Directorate General of Human Settlements, Ministry of Public Works

DKI Jakarta

PD PAL JAYA

THE PROJECT FOR CAPACITY DEVELOPMENT OF WASTEWATER SECTOR THROUGH REVIEWING THE WASTEWATER MANAGEMENT MASTER PLAN IN DKI JAKARTA IN THE REPUBLIC OF INDONESIA

FINAL REPORT

(SUPPORTING REPORT)

MARCH 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.
JAPAN ENVIRONMENTAL SANITATION CENTER
WATER AGENCY INC.

GED
JR
12-058

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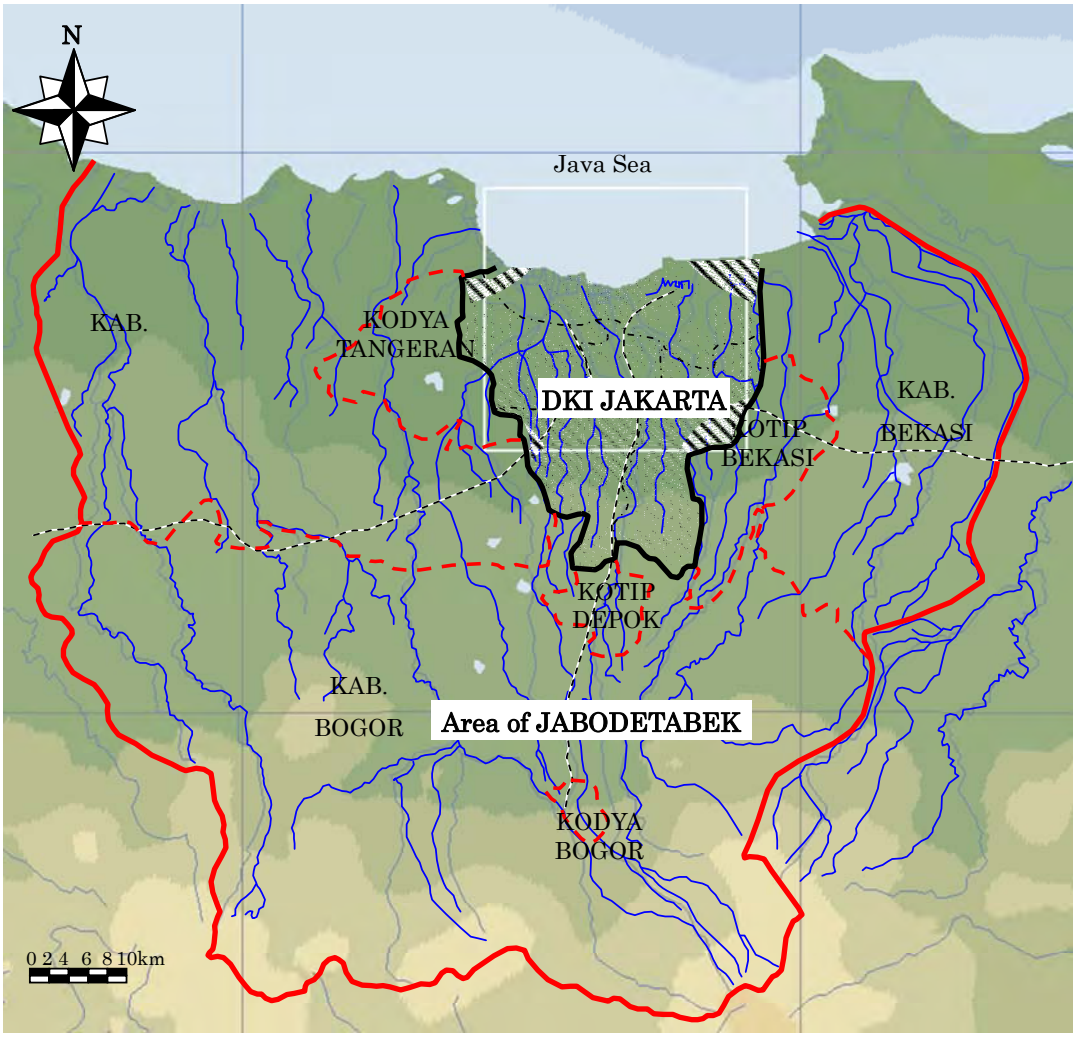
Foreign Exchange Rate

USD 1.00 = JPY 79.87、USD 1.00 = IDR 8,570

JPY 1.00 = IDR 107.38、IDR 1.00 = JPY 0.00931

(Average of end of March 2011 to August)



Location Map of Study Area

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The Project for Capacity Development of Wastewater Sector
Through
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FINAL REPORT
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Abbreviations

A2O	Anaerobic Anoxic Oxic Process
ADB	Asia Development Bank
AMDAL	Environmental Impact Assessment (*Analisis Mengenai Dampak Lingkungan*)
ANDAL	Environmental Impact Analysis Report (*Analisis Dampak Lingkungan*)
APBD	Regional Income and Expenditure Budget (*Anggaran Pendapatan dan Belanja Daerah*)
APBN	Indonesian National Income and Expenditure Budget (*Anggaran Pendapatan dan Belanja Negara*)
ASP	Activated Sludge Process
ASRT	Aerobic Solids Retention Time
ATP	Affordability To Pay
BAPPEDA	Regional Planning and Development Board (*Badan Perencanaan Pembangunan Daerah*)
BAPPENAS	National Planning and Development Board (*Badan Perencanaan Pembangunan Nasional*)
BBWS CC	Central Hall of River Management of Ciliwung – Cisadane (*Balai Besar Wilayah Sungai Ciliwung – Cisadane*)
BLUD	Regional Public Service Board (*Badan Layanan Umum Daerah*)
BLUPAL	Public Service Board for Wastewater Management (*Badan Layanan Umum Pengelolaan Air Limbah*)
BOD	Biochemical Oxygen Demand
BOO	Build Own Operate
BOT	Built Operate Transfer
BTO	Built Transfer Operate
BPAL	Wastewater Management Board (*Badan Pengelolaan Air Limbah*)
BPKD	Regional Finance Management Board (*Badan Pengelola Keuangan Daerah*)
BPLHD	Regional Environment Management Board (*Badan Pengelolaan Lingkungan Hidup*)
BPMP	Investment Board (*Badan Penanaman Modal dan Promosi*)
BPS	Central Bureau of Statistic (*Badan Pusat Statistik*)
BW	Black Water
B/C	Benefit/Cost
CA	Capacity Assessment
CAD	Computer Aided Design
CBP	Concrete Batching Plan
CBS	Community-Based Sanitation approach
CD	Capacity Development
CFU	Colony Forming Unit
COD	Chemical Oxygen Demand
C/P	Counterpart
CSS	City Sanitation Strategy
CST	Conventional Septic Tank
DB	Data Base
DBJ	Development Bank of Japan
DBO	Design Build Operate
DESD	Directorate of Environmental Sanitation Development
DF/R	Draft Final Report
DGHS	Directorate General of Human Settlements, Ministry of Public Works (*Direktorat Jenderal Cipta Karya*)
DGSP	Directorate General of Spatial Planning, Ministry of Public Works
DHS	Down-flow Hanging Sponge
DK	Cleansing Agency (*Dinas Kebersihan*)
DKI	Special State Capital of Jakarta (*Daerah Khusus Ibukota Jakarta*)
DPU	Public Works Agency (*Dinas Pekerjaan Umum*)
DP2B	Building Supervision and Control Agency (*Dinas Penertiban dan Pengawasan Bangunan*)

DTR	Spatial Planning Agency (*Dinas Tata Ruang*)
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FPU	Final Polishing Pond
F/R	Final Report
F/S	Feasibility Study
FY	Fiscal Year
GDP	Gross Domestic Product
GIS	Geographical Information System
GW	Gray Water
HWL	High Water Level
HRT	Hydraulic Retention Time
IC/R	Inception Report
IEE	Initial Environmental Examination
IMB	Building Construction Permit (*Izin Mendirikan Bangunan*)
IRR	Internal Rate of Return
ISSDP	Indonesia Sanitation Sector Development Program
ITP	Individual Treatment Plant
IT/R	Interim Report
IWK	Indah Water Konsortium Sdn Bhd
JBIC	Japan Bank for International Cooperation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JSSP	Jakarta Sewerage and Sanitation Project
JWDP	Jakarta Wastewater Development Plan
KA-ANDAL	Executive Summary of the Project (Terms of Reference of ANDAL) (*Kerangka Acuan Analisis Dampak Lingkungan Hidup*)
KLH	Ministry of Environment (*Kementrian Lingkungan Hidup*)
KMB	Feasibility of Building Utilization Permit (*Kelayakan Menggunakan Bangunan*)
KPI	Key Performance Indicator
KRK	Keterangan Rencana Kota
LWL	Low Water Level
MBBR	Moving Bed Bio-film Reactor
MBR	Membrane Biological Reactor
MCK	Communal Place for Bathing, Washing and Toilet (*Mandi, Cuci, Kakus*)
MLSS	Mixed Liquor Suspended Solids
M/M	Minutes of Meetings
M/P	Master Plan
MPW	Ministry of Public Works
MRT	Mass Rapid Transit
MST	Modified Septic Tank
NPV	Net Present Value
ODA	Official Development Assistance
OJT	On-the-job Training
O&M	Operation and Maintenance
PDAM	Local Water Supply Enterprise (*Perusahaan Daerah Air Minum*)
PDM	Project Design Matrix
PD PAL JAYA	Regional Company of Wastewater Management of DKI Jakarta (*Perusahaan Daerah Pengelolaan Air Limbah Jakarta Raya*)
PFI	Private Finance Initiative
PI	Performance Indicator
PJ	Project
PO	Plan of Operation
PPMK	Community of Kelurahan Empowerment Program
PPP	Public-Private-Partnership
PPSP	Acceleration of Urban Sanitation Development Program (*Program Percepatan Pembangunan Sanitasi Permukiman*)
PST	Primary Settling Tank
RBC	Rotating Biological Contactor

