.51	32.97	
53	4EA4	0	71.110	36.44	4.80	31.64	

<<ZONE-4 (2005)>>

Branch Data

Pipe-page : 1

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
1	4AA1		4BX1	0	600	2350	110	8.524	0.030	0.00	0.01	0.00	
2	4CX1		4BX1	0	600	1660	110	71.426	0.253	0.16	0.27	0.00	
3	4CA1		4CX1	0	500	1260	110	49.259	0.251	0.20	0.25	0.00	
4	4CA1		4BA2	0	900	2010	110	115.104	0.181	0.05	0.11	0.00	
5	4CA2		4CA1	0	600	1510	110	112.731	0.399	0.38	0.57	0.00	
6	4DA2		4CA1	0	800	1740	110	220.763	0.439	0.32	0.56	0.00	
7	4DX1		4CX1	0	600	2330	110	102.117	0.361	0.32	0.73	0.00	
8	4DA2		4DX1	0	700	1290	110	63.024	0.164	0.06	0.08	0.00	
9	4EA6		4DX1	0	600	1740	110	119.043	0.421	0.42	0.73	0.00	
10	4EA4		4EA6	0	800	2740	110	119.043	0.237	0.10	0.28	0.00	
11	4DC2		4DD8	0	400	2050	110	49.734	0.395	0.60	1.23	0.00	
12	4DD4		4DD8	0	800	1200	110	65.308	0.130	0.03	0.04	0.00	
13	4FC4		4EC8	0	500	720	110	27.718	0.141	0.07	0.05	0.00	
14	4GC5		4FC4	0	500	1370	110	19.873	0.101	0.04	0.05	0.00	
15	4EA1		4FA1	0	600	3030	110	54.381	0.192	0.10	0.29	0.00	
16	4FB1		4FA1	0	600	1690	110	16.729	0.059	0.01	0.01	0.00	
17	4EB2		4FB1	0	700	2190	110	156.406	0.406	0.33	0.72	0.00	
18	4EB2		4EB3	0	1800	970	110	741.690	0.291	0.06	0.06	0.00	
19	4EB3		4EB1	0	1350	1410	110	62.037	0.013	0.00	0.00	0.00	
20	4EB1		4DB2	0	1350	1750	110	76.426	0.053	0.00	0.01	0.00	
21	4DB1		4DB2	0	1200	1230	110	178.950	0.158	0.03	0.04	0.00	
22	4DB1		4DA1	0	900	2090	110	337.584	0.531	0.40	0.83	0.00	
23	4BA1		4CA2	0	600	1870	110	63.678	0.225	0.13	0.25	0.00	
24	4BB2		4BB1	0	600	1840	110	177.395	0.627	0.88	1.61	0.00	
25	4BC2		4BB2	0	600	2210	110	325.595	1.152	2.69	5.95	0.00	
26	4CC2		4BC2	0	700	2260	110	501.225	1.302	2.82	6.41	0.00	
27	4CC2		4CC1	0	600	1880	110	525.362	1.858	6.53	12.27	0.00	
28	DC-R6		4CC2	0	1800	450	110	2451.930	0.964	0.54	0.23	0.00	
29	4CC2		4CC4	0	300	270	110	177.718	2.514	25.70	6.91	0.00	
30	4CC2		4CB1	0	500	2500	110	264.857	1.349	4.47	11.17	0.00	
31	4CB1		4BB2	0	300	1510	110	27.430	0.388	0.81	1.22	0.00	
32	4CB1		4BA1	0	800	2230	110	462.722	0.921	1.27	2.83	0.00	
33	4BB1		4BA1	0	600	880	110	1.765	0.006	0.00	0.00	0.00	
34	4DA1		4CA2	0	600	1350	110	138.233	0.489	0.55	0.75	0.00	
35	4CB1		4DB1	0	1000	2310	110	579.112	0.737	0.65	1.50	0.00	
36	4CC1		4DB1	0	400	2110	110	26.602	0.212	0.19	0.40	0.00	
37	4CC1		4DC1	0	800	990	110	201.506	0.401	0.27	0.27	0.00	
38	4DC1		4EB1	0	600	1640	110	53.942	0.191	0.10	0.16	0.00	
39	4EC2		4EB1	0	600	1280	110	5.688	0.020	0.00	0.00	0.00	
40	4EB3		4EA1	0	1350	2310	110	608.543	0.425	0.17	0.38	0.00	
41	4EC3		4EB2	0	500	1220	110	32.708	0.167	0.09	0.11	0.00	
42	4EC3		4EC2	0	900	1360	110	181.281	0.285	0.13	0.17	0.00	
43	4CC2		4CB1	0	800	2600	110	893.587	1.778	4.30	11.17	0.00	
44	4DC1		4EC1	0	600	3250	110	102.324	0.362	0.32	1.03	0.00	
45	4EC1		4EC6	0	500	460	110	187.438	0.955	2.36	1.08	0.00	
46	4EC6		4EC7	0	600	270	110	201.028	0.711	1.10	0.30	0.00	
47	4EC7		4ED1	0	600	180	110	133.168	0.471	0.52	0.09	0.00	
48	4ED1		4DD4	0	600	1340	110	65.308	0.231	0.14	0.19	0.00	
49	4EC5		4EC6	0	500	1590	110	58.830	0.300	0.28	0.44	0.00	
50	4EC4		4EC5	0	500	1610	110	121.592	0.619	1.06	1.70	0.00	
51	4EC4		4EC3	0	1000	120	110	238.093	0.303	0.13	0.02	0.00	
52	4FC1		4EC4	0	1200	480	110	360.030	0.318	0.11	0.05	0.00	
53	DC-R4		4FC1	0	1800	360	110	1560.000	0.613	0.23	0.09	0.00	
54	4FC1		4FC3	0	600	1550	110	152.201	0.538	0.66	1.02	0.00	
55	4FC3		4FC2	0	500	400	110	31.767	0.177	0.10	0.04	0.00	
56	4FB1		4FC2	0	500	450	110	68.567	0.319	0.37	0.16	0.00	
57	4FC2		4GC4	0	500	1370	110	58.093	0.296	0.27	0.37	0.00	
58	4FC3		4FC4	0	500	1760	110	72.194	0.368	0.40	0.71	0.00	
59	4EC5		4EC8	0	500	850	110	17.522	0.089	0.03	0.03	0.00	
60	4EC2		4EC1	0	600	1760	110	130.353	0.461	0.50	0.87	0.00	

<<ZONE-4 (2005)>>

Pipe page : 2

NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
61	4CC3		4CC3	0	400	370	110	140.214	1.116	4.08	1.51	0.00	
62	4CC3		4DC2	0	400	130	110	94.974	0.756	1.99	0.26	0.00	
63	4DD8		4CD3	0	800	1540	110	47.182	0.094	0.02	0.03	0.00	
64	4DA1		4DA2	0	1000	1830	110	452.917	0.577	0.41	0.76	0.00	
65	4BA1		4BA3	0	800	1460	110	311.629	0.620	0.61	0.90	0.00	
66	4BA3		4BA2	0	800	1430	110	54.026	0.107	0.02	0.03	0.00	
67	4BA3		4AA1	0	600	1810	110	88.474	0.313	0.24	0.43	0.00	
68	4EA1		4EA2	0	1200	440	110	483.052	0.427	0.19	0.08	0.00	
69	4CC4		4CD1	0	300	1180	110	88.538	1.253	7.08	8.35	0.00	
70	4CD1		4CD3	0	800	1280	110	20.678	0.011	0.00	0.01	0.00	
71	4GC4		4GC5	0	500	1920	110	38.983	0.199	0.13	0.25	0.00	
72	4EA4		4DA1	0	1200	1760	110	342.746	0.303	0.10	0.17	0.00	
73	4EA2		4EA4	0	1200	1810	110	322.762	0.285	0.09	0.17	0.00	
74	4DB2		4EA4	0	800	2100	110	210.137	0.418	0.30	0.62	0.00	
75	4EC3		4EB2	0	1800	1260	110	936.498	0.368	0.09	0.11	0.00	
76	4EC4		4EC3	0	1800	160	110	957.634	0.376	0.09	0.02	0.00	
77	4FC1		4EC4	0	1800	520	110	1002.529	0.394	0.10	0.05	0.00	