R/D	Record of Discussions
RDTR	Detailed Spatial Plan (*Rencana Detil Tata Ruang*)
RKL	Environmental Management Planning Document (*Rencana Pengelolaan Lingkungan*)
ROT	Rehabilitate Operate Transfer
RPL	Environmental Monitoring Planning Document (*Rencana Pemantauan Lingkungan*)
RT	Smallest Community Group (*Rukun Tetangga*)
RTLB	Blok Plan (*Rencana Tata Letak Bangunan*)
RTO	Rehabilitate Transfer Operate
RTRW	Provincial Spatial Plan (*Rencana Tata Ruang Wilayah*)
RTRWN	National Spatial Plan (*Rencana Tata Ruang Wilayah Nasional*)
RTRW Kabupaten	Regency Spatial Plan (*Rencana Tata Ruang Wilayah Kabupaten*)
RTRW Kota	Municipal Spatial Plan (*Rencana Tata Ruang Wilayah Kota*)
RW	Community Group (*Rukun Warga*)
SANIMAS	Community Based On-site System (*Sanitasi untuk Masyarakat*)
SD2PB	Building Supervision and Control Sub-Agency (*Suku Dinas Penertiban dan Pengawasan Bangunan*)
SER	Shadow Exchange Rate
SBR	Sequencing Batch Reactor
SIDA	Swedish Agency for International Development
SIPPT	Permit of Land Use and Designation (*Surat Izin Penunjukan dan Penggunaan Tanah*)
SLF	Certificate for Sustainability of Functions (*Sertifikat Laik Fungsi*)
SOP	Standard Operating Procedure
SP3L	Principle Approval Letter of Land Acquisition (*Surat Persetujuan Pembebasan & Penguasaan Lahan*)
SPPL	Statement Letter of Environmental Management (*Surat Pernyataan Pengelolaan Lingkungan*)
SRT	Solid Retention Time
SS	Suspended Solid
SSA	Sewerage Services Act in Malaysia
SV	Sludge Volume
TTPS	National Sanitation Technical Team (*Tim Teknis Pembangunan Sanitasi*)
TPUT	Consideration Team for Land Affairs (*Tim Pertimbangan Urusan Tanah*)
UASB	Up-flow Anaerobic Sludge Blanket
UKL	Environmental Management Plan (*Upaya Pengelolaan Lingkungan*)
UPL	Environmental Monitoring Plan (*Upaya Pemantauan Lingkungan*)
UPLS	Management Unit of Septic Tank's Waste (*Unit Pengelolaan Limbah Septic Tank*)
UPT-PAL	Technical Management Unit - Wastewater Management (*Unit Pengelola Teknis - Pengelola Air Limbah*)
USDP	Urban Sanitation Development Program
UV/VIS	Ultra-Violet/Visible Sepctrophotometry
VGF	Viability Gap Funding
WOPs	Water Operators Partnership
WSIA	Water Services Industry Act
WSP	Water and Sanitation Program
WTP	Willingness To Pay
WWTP	Wastewater Treatment Plant

Units

℃	Degree Celsius
ha	Hectare
IDR	Indonesian Rupiah
km	Kilometer
L	Liter
L/min	Liter per minute
L/sec	Liter per second
LCD	Liter per Capita per Day
m	Meter
mg/L	Milligram per liter
min	Minute
mm	Millimeter
m^2	Square meter
m^3	Cubic meter
m^3/day	Cubic meter per day
m^3/sec	Cubic meter per second
No(s).	Number(s)
NTU	Nephelometric Turbidity Units
ohm m	Ohm meter
%	Percent
USD	U.S. (United States) Dollar

PART-B DATA AND INFORMATION

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SP/R : Supporting Report
M/R : Main Report