3.1.4 The Results of Preliminary Primary Pipe Network Analysis for Zone 5 and Zone 6 (2005)

<<ZONE-5_6(2005)>>

Node Data

Node-page : 1

NO	Node	Type	Q (l/sec)	EL (m)	GL (m)	FH (m)	Comments
1	6FK1	0	31.710	59.37	13.00	46.37	
2	6GG8	0	0.000	55.00	17.00	38.00	
3	6GGG	0	42.120	53.53	17.00	36.53	
4	6GG3	0	42.120	52.37	18.00	34.37	
5	6GGJ	0	37.310	51.72	20.00	31.72	
6	6HG3	0	37.310	51.12	20.00	31.12	
7	6HG1	0	37.310	50.97	20.00	30.97	
8	6HG8	0	37.310	50.85	24.00	26.85	
9	6HG5	0	37.310	50.78	23.00	27.78	
10	6HG7	0	39.000	51.62	22.00	29.62	
11	6HH2	0	39.000	51.22	21.50	29.72	
12	6HH6	0	39.000	51.22	20.00	31.22	
13	6HH5	0	39.000	51.51	20.00	31.51	
14	6HH4	0	39.000	52.49	24.00	28.49	
15	6GH3	0	42.120	53.35	18.00	34.35	
16	6GG9	0	42.120	53.11	16.00	37.11	
17	6GGE	0	42.120	52.74	16.50	36.24	
18	6GGF	0	42.120	51.80	22.00	29.80	
19	6GGB	0	42.120	51.46	21.00	30.46	
20	6GGM	0	0.000	51.53	20.00	31.53	
21	6GGN	0	0.000	52.06	18.00	34.06	
22	6GGH	0	0.000	53.53	18.00	35.53	
23	6GG4	0	0.000	54.67	16.30	38.37	
24	6GG2	0	42.120	54.86	17.00	37.86	
25	6GG6	0	42.120	55.07	16.50	38.57	
26	6GGA	0	42.120	55.10	16.50	38.60	
27	6GGC	0	42.120	55.38	16.00	39.38	
28	6GG7	0	42.120	54.67	14.50	40.17	
29	6GH2	0	42.120	54.46	18.00	36.46	
30	6GH1	0	31.710	55.84	10.00	45.84	
31	6GJ3	0	34.710	55.90	15.00	40.90	
32	6GJ1	0	34.710	58.71	8.00	50.71	
33	6GK2	0	34.710	60.37	9.00	51.37	
34	6GK3	0	34.710	59.62	10.00	49.62	
35	6GK1	0	34.710	59.44	13.00	46.44	
36	6GGD	0	42.120	54.05	14.80	39.25	
37	6GH6	0	31.710	55.36	14.00	41.36	
38	6HH3	0	31.710	56.47	20.00	36.47	
39	6HJ1	0	34.710	57.30	11.00	46.30	
40	6HG1	0	37.310	50.93	20.00	30.93	
41	6HG2	0	37.310	50.87	20.00	30.87	
42	6HG5	0	37.310	49.44	24.00	25.44	
43	6HGA	0	37.310	49.22	21.00	28.22	
44	5HG1	0	59.670	48.68	18.00	30.68	
45	5HF5	0	59.670	48.67	21.00	27.67	
46	5GF2	0	44.350	49.31	20.50	28.81	
47	1GFF	0	0.000	49.49	20.50	28.99	
48	1GFE	0	0.000	49.85	18.00	31.85	
49	1GG1	0	43.810	50.52	17.00	33.52	
50	5GD2	0	76.570	47.58	12.00	35.58	
51	5GDE	0	28.730	47.76	14.00	33.76	
52	5GDB	0	28.730	47.77	15.00	32.77	
53	5GD3	0	28.730	47.77	16.00	31.77	
54	5HD1	0	28.730	47.80	24.00	23.80	
55	5GE4	0	41.330	48.43	14.00	34.43	
56	5GE6	0	41.330	48.16	14.00	34.16	
57	5HE2	0	101.000	47.77	24.00	23.77	
58	5HE3	0	101.000	47.77	22.00	25.77	
59	5HF2	0	59.670	48.52	25.00	23.52	
60	5HF4	0	0.000	48.62	21.00	27.62	