PART-B DATA AND INFORMATION

B1 Present Conditions and Issues in Sewage and Sanitation Sectors in Indonesia

B1.1 Organization and Institution

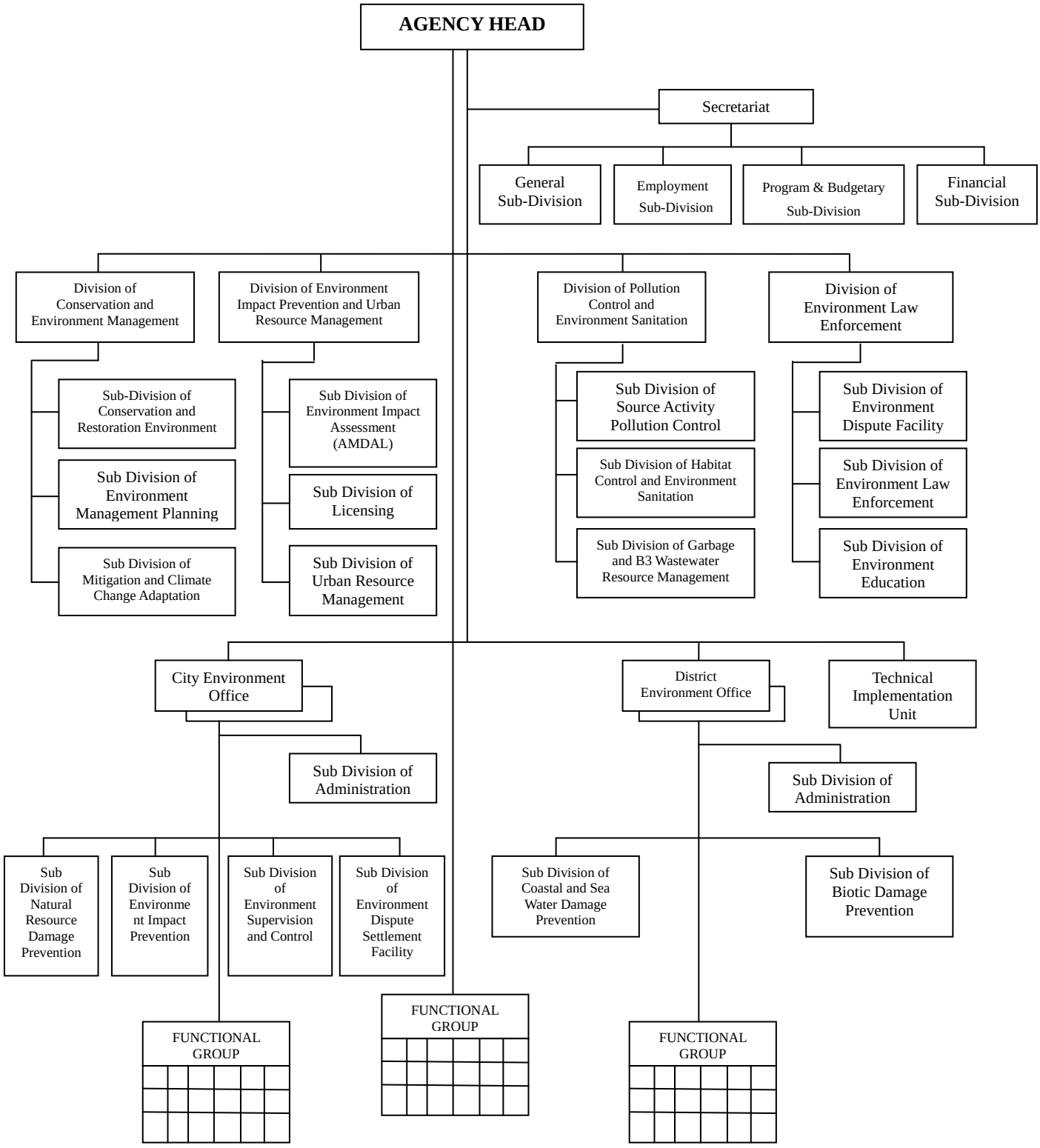


Figure S/R-B1-2 Organization Chart of BPLHD

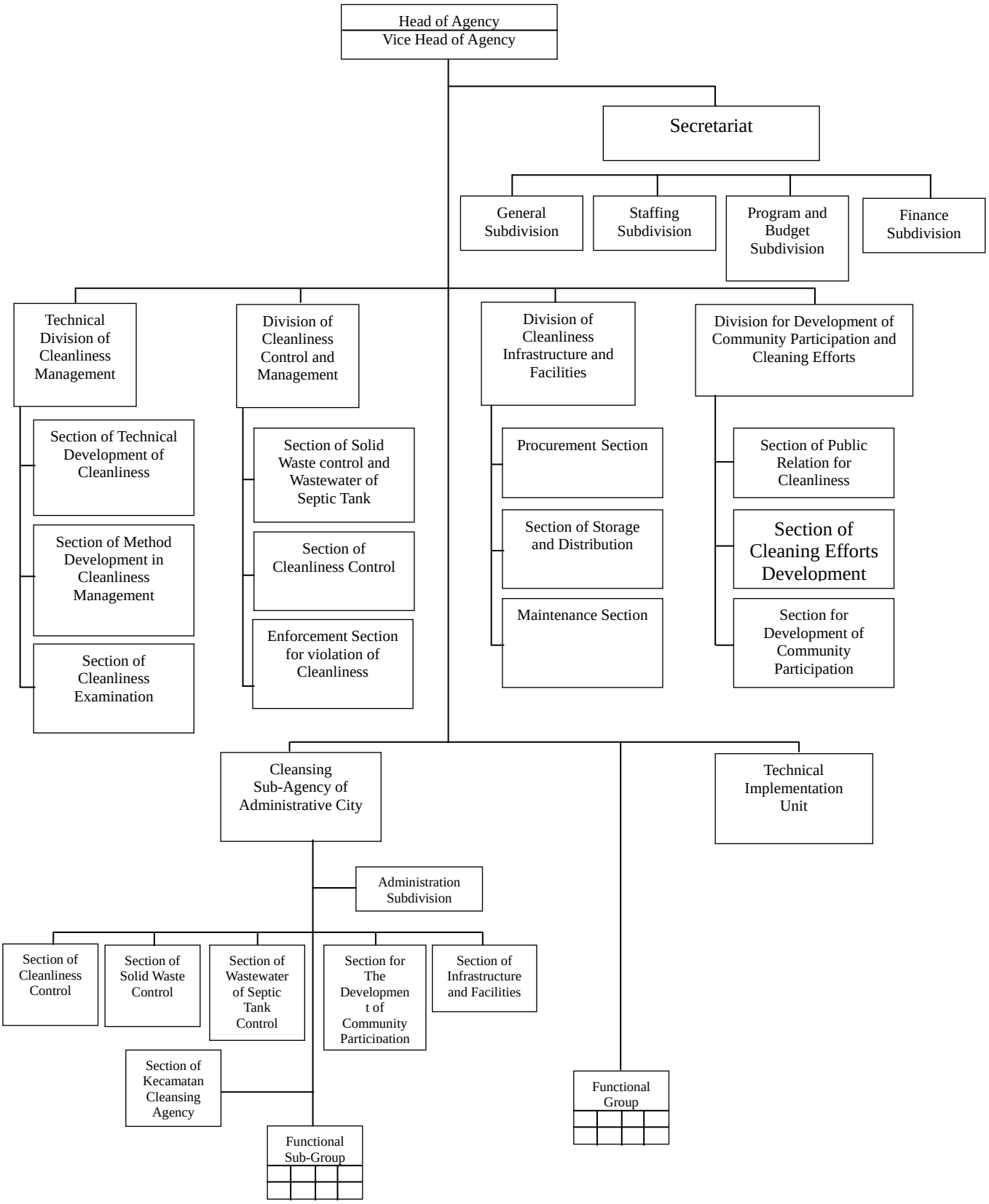


Figure S/R-B1-2 Organization Chart of DK

B1.3.3 PD PAL JAYA

Table S/R-B1-1 Number of Staff of PD PAL JAYA

Category		Number of staff		Rate(%)	Job title					
					Management Director	Supervisor	Director	Division Manager	Sub-Division Manager	Staff
General Director		1	3	2.9%	1					
Director		2					2			
Technical & Business	Operation & Maintenance Div.	18	38	36.9%				1	3	14
	Technical Div.	12						1	3	8
	Development & Program Div.	8						1	2	5
Administration & Finance	Customer Service Div.	12	62	60.2%				1	3	8
	Finance Div.	13						1	3	9
	General Div.	25						1	4	20
Internal Audit supervisor		9				4				5
Others(contract basis worker)		3								3
total		103		100.0%	1	4	2	6	18	72

Source : PD PAL JAYA

B1.3.4 Duty Sharing Regarding Wastewater Management

Table S/R-B1-2 Current Institutions of Roles on Function & Responsibility of Off-site Sanitation (Sewerage Service) (1/2)

Implementation items		comments	MPW	DKI Jakarta				PD PAL JAYA	Private
			DGHS (Cipta Karya)	Regional Development Planning Agency (BAPPEDA)	Emvironmental Board (BPLHD)	Public Works Agency (DPU)	Cleansing Agency (DK)		
Ⅰ	Decision-making on Sewerage Service		○	○					
Ⅱ	Master Plan								
1	Preliminary Survey	Field Survey, Data Collection & Analysis	○						
2	Determination of planning area	Set up of Off-site and On-site Area	○						
3	Set up of Design Parameters	Design Pppulation, Unit Wastewater Generation, Design Wastewater Flow and Pollution Loads, etc.	○						
4	Coordination with Other Development Plan	Coordination with Development Plan such as Spacial Plan	○						
5	Set up of Effluent Water Quality Standards	Not effect to Public Water Quality	○						
6	Implementation Plan	Set up of Sewerage Zones, Facilities Plan, Sludge Disposal Plan and Oparation and Maitemance Plan	○						
7	Financial Plan	Feasibility Study, Multi-year Business Plan	○						
Ⅲ	Approval by Government	Compliance with Related Laws	●	●					
Ⅳ	Detaild Design	Detail Drawing, Quantity calculation, Estimation of Ploject Cost	○						
Ⅴ	Construction		○						
Ⅵ	Start of Operation								
1	Notification and Reception for Legal Regulations	Water Quality, Odor Control, Noise, Vibration, Air Pollution, Occupational Safety and Health, etc.		○					
2	Facility Inspection before the Start of Services		○						

Notes : MPW=Ministry of Public Works, DGHS=Directrate General of Human Settlement

Table S/R-B1-2 Current Institutions of Roles on Function & Responsibility of Off-site Sanitation (Sewerage Service) (2/2)

Implementation items		comments	MPW	DKI Jakarta				PD PAL JAYA	Private
			DGHS (Cipta Karya)	Regional Development Planning Agency (BAPPEDA)	Emvironmental Board (BPLHD)	Public Works Agency (DPU)	Cleansing Agency (DK)		
Ⅶ	Operation and Maintenance								
1	General affairs	Enactment of Ordinance of Sewerage Service, General Administrative Affairs, Personnel and Payroll Management, Budget, Accounting, Employee Welfare, Publicity		○				○	
2	Budget Implementation	Purchase of Materials, Purchase Order and Contracts						○	
3	Asset Management	Fixed Assets Management, Building and Repairs						○	
4	Notification of Starting Operation							○	
5	Customer Management	Settlement and Collection of Charge, Investigation of the Presence of Charge Payments, Customer Information Management, Handling of Complaints						○	
6	Operation & Maintenance for Pipes	Inspection and Survey, Cleaning and Dredging, Repair and Reconstruction Planning, Design, Construction, and Supervision, Protection of Pipelines						○	
7	Operation & Maintenance for WWTP and Pumping Station	Operation, Maintenance, Repair and Reconstruction						○	
8	Water Quality Management	Preparation and Implementation of Water Quality Management and Research Plan, Preparing of Operational Indicator, Support in Water Quality Accident Situation, etc.			●				
9	Ledger Management	Preparation, Safekeeping, Fix, Browse of Ledger, Administrative of Drawing						○	
10	Environmental Conservation	Preparation and Inplementation of River and Ground Water Quality Analysis Plan, Other Activities Related to Environmental Regulations			○				
11	Others	Report for Related Public Supervision, Safety and Sanitary Management, Reseach and Development for Sewarage, Facilities Tour Management, Promotional Activities, Advocacy, Education Management for Employee						○	

Notes : MPW=Ministry of Public Works, DGHS=Directrate General of Human Settlement

B1.3.5 Evaluation of DKI Jakarta and PD PAL JAYA

Table S/R-B1-3 Financial Situation of PD PAL JAYA

Income

Description	2005	2006	2007	2008	2009	Remarks
Main business income	14,913,181,286	16,872,136,913	21,122,934,133	24,960,685,664	28,674,678,488	
Main business income Percentage	80.82%	82.94%	84.52%	90.30%	90.53%	
Sideline buisiness income	988,154,045	1,168,673,625	1,600,134,121	995,764,082	1,271,707,050	
Sideline buisiness income Percenta	5.35%	5.74%	6.40%	3.60%	4.02%	
Others	2,551,862,414	2,302,614,817	2,267,237,331	1,685,414,869	1,727,276,291	
Others Percentage	13.83%	11.32%	9.07%	6.10%	5.45%	
total	18,453,197,745	20,343,425,355	24,990,305,585	27,641,864,615	31,673,661,829	

source : Annual Report PD PAL JAYA, 2005 - 2009

Expenses

Description	2005	2006	2007	2008	2009	Remarks
Treatment cost	6,473,988,880	6,809,204,455	7,444,802,042	8,449,589,604	8,981,886,532	
Treatment cost percentage	47.73%	48.50%	46.92%	48.21%	47.34%	
Overhead costs	5,724,997,529	6,083,949,153	7,631,111,844	7,920,451,197	8,614,024,014	
Overhead costs percentage	42.20%	43.33%	48.10%	45.19%	45.40%	
Depreciation costs	885,304,928	786,331,407	694,717,445	699,774,077	809,827,765	
Depreciation costs percentage	6.53%	5.60%	4.38%	3.99%	4.27%	
other costs	480,623,980	361,030,287	94,934,856	456,804,434	567,160,905	
other costs percentage	3.54%	2.57%	0.60%	2.61%	2.99%	
total	13,564,915,317	14,040,515,302	15,865,566,187	17,526,619,312	18,972,899,216	