〈 ZONE-5_6(2005)〉

Node-page : 2

NO	Node	Type	Q (1/sec)	WL (m)	CL (m)	EH (m)	Comments
61	5HF3	0	30.030	48.46	25.00	23.46	
62	5JF1	0	30.030	48.09	30.00	18.09	
63	5JE2	0	30.030	47.07	28.00	19.07	
64	5HE7	0	59.670	47.64	22.00	25.64	
65	5HE4	0	44.330	48.22	22.00	26.22	
66	5HE5	0	44.330	48.35	22.00	26.35	
67	5HD1	0	28.730	48.82	24.00	24.82	
68	5HD2	0	28.730	49.35	24.00	25.35	
69	5HC2	0	76.570	50.42	21.00	29.42	
70	5HD5	0	28.730	47.87	24.00	23.87	
71	5HD7	0	28.730	46.90	24.00	22.90	
72	5HD6	0	28.730	47.74	24.00	23.74	
73	5HD8	0	28.730	47.56	24.00	23.56	
74	5GD7	0	28.730	47.90	21.00	26.90	
75	5GD6	0	28.730	48.02	22.00	26.02	
76	5GD4	0	28.730	48.19	22.10	26.09	
77	5GD8	0	28.730	48.14	22.00	26.14	
78	5GDA	0	28.730	47.97	17.50	30.47	
79	5GD9	0	28.730	47.82	17.70	30.12	
80	5GE1	0	28.730	48.01	12.00	36.01	
81	5GE3	0	44.330	48.01	14.00	34.01	
82	5HE1	0	44.330	47.34	24.00	23.34	
83	5GE2	0	28.730	47.82	18.00	29.82	
84	6HGC	0	37.310	50.53	23.00	27.53	
85	6JG4	0	0.000	48.86	32.00	16.86	
86	6JG2	0	163.410	46.29	39.00	7.29	
87	PSRBO	0	48.750	46.27	44.00	2.27	
88	6JG1	0	182.650	46.29	39.00	7.29	
89	6JG6	0	0.000	48.40	32.00	16.40	
90	6JG5	0	37.310	48.78	32.00	16.78	
91	6HG9	0	37.310	49.10	23.00	26.10	
92	5JE3	0	30.030	46.79	32.00	14.79	
93	5KE2	0	30.030	46.68	35.00	11.68	
94	5HE8	0	30.030	46.68	29.00	17.68	
95	5KE1	0	0.000	46.68	25.00	21.68	
96	5JE1	0	30.030	46.64	28.00	18.64	
97	5JE4	0	30.030	46.65	26.20	20.45	
98	5HE6	0	0.000	48.10	22.00	26.10	
99	5JD1	0	73.580	46.85	26.00	20.85	
100	5JD2	0	73.580	47.14	26.00	21.14	
101	5KD1	0	73.580	51.52	28.00	23.52	
102	5KD2	0	103.610	46.83	23.50	23.33	
103	CLDAK	0	0.000	46.83	23.00	23.83	
104	5KD4	0	0.000	51.59	31.50	20.09	
105	5JC2	0	73.580	52.59	32.00	20.59	
106	DC-R5	0	-2,080.000	53.41	26.00	27.41	
107	5JC1	0	65.390	51.51	27.00	24.51	
108	5HD3	0	28.730	48.78	24.00	24.78	
109	5GC2	0	76.570	49.49	18.00	31.49	
110	5GC1	0	76.570	49.51	18.00	31.51	
111	5GB1	0	65.390	49.93	20.00	29.93	
112	5HC1	0	65.390	50.47	23.00	27.47	
113	5GC3	0	76.570	48.42	18.00	30.42	
114	6GK4	0	34.710	59.86	12.00	47.86	
115	6GK5	0	34.710	60.36	10.00	50.36	
116	6HK2	0	34.710	60.93	17.00	43.93	
117	6HK1	0	34.710	61.68	15.00	46.68	
118	BUARN	1	-3,326.440	62.00	8.00	54.00	
119	6HJ2	0	34.710	59.65	12.00	47.65	
120	6HJ3	0	73.710	58.38	11.00	47.38	

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Node-page : 3

NO	Node	Type	Q (1/sec)	WL (m)	GL (m)	EH (m)	Comments
121	6GJ2	0	34.710	59.14	10.00	49.14	
122	6FK2	0	34.710	58.55	10.00	48.55	
123	6FJ2	0	34.710	57.71	11.00	46.71	
124	6GH1	0	34.710	56.77	13.00	43.77	
125	6GH5	0	34.710	55.94	12.00	43.94	
126	6GG5	0	0.000	54.80	16.30	38.50	
127	6FJ1	0	34.710	58.27	11.00	47.27	
128	6FK3	0	34.710	58.58	10.90	47.68	
129	6FK4	0	34.710	59.53	9.90	49.63	
130	6FJ3	0	34.710	57.37	12.10	45.27	
131	6FG1	0	42.120	56.12	14.20	41.92	
132	5GB2	0	65.390	49.76	21.00	28.76	
133	6HGD	0	39.000	51.96	22.00	29.96	
134	5FA1	0	27.690	49.75	11.30	38.45	
135	5GB3	0	27.690	49.78	14.50	35.28	
136	5KC1	0	73.580	52.38	31.80	20.58	
137	5KE5	0	33.150	46.65	39.80	6.85	
138	5Z03	0	0.000	50.97	27.47	23.50	
139	5Z01	0	0.000	46.70	24.75	21.95	
140	5Z05	0	0.000	46.84	26.12	20.72	

((ZONE-5_6(2005))

Branch Data

Pipe-page : 1

NO	Node(U)	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
1	6GCG	6GG3	0	600	820	90	187.585	0.663	1.41	1.16	0.00	
2	6GG3	6GGJ	0	600	740	90	145.465	0.514	0.88	0.65	0.00	
3	6GGJ	6HG3	0	800	580	110	415.806	0.827	1.04	0.60	0.00	
4	6HG3	6HG4	0	800	170	110	378.496	0.753	0.88	0.15	0.00	
5	6HG4	6HG8	0	800	690	110	153.561	0.306	0.17	0.12	0.00	
6	6HG8	6HG6	0	800	740	110	116.251	0.231	0.10	0.07	0.00	
7	6HG7	6HH2	0	400	1000	110	40.237	0.320	0.41	0.40	0.00	
8	6HH2	6HH6	0	400	880	110	1.237	0.010	0.00	0.00	0.00	
9	6HH5	6HH6	0	400	810	110	37.763	0.301	0.36	0.29	0.00	
10	6HH4	6HH5	0	400	730	110	76.763	0.611	1.34	0.98	0.00	
11	6GH3	6HH4	0	500	890	110	115.763	0.590	0.97	0.86	0.00	
12	6GH3	6GG9	0	1100	230	110	948.757	0.998	1.02	0.24	0.00	
13	6GG9	6GGE	0	1100	340	110	990.274	1.042	1.10	0.37	0.00	
14	6GGE	6GGF	0	1000	580	110	948.154	1.207	1.62	0.94	0.00	
15	6GGF	6GGJ	0	1000	390	110	307.652	0.392	0.20	0.08	0.00	
16	6GGF	6GGB	0	1000	490	110	598.383	0.762	0.69	0.34	0.00	
17	6GGM	6GGB	0	600	280	110	90.399	0.320	0.25	0.07	0.00	
18	6GGN	6GGM	0	600	300	90	210.957	0.746	1.75	0.53	0.00	
19	6GGH	6GGN	0	600	840	90	210.957	0.746	1.75	1.47	0.00	
20	6GGH	6GGC	0	600	80	110	1.941	0.007	0.00	0.00	0.00	
21	6GG4	6GGH	0	600	640	90	212.898	0.753	1.78	1.14	0.00	
22	6GG2	6GG1	0	600	110	90	212.898	0.753	1.78	0.19	0.00	
23	6GG8	6GG2	0	600	80	110	255.018	0.902	1.71	0.14	0.00	
24	6GGA	6GG6	0	600	550	110	42.120	0.149	0.06	0.03	0.00	
25	6GGC	6GGA	0	1000	450	110	567.022	0.722	0.62	0.28	0.00	
26	6GG7	6GH2	0	300	680	110	16.007	0.226	0.30	0.21	0.00	
27	6GH1	6GH2	0	300	1860	110	26.113	0.369	0.74	1.38	0.00	
28	6GJ3	6GH1	0	300	1180	110	6.141	0.087	0.05	0.06	0.00	
29	6GJ1	6GJ3	0	300	1660	110	40.851	0.578	1.69	2.81	0.00	
30	6GK2	6GJ1	0	300	1470	110	32.863	0.465	1.13	1.66	0.00	
31	6GK2	6GK3	0	400	1140	110	52.295	0.416	0.66	0.75	0.00	
32	6GK3	6GK1	0	300	500	110	17.585	0.249	0.36	0.18	0.00	
33	6GG7	6GGD	0	900	570	110	577.548	0.908	1.08	0.62	0.00	
34	6GGD	6GG9	0	900	1000	110	535.428	0.842	0.94	0.94	0.00	
35	6GH6	6GH3	0	1100	1490	110	1106.640	1.164	1.35	2.01	0.00	
36	6HH3	6GH6	0	1100	770	110	1141.350	1.201	1.43	1.11	0.00	
37	6HJ1	6HH3	0	1100	550	110	1176.060	1.238	1.51	0.83	0.00	
38	6GGM	6HG1	0	600	970	90	120.558	0.426	0.62	0.60	0.00	
39	6HG1	6HG2	0	600	190	90	83.248	0.294	0.31	0.06	0.00	
40	6HG4	6HG2	0	600	100	110	187.625	0.664	0.97	0.10	0.00	
41	6HG2	6HG5	0	600	680	90	233.563	0.826	2.11	1.43	0.00	
42	6HGA	5HG1	0	400	550	110	64.698	0.515	0.98	0.54	0.00	
43	5HG1	5HF5	0	400	1430	110	5.028	0.040	0.01	0.01	0.00	
44	5GF2	5HF5	0	800	1150	110	291.531	0.586	0.55	0.64	0.00	
45	1GFF	5GF2	0	1000	260	110	602.852	0.768	0.70	0.18	0.00	
46	1GGJ	1GFE	0	1000	960	110	602.852	0.768	0.70	0.67	0.00	
47	6GGB	1GG1	0	1000	1180	110	646.662	0.823	0.80	0.94	0.00	
48	1GFE	1GFF	0	1000	520	110	602.852	0.768	0.70	0.36	0.00	
49	5GDE	5GD2	0	500	1630	110	36.257	0.185	0.11	0.18	0.00	
50	5GD3	5GDB	0	400	250	90	4.512	0.036	0.01	0.00	0.00	
51	5GD3	5GDE	0	800	350	110	64.987	0.129	0.03	0.01	0.00	
52	5HD1	5GDB	0	400	2480	90	4.547	0.036	0.01	0.03	0.00	
53	5GE4	5GE6	0	600	210	110	219.662	0.777	1.30	0.27	0.00	
54	5GE6	5HE2	0	600	1220	110	103.336	0.365	0.32	0.39	0.00	
55	5HE3	5HE2	0	600	960	110	0.661	0.002	0.00	0.00	0.00	
56	5HF2	5HE3	0	500	1670	110	76.568	0.390	0.45	0.75	0.00	
57	5HF4	5HF2	0	800	260	110	239.888	0.477	0.38	0.10	0.00	
58	5HF5	5HF4	0	800	150	110	239.888	0.477	0.38	0.05	0.00	
59	5HF2	5HF3	0	600	170	110	103.651	0.367	0.32	0.06	0.00	
60	5HF3	5JF1	0	600	2140	110	73.621	0.260	0.17	0.37	0.00	