source : Annual Report PD PAL JAYA, 2005 - 2009

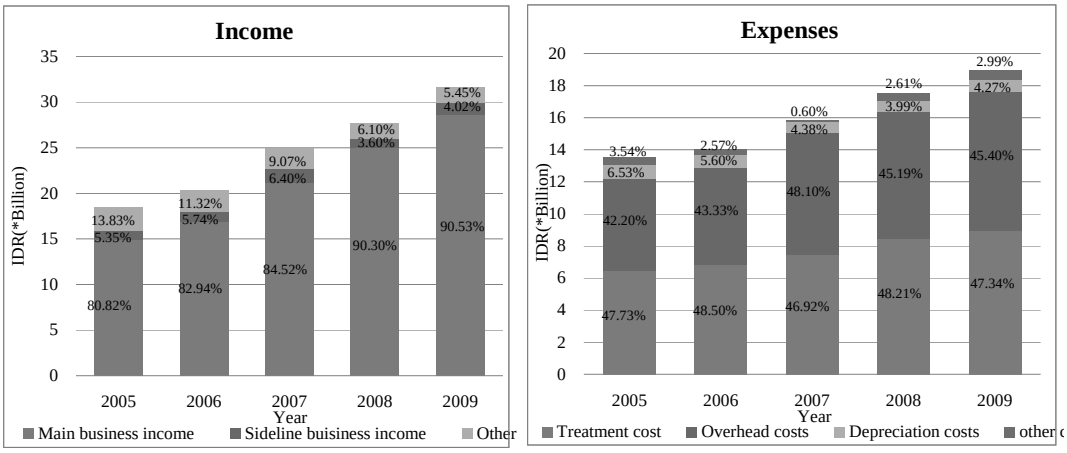


Figure S/R-B1-2 Financial Situation of PD PAL JAYA

B1.4 Budget

B1.4.3 PD PAL JAYA

Table S/R-B1-4 O&M of PD PAL JAYA

Financial Situation of PD PAL JAYA

*** Expenses : Treatment cost**

Description	2005	2006	2007	2008	2009	Remarks
Expenses of salary and allowance	2,602,830,433	2,720,900,999	2,506,625,391	2,530,756,863	2,463,773,839	27%
Expenses of depreciation of wastewater network	826,849,358	1,080,994,827	1,429,268,390	1,595,585,861	2,069,123,742	23%
Expenses of O&M	1,182,737,284	1,233,893,003	1,222,597,526	1,481,646,902	2,031,705,630	23%
Expenses of employee welfare	1,232,015,452	1,346,044,521	1,412,723,677	1,874,322,156	1,640,451,497	18%
Office expenses	365,328,707	498,650,588	741,980,323	754,795,412	492,144,576	5%
Expenses of depriciation of production equipment	264,227,746	166,045,875	205,759,954	212,482,410	284,687,248	3%
total	6,473,988,980	7,046,529,813	7,518,955,261	8,449,589,604	8,981,886,532	100%
Ratio of change	-	9%	7%	12%	6%	9%

Description	2005	2006	2007	2008	2009	Remarks
Expenses of salary and allowance	2,602,830,433	2,720,900,999	2,506,625,391	2,530,756,863	2,463,773,839	
Expenses of salary and allowance Percentage	40.20%	38.61%	33.34%	29.95%	27.43%	
Expenses of depreciation of wastewater network	826,849,358	1,080,994,827	1,429,268,390	1,595,585,861	2,069,123,742	
Expenses of depreciation of wastewater network Percentage	12.77%	15.34%	19.01%	18.88%	23.04%	
Expenses of O&M	1,182,737,284	1,233,893,003	1,222,597,526	1,481,646,902	2,031,705,630	
Expenses of O&M Percentage	18.27%	17.51%	16.26%	17.54%	22.62%	
Expenses of employee welfare	1,232,015,452	1,346,044,521	1,412,723,677	1,874,322,156	1,640,451,497	
Expenses of employee welfare percentage	19.03%	19.10%	18.79%	22.18%	18.26%	
Office expenses	365,328,707	498,650,588	741,980,323	754,795,412	492,144,576	
Office expenses percentage	5.64%	7.08%	9.87%	8.93%	5.48%	
Expenses of depriciation of production equipment	264,227,746	166,045,875	205,759,954	212,482,410	284,687,248	
Expenses of depriciation of production equipment percentage	4.08%	2.36%	2.74%	2.51%	3.17%	
total	6,473,988,980	7,046,529,813	7,518,955,261	8,449,589,604	8,981,886,532	

Source : Financial report PD PAL JAYA, 2005-2009

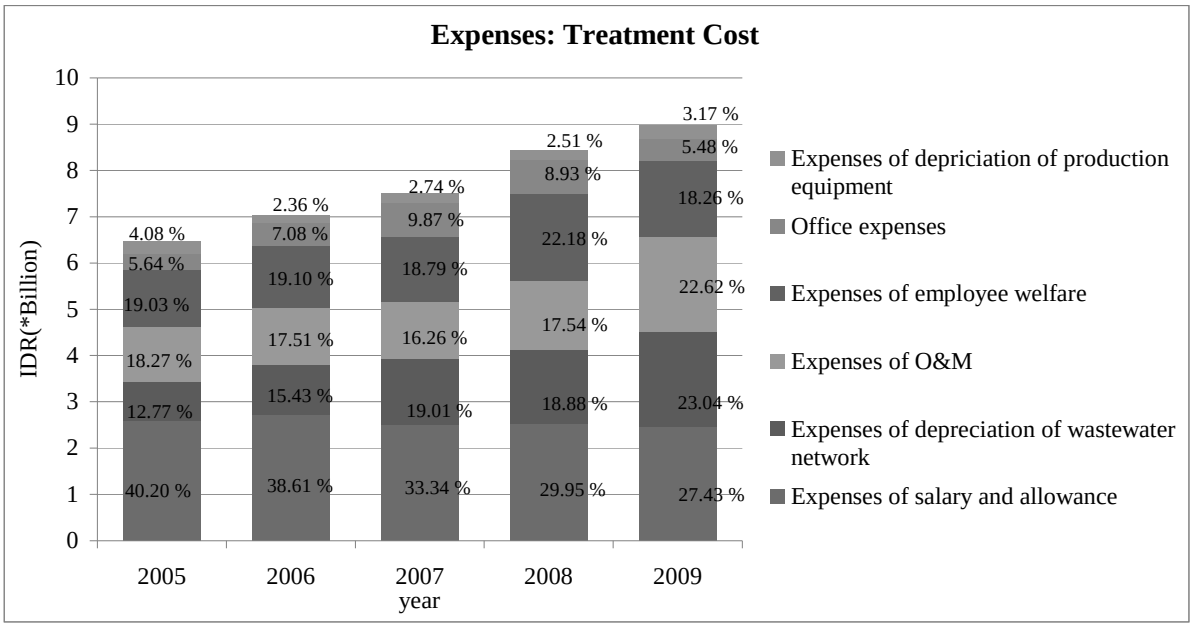


Figure S/R-B1-4 O&M of PD PAL JAYA

B1.5 Regulations for Water Pollution

B1.1.5 Wastewater Quality Standards (Governor's Decree No. 122-2005)

Decree of Ministry of Environment No 51 Year 1995
About
Wastewater Quality Standards for Industrial Activities

Industrial Wastewater Quality Standards is maximum limit of wastewater which can be disposed to the environment.
This regulation, regulate about wastewater quality standards for industries as follows (Appendix A and Appendix B) (*From Article 2 verse 1*):

1.	Caustic Soda	(Appendix A.I and B.I)
2.	Metal Plating	(Appendix A.II and B.II)
3.	Tannery	(Appendix A.III and B.III)
4.	Palm Oil	(Appendix A.IV and B.IV)
5.	Pulp and Paper	(Appendix A.V and B.V)
6.	Rubber	(Appendix A.VI and B.VI)v
7.	Sugar	(Appendix A.VII and B.VII)
8.	Tapioca	(Appendix A.VIII and B.VIII)
9.	Textile	(Appendix A.IX and B.IX)
10.	Urea/Nitrogen Fertilizer	(Appendix A.X and B.X)
11.	Ethanol	(Appendix A.XI and B.XI)
12.	Mono Sodium Glutamate (MSG)	(Appendix A.XII and B.XII)
13.	Plywood	(Appendix A.XIII and B.XIII)
14.	Milk, and food made from milk	(Appendix A.XIV and B.XIV)
15.	Soft drink	(Appendix A.XV and B.XV)
16.	Soap, detergent, and vegetables oil product	(Appendix A.XVI and B.XVI)
17.	Beer	(Appendix A.XVII and B.XVII)
18.	Dry Cell Battery	(Appendix A.XVIII and B.XVIII)
19.	Paint	(Appendix A.XIX and B.XIX)
20.	Pharmaceutical	(Appendix A.XX and B.XX)
21.	Pesticide	(Appendix A.XXI and B.XXI)

The Wastewater Quality Standards for All of the type of industries stated in the above is determined based on pollution load and concentration, except pesticide industry of packing formulation (*From Article 2 verse 2*).
For Industrial activities stated above:

a. Appendix A is applicable for industry which already running before this regulation is stipulated, but have the obligation to conform to the Appendix B maximum before 1 January 2000 (*From Article 2 verse 3*).
b. For the industry which is already implemented the planning phase, but starting to operate after this regulation is applicable, then Appendix A will be applicable but have the obligation to conform to the Appendix B maximum before 1 January 2000 (*From Article 2 verse 3*).

For Industrial activities stated above which the planning and operation is implemented after this regulation is applicable, then they must conform to the Appendix B (*From Article 2 verse 4*).
For other Industrial activities which are not covered by the industrial activities as referred to in Article 2 verse 2, then Governor could use Appendix C to determine the wastewater quality standards for other industrial activities (*From Article 3 verse 2*).
Governor can set additional parameter outside listed parameter as referred to in Article 3 verse 2, after receiving Minister approval (*From Article 3 verse 4*).

Governor can set stricter wastewater quality standard from the provision as referred to in the Appendix of this regulation (*From Article 4 verse 1*).
Based on the Article 6, every person in charge of their industrial activities as referred to in *Article 2 verse 1*, have the obligation:

a. To manage the wastewater so the wastewater quality can be disposed to the environment without exceeding the stipulated wastewater quality standards.
b. To make waterproof wastewater channel so that there is no infiltration to the environment.
c. To install tool to measure flow rate and record the daily wastewater flow rate.
d. Do not dilute the wastewater; including mixing used cooling water to the wastewater disposal channel.
e. To check the wastewater quality standard as referred to in this regulation appendix in periodically at least once a month.
f. To separate the wastewater channel with storm water channel.
g. To record the monthly production.
h. To report the record of flow rate, wastewater quality concentration, monthly production as referred to in letter c, e, g at least every three months to the head of Bappeda, Governor, Technical Institution which in charge of other industrial activities which deemed necessary based on applicable regulation.