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NO	Node(U) ->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
61	5JF1	5JE2	0	400	2180	110	43.591	0.347	0.47	1.02	0.00	
62	5HE7	5JE2	0	600	2090	110	91.891	0.336	0.28	0.57	0.00	
63	5HE3	5HE7	0	600	180	110	154.561	0.547	0.68	0.13	0.00	
64	5HE4	5HE3	0	800	1980	110	182.657	0.363	0.23	0.45	0.00	
65	5HE5	5HE4	0	800	350	110	251.099	0.500	0.41	0.14	0.00	
66	5HD4	5HE5	0	900	1200	110	323.288	0.518	0.38	0.46	0.00	
67	5HD2	5HD4	0	900	1200	110	358.018	0.563	0.45	0.53	0.00	
68	5HC2	5HD2	0	1000	1600	110	587.058	0.747	0.67	1.07	0.00	
69	5HD5	5HD1	0	400	210	90	30.313	0.241	0.35	0.07	0.00	
70	5HD2	5HD5	0	350	1000	90	46.724	0.486	1.48	1.48	0.00	
71	5HD5	5HD7	0	300	1100	110	28.730	0.406	0.88	0.97	0.00	
72	5HD5	5HD6	0	400	350	110	37.597	0.299	0.36	0.13	0.00	
73	5HD6	5HD8	0	300	1230	90	8.867	0.125	0.15	0.18	0.00	
74	5GD7	5HD8	0	300	520	90	19.863	0.281	0.65	0.34	0.00	
75	5GD6	5GD7	0	300	150	110	27.280	0.385	0.80	0.12	0.00	
76	5GD4	5GD6	0	500	420	110	71.199	0.363	0.39	0.17	0.00	
77	5GD4	5GD8	0	800	210	110	171.185	0.341	0.20	0.05	0.00	
78	5GD8	5GD7	0	300	330	90	21.313	0.302	0.74	0.24	0.00	
79	5GD8	5GD3	0	400	820	90	31.954	0.278	0.45	0.37	0.00	
80	5GDA	5GD3	0	500	630	110	63.275	0.322	0.32	0.20	0.00	
81	5GD4	5GDA	0	500	340	110	92.005	0.469	0.63	0.22	0.00	
82	5GD8	5GD9	0	350	440	110	39.043	0.406	0.73	0.32	0.00	
83	5GD9	5GD8	0	350	810	110	10.313	0.107	0.06	0.05	0.00	
84	5GE1	5GD8	0	300	2150	110	9.358	0.132	0.11	0.24	0.00	
85	5GE3	5GE1	0	600	440	110	7.448	0.026	0.00	0.00	0.00	
86	5GE6	5GE3	0	600	910	110	71.996	0.255	0.17	0.15	0.00	
87	5GE3	5HE1	0	300	1460	110	20.218	0.286	0.46	0.67	0.00	
88	5HE4	5HE1	0	300	1380	110	24.112	0.341	0.64	0.88	0.00	
89	5GE1	5GE2	0	300	590	110	16.505	0.233	0.32	0.19	0.00	
90	5GD6	5GE2	0	350	1580	110	15.189	0.158	0.13	0.20	0.00	
91	5GE2	5HD1	0	300	1940	110	2.964	0.042	0.01	0.02	0.00	
92	5GD8	5GE1	0	600	1800	110	47.145	0.167	0.08	0.13	0.00	
93	6HG6	6HGC	0	800	240	110	412.495	0.821	1.03	0.25	0.00	
94	6HGC	6JG4	0	800	1940	110	375.185	0.746	0.86	1.67	0.00	
95	6JG4	6JG2	0	600	1640	90	198.715	0.703	1.57	2.57	0.00	
96	6JG2	PSRB0	0	600	690	90	24.521	0.087	0.03	0.02	0.00	
97	6JG1	PSRB0	0	600	690	90	24.229	0.086	0.03	0.02	0.00	
98	6JG2	6JG1	0	600	100	110	10.784	0.038	0.00	0.00	0.00	
99	6JG6	6JG1	0	600	1380	90	195.095	0.691	1.53	2.11	0.00	
100	6JG5	6JG6	0	600	250	90	196.095	0.694	1.53	0.38	0.00	
101	6JG4	6JG5	0	600	90	110	176.470	0.624	0.87	0.08	0.00	
102	6HG9	6JG5	0	600	2070	90	56.935	0.201	0.16	0.32	0.00	
103	6HG5	6HG9	0	600	840	90	94.245	0.333	0.39	0.34	0.00	
104	5JE2	5JE3	0	600	790	110	108.452	0.384	0.35	0.28	0.00	
105	5JE3	5KE2	0	400	960	110	20.562	0.164	0.12	0.11	0.00	
106	5JE3	5KE2	0	600	1020	110	57.860	0.205	0.11	0.11	0.00	
107	5KE2	5HE8	0	400	530	110	3.987	0.032	0.01	0.00	0.00	
108	5KE1	5HE8	0	400	100	110	4.319	0.034	0.01	0.00	0.00	
109	5KE1	5JE1	0	400	1430	110	8.882	0.071	0.02	0.01	0.00	
110	5JE4	5JE1	0	300	480	110	3.828	0.054	0.02	0.01	0.00	
111	5HE6	5JE4	0	300	1210	110	33.858	0.479	1.20	1.45	0.00	
112	5HE5	5HE6	0	300	220	110	33.858	0.479	1.20	0.26	0.00	
113	5Z05	5JE1	0	400	2307	110	17.320	0.138	0.09	0.20	0.00	
114	5JD2	5JD1	0	350	310	110	44.690	0.464	0.94	0.29	0.00	
115	5KD1	5JD2	0	400	1470	110	118.270	0.941	2.98	4.38	0.00	
116	5KD1	5Z03	0	400	162	110	127.280	1.013	3.41	0.55	0.00	
117	5KD2	OLDAK	0	400	190	110	0.000	0.000	0.00	0.00	0.00	
118	5KD2	5Z04	0	400	857	110	23.670	0.188	0.15	0.13	0.00	
119	5KD4	5KD1	0	800	110	110	319.130	0.635	0.64	0.07	0.00	
120	DC-R5	5JC2	0	1200	660	110	1321.995	1.169	1.23	0.82	0.00	