APPENDIX A.I
Wastewater Quality Standards for Caustic Soda Industry

PARAMETER	MERCURY (Hg) PROCESS		MEMBRANE/DIAPRAGHM PROCES	
	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (Kg/Ton)
COD	150	1.5 kg/ton	150	1.5
TSS	50	0.5 kg/ton	50	0.5
Mercury (Hg)	0.005	0.05 g/ton	-	-
Lead (Pb)	-	-	3	0.03
Copper (Cu)	-	-	0.3	0.003
Zinc (Zn)	-	-	2	0.02
pH	6.0 - 9.0		6.0 - 9.0	
Maximum Wastewater Flow Rate	10 m^3 per ton product of caustic soda		10 m^3 per ton product of caustic soda	

Notes:
1. Maximum Concentration for above parameters are stated in miligram per liter
2. Maximum Pollution Load for above parameters are stated in kilogram or gram per ton product of caustic soda

APPENDIX A.II
Wastewater Quality Standards for metal plating industry

PARAMETER	COPPER (Cu) PLATING		NICKEL (Ni) PLATING	
	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLUTION LOAD ($gram/m^2$)	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLUTION LOAD ($gram/m^2$)
TSS	60	60	60	6
Cadmium (Cd)	0.05	0.005	0.05	0.005
Cyanide (CN)	0.5	0.05	0.5	0.05
Total Metal	8	0.8	8	0.8
Copper (Cu)	3	0.3	-	-
Nickel (Ni)	-	-	5	0.5
pH	6.0 - 9.0		6.0 - 9.0	
Maximum Wastewater Flow Rate	100 L per m2 product of metal plating		100 L per m2 product of metal plating	

PARAMETER	CHROME (Cr) PLATING		ZINC (Zn) PLATING AND GALVANIZATION	
	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLUTION LOAD ($gram/m^2$)	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLUTION LOAD ($gram/m^2$)
TSS	60	60	60	6
Cadmium (Cd)	0.05	0.005	0.05	0.005
Cyanide (CN)	0.5	0.05	0.5	0.05
Total Metal	8	0.8	8	0.8
Total Chrome (Cr)	2	0.2	-	-
Chrome Hexavalent (Cr^{-6})	0.3	0.03	-	-
Zinc (Zn)	-	-	2	0.2
pH	6.0 - 9.0		6.0 - 9.0	
Maximum Wastewater Flow Rate	100 L per m2 product of metal plating		100 L per m2 product of metal plating	

APPENDIX A.III
Wastewater Quality Standards for tannery industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	150	10.5
COD	300	21
TSS	150	10.5
Sulfide (as H2S)	1	0.07
Total Chrome (Cr)	2	0.14
Oil and Grease	5	0.35
Total Ammonia	10	0.7
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	70 m3 per ton of raw material	

APPENDIX A.IV
Wastewater Quality Standards for palm oil industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	250	1.5
COD	500	3
TSS	300	1.8
Oil and Grease	30	0.18
Total Ammonia (as NH3-N)	20	0.12
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	6 m3 per ton of raw material	

APPENDIX A.V
Wastewater Quality Standards for pulp and paper industry

PARAMETER	PABRIK PULP		PABRIK KERTAS		PABRIK PULP DAN KERTAS	
	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_3	150	15	125	10	150	25.5
COD	350	35	250	20	350	59.5
TSS	200	20	125	10	150	25.9
pH	6.0 - 9.0		6.0 - 9.0		6.0 - 9.0	
Maximum Wastewater Flow Rate	100 m3 per ton of dry pulp		80 m3 per ton product of dry paper		170 m3 per ton product of dry paper	

APPENDIX A.VI
Wastewater Quality Standards for rubber industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	150	6
COD	300	12
TSS	150	6
Total Ammonia (as NH3-N)	10	0.4
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	40 m3 per ton product of rubber	

APPENDIX A.VII
Wastewater Quality Standards for sugar industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	100	4
COD	250	10
TSS	175	7
Sulfide (as H2S)	1	0.04
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	40 m3 per ton product of sugar	

APPENDIX A.VIII
Wastewater Quality Standards for tapioca industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	200	12
COD	400	24
TSS	150	9
Cyanide (CN)	0.5	0.03
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	60 m3 per ton product	

APPENDIX A.IX
Wastewater Quality Standards for Textile industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	85	12.75
COD	250	37.5
TSS	60	9
Total Phenol	1	0.15
Total Chrome (Cr)	2	0.3
Oil and Grease	5	0.75
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	150 m3 per ton product of textile	

APPENDIX A.X
Wastewater Quality Standards for Urea Fertilizer industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	100	1.5
COD	250	3.75
TSS	100	1.5
Oil and Grease	25	0.4
Total Ammonia (as NH3-N)	50	0.75
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	15 m3 per ton product of urea fertilizer	

APPENDIX A.XI
Wastewater Quality Standards for Ethanol industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	150	10.5
TSS	400	28
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	70 m3 per ton product of ethanol	

APPENDIX A.XII
Wastewater Quality Standards for Mono Sodium Glutamate (MSG) industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	100	12
COD	250	30
TSS	100	12
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	120 m3 per ton product of MSG	

APPENDIX A.XIII
Wastewater Quality Standards for plywood industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton)
BOD_5	100	0.28 kg/m3
COD	250	0.70 kg/m3
TSS	100	0.28 kg/m3
Total Phenol	1	2.8 g/m3
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	2.8 m3 per ton product of plywood	

APPENDIX A.XIV
Wastewater Quality Standards for milk and food made from milk industry

PARAMETER	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD PENCEMARAN	
		BASIC MILK FACTORY (kg/ton)	INTEGRATED FACTORY (kg/ton)
BOD_5	40	0.14	0.2
COD	100	0.35	0.5
TSS	50	0.175	0.25
pH		6.0 - 9.0	6.0 - 9.0
Maximum Wastewater Flow Rate		3.5 L per kg total of solid milk	5.0 L per kg product

APPENDIX A.XV
Wastewater Quality Standards for softdrink industry

PARAMETER	MAXIMUM CONCENTRATION	MAXIMUM POLUTION LOAD (gram/m3)			
		WITH BOTTLE WASHING AND SYRUP MAKING	WITH BOTTLE WASHING AND WITHOUT SYRUP MAKING	WITHOUT BOTTLE WASHING AND WITH SYRUP MAKING	WITHOUT BOTTLE WASHING AND SYRUP MAKING
	(mg/L)				
BOD_5	100	600	500	300	200
TSS	90	540	450	270	180
Oil and Grease	12	72	60	36	24
pH		6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0
Maximum Wastewater Flow Rate		6 L per L product of beverages	5 L per L product of beverages	3 L per L product of beverages	2 L per L product of beverages

APPENDIX A.XVI
Wastewater Quality Standards for Soap, Detergent, and Vegetables Oil Product industry

PARAMETER	MAXIMUM CONCENTRATION	MAXIMUM POLUTION LOAD (kg/ton)		
	(mg/L)	SOAP	VEGETABLES OIL	DETERGENT
BOD_5	125	2.5	7.5	0.75
COD	300	6	18	1.8
TSS	100	2	6	0.6
Oil and Grease	25	0.5	1.5	0.15
Phospate (as PO4)	3	0.06	0.18	0.018
MBAS	5	0.1	0.3	0.03
pH	6.0-9.0			
Maximum Wastewater Flow Rate		20 m^3 per ton product of soap	60 m^3 per ton product of vegetables oil	60 m^3 per ton product of detergent

APPENDIX A.XVII
Wastewater Quality Standards for beer industry

PARAMETER	MAXIMUM CONCENTRATION	MAXIMUM POLLUTION LOAD
	(mg/L)	(kg/hektoliter)
BOD_5	75	67.5
COD	170	153
TSS	70	63
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	9 hektoliter per hektoliter Beer	

APPENDIX A.XVIII
Wastewater Quality Standards for dry battery industry

PARAMETER	ALKALINE-MANGANESE		CARBON-ZINC	
	MAXIMUM CONCENTRATION	MAXIMUM POLLUTION LOAD	MAXIMUM CONCENTRATION	MAXIMUM POLLUTION LOAD
	(mg/L)	(mg/kg product)	(mg/L)	(mg/kg product)
COD	-	-	30	15
TSS	15	45	10	5
NH_3-N Total	-	-	4	2
Oil and Grease	3	9	12	6
Zinc (Zn)	0.3	0.9	0.8	0.4
Mercury (Hg)	0.015	0.045	0.02	0.01
Mangan (Mn)	0.5	1.5	0.6	0.3
Chrome (Cr)	0.1	0.3	-	-
Nickel (Ni)	0.6	1.8	-	-
pH	6.0 - 9.0		6.0 - 9.0	
Maximum Wastewater Flow Rate	3.0 L per kg battery		0.5 L per kg battery	

APPENDIX A.XIX
Wastewater Quality Standards for paint industry

PARAMETER	MAXIMUM CONCENTRATION	MAXIMUM POLLUTION LOAD
	(mg/L)	(gram/m^3)
BOD_5	100	80
TSS	60	48
Mercury (Hg)	0.015	0.012
Zinc (Zn)	1.5	1.2
Lead (Pb)	0.4	0.32
Copper (Cu)	1	0.8
Chrome Hexavalent (Cr+6)	0.25	0.2
Titanium (Ti)	0.5	0.4
Cadmium (Cd)	0.1	0.08
Fenol	0.25	0.2
Oil and Grease	15	12
pH	6.0 - 9.0	
Maximum Wastewater Flow Rate	0.8 L per L product of water base paint Zero Discharge for solvent base	