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NO	Node(F) ->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
121	5JC2	5HC2	0	1100	3020	110	787.078	0.828	0.72	2.17	0.00	
122	5JC1	5HC2	0	800	2050	110	288.278	0.574	0.53	1.09	0.00	
123	5JC2	5JC1	0	1200	2110	110	826.632	0.731	0.52	1.08	0.00	
124	5HD2	5HD3	0	350	160	90	74.910	0.779	3.56	0.57	0.00	
125	5HD3	5JD1	0	350	1330	90	46.210	0.480	1.45	1.93	0.00	
126	5HC2	5GC2	0	1000	2680	110	411.728	0.524	0.35	0.93	0.00	
127	5GC2	5GD1	0	800	1610	110	363.119	0.722	0.81	1.30	0.00	
128	5GC1	5GC2	0	500	1420	110	10.909	0.056	0.01	0.02	0.00	
129	5GB1	5GC1	0	800	1290	110	221.414	0.440	0.33	0.42	0.00	
130	5HC1	5GB1	0	1000	1590	110	407.574	0.519	0.34	0.54	0.00	
131	5JC1	5HC1	0	1000	2320	110	472.964	0.602	0.45	1.04	0.00	
132	5GC3	5GD2	0	400	2070	110	40.313	0.321	0.41	0.84	0.00	
133	5GC1	5GC3	0	500	1110	110	116.883	0.595	0.98	1.09	0.00	
134	6GK1	6FK1	0	400	1070	110	15.474	0.123	0.07	0.07	0.00	
135	6GK4	6GK1	0	400	1530	110	32.599	0.259	0.27	0.42	0.00	
136	6GK5	6GK4	0	400	470	110	67.309	0.536	1.05	0.50	0.00	
137	6HK2	6GK5	0	500	750	110	102.019	0.520	0.76	0.57	0.00	
138	6HK1	6HK2	0	600	1380	110	136.729	0.481	0.51	0.75	0.00	
139	BUARN	6HK1	0	1200	300	110	1227.935	1.086	1.07	0.32	0.00	
140	BUARN	6HK1	0	1500	330	110	2098.505	1.188	0.98	0.32	0.00	
141	6HK1	6HJ2	0	1200	1340	110	1480.100	1.309	1.52	2.03	0.00	
142	6HJ2	6HJ3	0	1200	1000	110	1345.216	1.189	1.27	1.27	0.00	
143	6HJ3	6HJ1	0	1200	940	110	1271.506	1.124	1.14	1.08	0.00	
144	6HJ2	6GJ2	0	500	680	110	100.173	0.510	0.74	0.51	0.00	
145	6GJ2	6GJ1	0	500	1290	110	65.463	0.333	0.34	0.43	0.00	
146	6GJ1	6FK2	0	400	1090	110	22.765	0.181	0.14	0.16	0.00	
147	6HK1	6GK2	0	1500	2030	110	1674.901	0.948	0.64	1.31	0.00	
148	6GH1	6GH1	0	300	1060	110	28.656	0.405	0.88	0.93	0.00	
149	6GH5	6GH1	0	400	530	110	26.026	0.207	0.18	0.10	0.00	
150	6HJ1	6GH5	0	400	1570	110	60.736	0.483	0.87	1.36	0.00	
151	6HG5	6HGA	0	500	280	110	102.008	0.520	0.76	0.22	0.00	
152	6GG8	6GG5	0	600	100	90	227.763	0.806	2.02	0.20	0.00	
153	6GG5	6GGG	0	600	630	90	227.763	0.806	2.02	1.27	0.00	