Notes: Solvent Based paint must be Zero Discharge; all of the wastewater produced must be contained or recycled and cannot be disposed on public water body

APPENDIX A.XX
Wastewater Quality Standards for pharmaceutical industry

PARAMETER	PROCESS OF FORMULA MAKING (mg/L)	FORMULA - FORMULATION (MIXING) (mg/L)
BOD_5	150	100
COD	500	200
TSS	130	100
Total N	45	-
Fenol	5	-
pH	6.0 - 9.0	6.0 - 9.0

APPENDIX A.XXI
Wastewater Quality Standards for pesticide industry

PARAMETER	TECHNICAL MAKING OF PESTICIDE		PACKING FORMULATION
	MAXIMUM CONCENTRATION (mg/L)	MAXIMUM POLLUTION LOAD (kg/ton product)	MAXIMUM CONCENTRATION (mg/L)
BOD_5	70	1.75	40
COD	200	5	100
TSS	50	1.25	25
Fenol	3	0.075	2.5
Total CN	1	0.025	-
Copper (Cu)	1.5	0.038	-
Bahan Aktif Total	2	0.05	1
pH	6.0 - 9.0		6.0 - 9.0
Maximum Wastewater Flow Rate	25 m3 per ton product		-

B3 Environmental Conditions

B3.2 River Water Quality and Flow

B3.2.1 Results of River Water Quality Survey (JICA)

Table S/R-B3-1 Water Quality Analysis Method in Water Quality Survey by JICA Expert Team

Items	Method	
Electrical Conductivity（EC）	-	SNI06-6989.1-2004
Total Dissolved Oxygen (TDS)	-	SNI06-2413-1991
Total Suspended Solids	-	Spectrophotometer
Turbidity	Nephelometric Method	SNI06-6989.25-2005
Temperature	Thermometer Method	APHA2550-B-2005
Color	Spectrophotometric Method	APHA2120-C-2005
Dissolved Oxygen（DO）	Membrane Electrode Method	APHA4500-O-G-2005
pH	Electrode Method	SNI06-6989.11-2004
Salinity		Spectrophotometer
Mercury（Hg）		IKM/5.4.13/SMM-LL
Total Iron (Fe)		SNI 06-6989.4-2004
Cadmium（Cd）	Direct Air-Acetylene Flame Method	SNI-6989.16-2009
Total Chromium（Cr）	Direct Air-Acetylene Flame Method	SNI-6989.17-2009
Chromium Hexavalent (Cr^{6+})	Direct Air-Acetylene Flame Method	APHA3500-Cr-B-2005
Nickel（Ni）		SNI-06-6989.7-2004
Zinc（Zn）		SNI-06-6989.6-2004
Cupper （Cu）		SNI06-6989.8-2004
Lead （Pb）		SNI-06-6989.5-2004
Manganese (Mn)		SNI-06-6989.18-2004
Ammonia（NH_3-N）	Ammonia-Selective Electrode Method	APHA4500-NH_3-F-2005
Fluorine（F）		SNI 06-2482-1991
Chloride（Cl^-）	Argento metric Method	SNI06-6989.19-2009
Chlorine（Cl_2）	DPD Colorimetric Method	APHA4500-Cl-G-2005
Nitrate（NO_3-N）		
Nitrite（NO_2-N）	NED hydrochloride method	SNI06-6989.09-2004
Phosphorous（PO_4-P）		SNI06-2483-1991
Sulfate （SO_4）		
Hydrogen Sulfide （H_2S）		SNI06-6989.21-1991
Phenols		SNI06-6989.20-1991
Oil and Grease		Spectrophotometer
Methylene Blue Active Substance		SNI06-2476-1991
Chemical Oxygen Demand（COD_{Mn}）	Permanganic Acid Potassium Method	SNI06-6989.22-2004
Biochemical Oxygen Demand（BOD）	-	SNI-6989.72-2009
Chemical Oxygen Demand（COD_{Cr}）	Dichromate Reduction Method	SNI06-6989.2-2004
Total Coliform		MU-14/SMM-LL
Fecal Coliform		MU-15/SMM-LL

SNI: Indonesia National Standard
APHA-AWWA: American Public Health Association

※1st survey executed on February 2011

Table S/R-B3-2 Result of Water Quality Survey by JICA Expert Team (1/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS																								
			Sample ID																								
			A1	A2	A3	A4	A5	A6	B1	C1	D1	D2	D3	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	F1	F2	F3
			5				5A	27																	29		
I. GENERAL																											
1	Temperature	^{0}C	28	29	30	30	30	30	32	30	30	28	31	32	30	28	30	29	30	30	29	30	30	30	30	30	31
2	Color	scale Pt-Co	4	8	25	7	8	39	7	3	35	17	24	16	57	13	18	16	32	23	14	51	31	30	10	14	11
3	Turbidity	NTU	151	16.8	49.0	44.2	14.1	12.0	11.9	50.1	57.3	12.9	35.5	30.8	51.1	81.0	49.2	7.60	6.90	6.60	11.7	45.5	30.0	24.9	13.1	13.5	14.7
4	pH	-	6.92	7.02	6.82	6.90	7.02	7.12	7.12	7.01	7.01	7.12	7.11	7.11	7.65	7.63	7.58	7.22	7.01	7.11	7.05	7.02	7.11	7.10	7.51	7.10	7.21
5	Dissolved Oxyge	mg/L	1.2	1.5	0.40	1.64	1.40	0.50	0.80	1.44	0.67	0.30	1.90	1.00	0.28	0.23	0.37	0.60	0.20	0.30	0.70	1.10	0.30	1.00	0.53	1.00	0.40
II. METAL, ORGANIC AND INORGANIC SUBSTANCE																											
6	BOD_5	mg/L	28	25	164	29	57	109	17	19	94	87	102	115	129	17	9	37	112	195	19	240	139	198	50	133	51
7	COD	mg/L	40	37	208	38	69	153	31	24	156	125	176	144	173	26	15	54	163	279	29	410	246	280	69	195	78
8	Chloride (Cl^-)	mg/L	25	20	58	31	23	347	42	149	47	54	65	33	56	43	43	45	78	1141	46	119	496	130	26	54	79
9	Ammonia (NH3)	mg/L	6.6	6.3	19.5	6.9	7.3	17.4	6	2.9	21.8	15.4	15.1	15.4	31	18.5	18.1	18.5	21.8	21.2	20.8	53	40.1	34.7	6.3	13.4	14.1
10	Nitrate (NO_3)	mg/L	31.2	3.6	2.7	3.2	4.2	3.2	3.4	2.0	3.5	6.3	6.2	2.8	5.1	2.2	4.2	8.0	2.3	3.5	4.8	3.5	2.5	2.1	9.2	1.0	2.1
11	Nitrite (NO_2)	mg/L	0.3	0.01	0.01	0.3	0.02	<0.003	0.03	0.2	0.02	0.01	0.01	0.02	0.08	0.01	0.01	0.01	<0.003	<0.003	0.02	<0.003	0.02	0.02	0.3	<0.003	<0.003
12	Phosphorous (P)	mg/L	0.2	0.2	1.4	0.07	0.3	1.4	0.4	0.2	1.4	1.4	1.5	4.5	2.6	0.4	1.3	3	1.7	1.6	1.2	3.2	2.4	1.7	0.4	1.0	1.1
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
15	Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
III. MICROBIOLOGY																											
16	Fecal Coliform	MPN/100ml	2	>1600	26	500	280	50	>1600	17	>1600	110	350	>1600	>1600	>1600	>1600	130	1600	350	140	900	140	>1600	33	>1600	>1600

※1st survey executed on February 2011

Table S/R-B3-2 Result of Water Quality Survey by JICA Expert Team (2/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS																								
			Sample ID																								
			F4	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	F5	F6	F7	G1	G2	G3	G4	G5	G6	G7	G8
				41	24 D	19	23	25	14	7	1	33	8	10	17	35											
I. GENERAL																											
1	Temperature	^{0}C	30	32	31	27	28	28	27	28	30	31	32	29	27	29	30	31	30	31	26	29	29	30	30	30	29
2	Color	scale Pt-Co	22	12	32	7	2	5	4	8	3	4	10	5	5	26	22	5	12	6	19	13	13	6	24	16	64
3	Turbidity	NTU	19.2	18.1	27.4	68.2	8.5	54.2	109	58.6	31.9	28.4	19.5	17.3	232	9.50	36.0	23.9	17.7	21.0	25.4	70.6	12.6	57.6	59.0	58.8	11.7
4	pH	-	7.20	7.32	6.51	7.12	7.05	7.01	7.20	6.71	7.53	7.42	7.21	6.82	7.21	7.01	7.30	7.48	7.31	7.52	7.15	7.47	7.22	7.01	7.49	7.32	7.22
5	Dissolved Oxyge	mg/L	0.5	1.0	0.8	1.1	3.1	3.7	2.8	3.3	4.20	3.72	1.55	2.8	2.25	0.49	0.3	1.88	0.9	1.51	0.12	0.12	0.21	2.5	0.54	0.23	0.22
II. METAL, ORGANIC AND INORGANIC SUBSTANCE																											
6	BOD_5	mg/L	63	41	91	63	8	18	10	34	25	35	40	11	<3	65	163	14	77	21	130	99	57	10	70	132	384
7	COD	mg/L	103	53	121	85	11	24	15	45	39	54	59	15	<10	85	257	20	114	29	188	155	91	13	114	218	504
8	Chloride (Cl^-)	mg/L	744	74	54	28	14	14	14	19	13	15	22	15	7	64	496	30	107	22	79	62	1091	12	58	63	17
9	Ammonia (NH3)	mg/L	14.1	10	7.6	5.9	1.9	1.5	1.2	1.5	1.5	3.2	4.9	0.8	1.9	20.5	23.2	8	15.4	6.3	24.2	20.8	18.8	1.9	17.4	16.8	23.9
10	Nitrate (NO_3)	mg/L	0.8	1.7	2.1	4.7	13.9	11.0	11.1	10.0	7.8	19.1	3.3	6.2	6.8	2.2	3.5	11.8	2.9	8.6	1.5	1.2	2.1	6.2	1.5	1.7	3.6
11	Nitrite (NO_2)	mg/L	<0.003	0.02	<0.003	0.1	0.8	1.2	0.5	0.5	0.2	0.5	0.2	0.4	0.2	0.01	<0.003	0.2	0.16	0.3	<0.003	0.01	<0.003	0.4	0.01	0.01	0.03
12	Phosphorous (P)	mg/L	0.9	0.6	0.3	0.3	0.03	0.06	0.03	0.10	0.03	0.03	0.06	<0.01	0.02	2	2.5	0.3	1.3	0.2	1.70	1.58	0.9	0.10	1.1	1.45	2.7
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.08	<0.02	<0.02	<0.02
15	Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
III. MICROBIOLOGY																											
16	Fecal Coliform	MPN/100ml	>1600	1600	>1600	14	60	14	33	350	>1600	1600	350	17	11	13	350	26	1600	31	60	220	350	>1600	110	9	170