154	6FJ1	6FJ2	0	250	1150	110	12.850	0.262	0.48	0.56	0.00	
155	6FK3	6FK2	0	400	490	110	11.945	0.095	0.04	0.03	0.00	
156	6GK2	6FK4	0	1500	1510	110	1555.034	0.880	0.56	0.84	0.00	
157	6FJ3	6GH4	0	400	640	110	63.366	0.504	0.94	0.60	0.00	
158	6FJ2	6FJ3	0	250	740	110	12.543	0.256	0.46	0.34	0.00	
159	6FK3	6FJ1	0	250	600	110	13.179	0.268	0.51	0.31	0.00	
160	6FK4	6FK3	0	1500	1810	110	1501.088	0.849	0.53	0.95	0.00	
161	6FG1	6GG7	0	900	1130	110	635.675	0.999	1.29	1.45	0.00	
162	5GB1	5GB2	0	600	1240	110	65.390	0.231	0.14	0.17	0.00	
163	6HGD	6HG6	0	700	890	110	333.554	0.867	1.33	1.18	0.00	
164	6HGD	6HG7	0	400	240	110	79.237	0.631	1.42	0.34	0.00	
165	6GG9	6HGD	0	1000	2800	110	451.791	0.575	0.41	1.15	0.00	
166	5GF2	5GE4	0	800	1940	110	263.992	0.525	0.45	0.88	0.00	
167	6FG1	6GGC	0	1000	1040	110	609.142	0.776	0.71	0.74	0.00	
168	6FJ3	6FG1	0	1500	3160	110	1286.937	0.728	0.39	1.25	0.00	
169	6GGA	6GG8	0	1000	220	110	482.762	0.615	0.46	0.10	0.00	
170	6FK4	6FK1	0	400	1510	110	19.236	0.153	0.10	0.16	0.00	
171	5GB1	5GB3	0	600	1520	110	55.380	0.196	0.10	0.15	0.00	
172	5GB3	5FA1	0	600	890	110	27.690	0.098	0.03	0.03	0.00	
173	5KC1	5KD1	0	800	1230	110	319.130	0.635	0.64	0.79	0.00	
174	5JC2	5KC1	0	1000	680	110	392.710	0.500	0.32	0.21	0.00	
175	5KE2	5KE5	0	600	680	110	33.150	0.117	0.04	0.03	0.00	
176	5GC1	5GC2	0	600	1510	110	17.052	0.060	0.01	0.02	0.00	
177	5HD2	5HD5	0	400	1060	110	78.646	0.626	1.40	1.48	0.00	
178	DC-R5	5JC2	0	1000	760	110	758.005	0.965	1.07	0.82	0.00	
179	5KE1	5HE8	0	600	140	110	10.470	0.037	0.00	0.00	0.00	
180	5KE2	5HE8	0	600	560	110	11.254	0.040	0.01	0.00	0.00	

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NO	Node(U)	->	Node(D)	Type	Dia (mm)	Len (m)	C	Q (l/sec)	V (m/sec)	i (‰)	dH (m)	f.dH (m)	Comments
181	6FJ2		6FJ3	0	1500	770	110	1372.470	0.777	0.44	0.34	0.00	
182	6FJ1		6FJ2	0	1500	1197	110	1406.863	0.796	0.47	0.56	0.00	
183	6FK3		6FJ1	0	1500	625	110	1441.254	0.816	0.49	0.31	0.00	
184	5Z03		5KD2	0	400	1212	110	127.280	1.013	3.41	4.14	0.00	
185	5Z04		5KE1	0	400	173	110	23.670	0.188	0.15	0.02	0.00	
186	5JD1		5Z05	0	400	146	110	17.320	0.138	0.09	0.01	0.00	