※1st survey executed on February 2011

Table S/R-B3-2 Result of Water Quality Survey by JICA Expert Team (3/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS														
			Sample ID														
			G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20	H1	H2	H3
											34						13
I. GENERAL																	
1	Temperature	^{0}C	28	30	31	30	31	29	30	31	29	30	31	31	28	29	30
2	Color	scale Pt-Co	5	22	21	3	4	12	49	26	29	55	97	15	18	17	13
3	Turbidity	NTU	361	74.6	6.4	33	24	9.7	23.6	9.6	18.7	27.4	208	25.2	10.7	8.2	11.2
4	pH	-	6.80	8.03	6.91	7.55	7.52	6.90	7.045	7.03	7.32	6.81	7.51	7.05	7.21	6.72	7.41
5	Dissolved Oxyge	mg/L	1.28	0.28	0.13	1.75	1.25	0.6	0.13	0.15	0.17	0.5	0.25	0.16	0.21	0.16	0.19
II. METAL, ORGANIC AND INORGANIC SUBSTANCE																	
6	BOD_5	mg/L	284	94	55	43	37	94	153	135	144	230	117	102	20	75	27
7	COD	mg/L	374	217	84	64	55	127	190	174	197	294	202	146	38	99	36
8	Chloride (Cl^-)	mg/L	198	84	942	16	24	33	78	134	992	55	347	120	73	75	2729
9	Ammonia (NH3)	mg/L	11.7	24.2	24.2	2.2	8.3	7.3	27.6	23.6	23.6	38.8	4.9	23.5	23.6	20.8	4.6
10	Nitrate (NO_3)	mg/L	3.2	2.1	1.5	6.5	2.0	15.7	2.0	2.8	3.5	5.4	3.2	3.1	2.1	1.9	29.2
11	Nitrite (NO_2)	mg/L	<0.003	0.01	<0.003	1.2	0.2	0.01	0.02	0.01	0.03	<0.003	0.05	0.02	0.02	0.02	3.5
12	Phosphorous ($P^$	mg/L	1.3	2.6	2.2	0.07	0.8	2	2.7	2.4	1.8	0.3	0.3	2.1	1.2	1.2	0.1
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
15	Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
III. MICROBIOLOGY																	
16	Fecal Coliform	MPN/100ml	23	1600	350	1600	1600	>1600	140	>1600	280	900	12	>1600	>1600	170	280

※2nd survey executed on February 2011

Table S/R-B3-3 Result of Water Quality Survey by JICA Expert Team (1/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS																					Method
			Sample ID																					
			A1	A2	A3	A4	A5	A6	B1	C1	D1	D2	D3	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	
			5				5A	27																	
I. PHYSICAL																									
1	Temperature	^{0}C	31	28	32	31	30	31	29	30	31	29	31	28	28	30	31	31	29	30	30	30	32	29	APHA 2550 B 2005
2	Color	scale Pt-Co	15	17	26	10	10	24	21	10	49	13	31	52	62	21	42	27	22	28	51	49	54	57	SNI 06 6989 24 2005
3	Turbidity	NTU	28.0	32.0	76.0	31.4	38.8	16.5	32.0	35.6	61.3	43.9	63.2	79.6	27.1	36.8	50.2	31.6	36.5	55.9	25.0	62.6	44.1	59.2	SNI 06 6989 25 2005
II. CHEMICAL																									
4	pH	-	7.08	6.90	7.10	8.20	6.98	6.90	7.13	6.70	7.10	7.18	7.14	7.13	7.24	7.22	7.17	7.29	7.07	7.00	7.42	7.18	7.43	7.34	SNI 06 6989 11 2004
5	Dissolved Oxygen	mg/L	1.26	1.60	0.31	0.51	1.77	0.37	1.31	0.52	0.34	0.55	0.53	0.51	0.62	1.04	0.80	0.24	0.32	0.27	0.50	0.41	0.30	0.58	APHA 4500-O-G-2005
6	BOD_5	mg/L	62	27	45	35	26	117	70	33	120	84	108	154	165	34	65	49	169	49	42	177	162	92	SNI 06 6989 72 2009
7	COD	mg/L	132	47	83	106	51	252	123	55	293	170	194	343	287	79	126	93	242	168	76	384	312	204	SNI 06 6989 2 2004
8	Chloride (Cl^-)	mg/L	29	24	83	107	17	344	76	23	51	70	87	62	64	21	50	56	23	591	47	283	304	96	SNI 6989 19 2009
9	Free Ammonia (NH3)	mg/L	0.020	0.004	0.100	1.360	0.004	0.020	0.110	0.002	0.080	0.120	0.160	0.150	0.180	0.120	0.070	0.300	0.010	0.020	0.340	0.470	0.840	0.370	SNI 06 6989 30 2005
10	Nitrate (NO_3-N)	mg/L	0.68	0.02	2.51	1.81	2.33	3.21	0.04	1.90	3.21	0.70	1.27	0.79	2.40	0.70	0.43	3.80	2.80	2.87	0.48	1.24	6.45	1.02	HACH-Nitraver
11	Nitrite (NO_2-N)	mg/L	<0.0009	0.091	0.003	<0.0009	0.335	<0.0009	0.030	0.122	<0.0009	0.030	0.009	<0.0009	0.012	0.012	0..015	<0.0009	0.018	<0.0009	0.030	0.006	<0.0009	0.030	SNI 06 6989 9 2004
12	Phosphorous (P)	mg/L	1.0	0.1	2.4	2.0	<0.01	1.1	1.8	0.1	1.7	3.2	2.4	1.5	1.9	1.2	1.2	1.6	1.1	1.5	3.2	3.3	2.7	2.0	APHA 4500-P-E-2005
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	SNI 6989 16 2009
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	SNI 6989 17 2009
15	Mercury (Hg)	mg/L	0.002	0.002	0.015	0.002	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.005	0.002	0.002	0.005	0.005	0.003	0.002	0.004	0.004	0.002	APHA 3500-Hg-B-2005
III. MICROBIOLOGY																									
16	Fecal Coliform	MPN/100mL	1600	2200	300	800	500	250	16000	170	9000	16000	1600	1600	1800	16000	2800	2800	1600	710	900	880	240	16000	SNI 19 3957 1995

※2nd survey executed on February 2011

Table S/R-B3-3 Result of Water Quality Survey by JICA Expert Team (2/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS																						Method
			Sample ID																						
			F1	F2	F3	F4	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	F5	F6	F7	G1	G2	
			29				41	24 D	19	23	25	14	7	1	33	8	10	17	35						
I. PHYSICAL																									
1	Temperature	^{0}C	30	31	31	31	29	32	31	29	28	28	33	29	29	30	29	30	27	32	30	34	30	31	APHA 2550 B 2005
2	Color	scale Pt-Co	19	18	26	23	42	28	18	13	10	10	16	27	16	13	9	20	9	21	20	18	17	28	SNI 06 6989 24 2005
3	Turbidity	NTU	24.7	27.5	16.8	20.2	46.3	55.6	36.2	31.2	48.8	56.9	8.8	9.8	24.1	9.1	29.0	444	88.6	16.1	31.2	27.9	4.5	35.8	SNI 06 6989 25 2005
4	pH	-	7.24	7.16	7.30	7.15	6.92	6.50	7.10	7.15	6.90	7.21	6.94	7.03	6.90	6.95	6.96	7.44	7.32	7.20	7.07	7.10	7.00	7.30	SNI 06 6989 11 2004
5	Dissolved Oxygen	mg/L	1.58	1.15	0.95	0.52	1.27	0.20	1.05	1.89	1.09	3.40	1.65	2.20	1.85	0.70	3.00	0.20	0.41	0.17	1.18	0.20	2.28	0.39	APHA 4500-O-G-2005
6	BOD_5	mg/L	27	123	93	83	54	236	77	21	32	16	82	49	67	34	5	67	56	84	26	34	51	239	SNI 06 6989 72 2009
7	COD	mg/L	63	263	180	158	108	437	164	38	69	30	179	97	119	63	12	114	104	32	45	98	89	523	SNI 06 6989 2 2004
8	Chloride (Cl^-)	mg/L	40	69	81	203	78	92	39	14	18	23	109	43	53	10	10	19	8	68	36	52	52	106	SNI 6989 19 2009
9	Free Ammonia (NH3)	mg/L	0.002	0.100	0.240	0.160	0.008	0.007	0.020	0.007	0.006	0.040	0.004	0.001	0.006	0.005	0.001	0.050	0.080	0.090	0.020	0.002	0.008	0.360	SNI 06 6989 30 2005
10	Nitrate (NO_3-N)	mg/L	0.32	0.11	3.51	1.54	0.68	2.42	0.61	2.65	0.88	2.10	4.82	2.53	2.83	0.09	1.56	2.78	2.28	0.43	0.11	0.27	0.27	0.54	HACH-Nitraver
11	Nitrite (NO_2-N)	mg/L	0.009	0.006	<0.0009	0.009	<0.0009	0.003	<0.0009	0.030	0.152	0.274	0.091	0.061	0.122	0.012	0.304	0.335	0.018	0.009	0.974	0.006	<0.0009	0.021	SNI 06 6989 9 2004
12	Phosphorous (P)	mg/L	0.7	1.1	1.5	2.0	1.9	0.2	0.1	0.5	0.06	0.04	0.4	0.3	0.3	0.06	0.04	1.7	0.3	0.8	0.4	0.03	0.2	1.1	APHA 4500-P-E-2005
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	SNI 6989 16 2009
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	SNI 6989 17 2009
15	Mercury (Hg)	mg/L	0.002	0.002	0.005	0.006	0.002	0.002	0.004	0.002	0.002	0.004	0.003	0.002	0.008	0.017	0.004	0.003	0.002	0.002	0.005	0.002	0.002	0.003	APHA 3500-Hg-B-2005
III. MICROBIOLOGY																									
16	Fecal Coliform	MPN/100mL	16000	2800	2100	16000	16000	2180	9000	1600	1600	410	350	16000	1690	1600	250	417	470	1600	1600	1600	350	540	SNI 19 3957 1995

※2nd survey executed on February 2011

Table S/R-B3-3 Result of Water Quality Survey by JICA Expert Team (3/3)

No	PARAMETER	UNIT	RESULT OF ANALYSIS																					Method
			Sample ID																					
			G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20	H1	H2	H3	
																	34						13	
I. PHYSICAL																								
1	Temperature	^{0}C	31	30	31	30	30	31	30	30	29	30	27	28	29	28	31	29	29	29	29	32	30	APHA 2550 B 2005
2	Color	scale Pt-Co	25	23	13	57	24	40	28	35	22	14	16	61	22	29	24	96	44	60	19	64	32	SNI 06 6989 24 2005
3	Turbidity	NTU	105	32.1	53.5	86.7	54.1	32.5	18.6	27.2	32.9	13.9	33.7	19.0	37.0	17.0	54.5	26.5	30.7	17.0	37.1	104	37.5	SNI 06 6989 25 2005
II. CHEMICAL																								
4	pH	-	7.30	7.17	7.09	6.98	7.70	6.70	6.90	7.00	7.14	7.02	7.06	7.00	6.94	7.05	7.37	6.97	7.21	7.00	7.30	7.18	7.65	SNI 06 6989 11 2004
5	Dissolved Oxygen	mg/L	0.34	0.30	3.0	0.71	0.18	0.25	0.40	0.45	0.35	1.45	1.79	0.42	0.92	1.02	0.56	0.70	1.92	0.69	0.60	0.85	1.69	APHA 4500-O-G-2005
6	BOD_5	mg/L	95	69	14	113	22	241	146	91	53	36	26	206	141	172	75	165	87	66	55	59	54	SNI 06 6989 72 2009
7	COD	mg/L	179	145	25	188	64	473	399	185	114	72	53	394	180	287	172	372	158	192	101	124	93	SNI 06 6989 2 2004
8	Chloride (Cl^-)	mg/L	82	969	15	62	53	67	102	94	785	73	62	55	69	100	1577	66	360	157	147	91	2139	SNI 6989 19 2009
9	Free Ammonia (NH3)	mg/L	0.310	0.150	0.004	0.020	0.800	0.030	0.040	0.030	0.160	0.016	0.040	0.030	0.010	0.033	0.390	0.050	0.220	0.030	0.310	0.160	0.390	SNI 06 6989 30 2005
10	Nitrate (NO_3-N)	mg/L	0.72	2.58	0.70	2.10	0.81	3.12	2.76	2.38	2.80	2.94	0.52	0.59	0.72	0.50	0.63	0.54	3.30	0.86	0.79	0.70	0.38	HACH-Nitraver
11	Nitrite (NO_2-N)	mg/L	0.013	0.021	0.024	0.009	0.012	<0.0009	<0.0009	<0.0009	0.018	<0.0009	0.009	<0.0009	0.006	<0.0009	0.009	0.030	<0.0009	<0.0009	0.015	0.015	0.030	SNI 06 6989 9 2004
12	Phosphorous (P)	mg/L	2.2	1.3	<0.01	2.0	1.6	1.1	2.0	2.1	1.5	0.6	0.9	1.3	0.5	1.6	0.3	2.9	2.0	1.6	1.2	1.4	0.3	APHA 4500-P-E-2005
13	Cadmium (Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	SNI 6989 16 2009
14	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	SNI 6989 17 2009
15	Mercury (Hg)	mg/L	0.003	0.007	0.013	0.002	0.003	0.003	0.002	0.005	0.002	0.002	0.003	0.002	0.003	0.002	0.005	0.004	0.002	0.004	0.002	0.002	0.004	APHA 3500-Hg-B-2005
III. MICROBIOLOGY																								
16	Fecal Coliform	MPN/100mL	1700	16000	2700	3500	1600	1350	580	2300	1600	1430	1710	1950	1600	16000	9200	1600	16000	1600	2800	250	3500	SNI 19 3957 1995

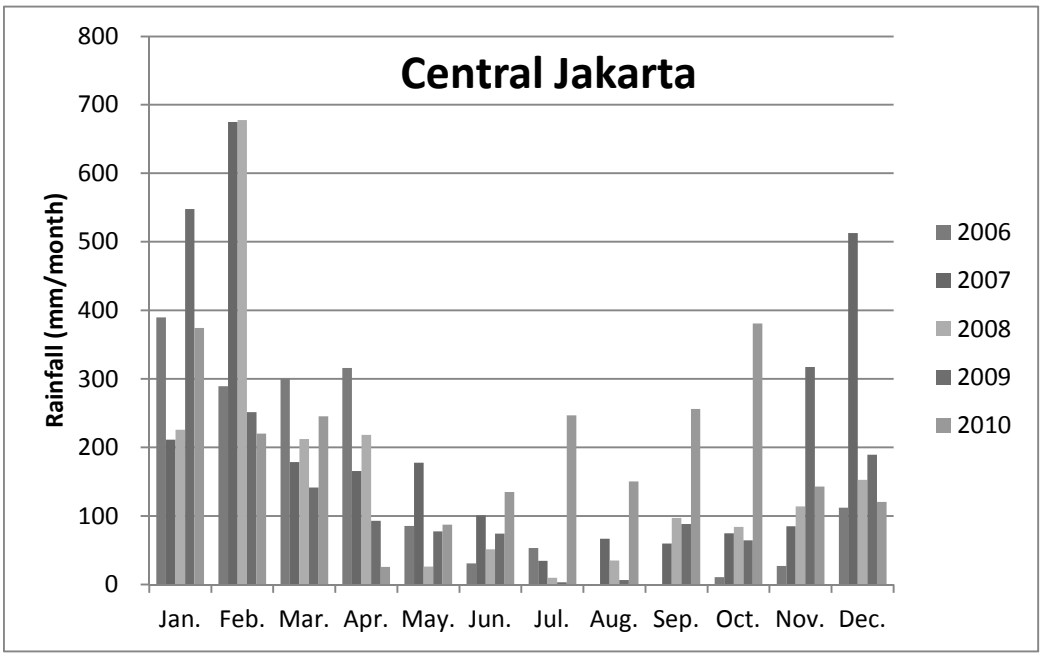


Figure S/R-B3-1 Monthly Rainfall from 2006 to 2010 (Place: Central Jakarta)

Table S/R-B3-4 Monthly Rainfall from 2006 to 2010 (Place: Central Jakarta)

	2006	2007	2008	2009	2010	Ave.
Jan.	390	211	226	548	375	350
Feb.	289	675	678	251	220	423
Mar.	300	178	212	141	245	215
Apr.	316	166	218	93	26	164
May.	85	177	26	78	87	91
Jun.	31	101	51	74	135	78
Jul.	53	35	10	3	247	69
Aug.	0	67	35	7	151	52
Sep.	0	60	97	88	256	100
Oct.	11	75	84	64	381	123
Nov.	27	85	114	317	143	137
Dec.	112	513	153	189	121	218
Total	1,614	2,341	1,903	1,854	2,386	2,020

B3.2.2 Data for River Water Quality and Flow (by BPLHD)

The Environmental Bureau of DKI Jakarta (hereinafter referred to as "BPLHD") has been conducting annual monitoring of river water quality and flow for the main rivers in DKI Jakarta since 1979 for 2 to 5 times in a year. JICA Expert Team collected the data from 2006 to 2010.

Table 1 shows the outline of river water quality and flow which JICA Expert Team has obtained.

Table S/R-B3-5 Outline of Water Quality and Flow for Main Rivers measured by BPLHD

No.	Item	Contents
1	Frequency/Date of Measurement	Frequency: 14 times in total Date: Jun. 2006, Dec. 2006, Jun. 2007, Dec. 2007, Aug. 2008, Oct. 2008, Nov. 2008, Apr. 2009, Jul. 2009, Mar. 2010, May 2010, Aug. 2010, Oct 2010, Nov. 2010
2	Location of measurement	67 locations on the main rivers in DKI Jakarta[*1]
3	Items measured	River flow: 2 times in 2006, 2 times in 2008, 2 times in 2009, 2 times in 2010

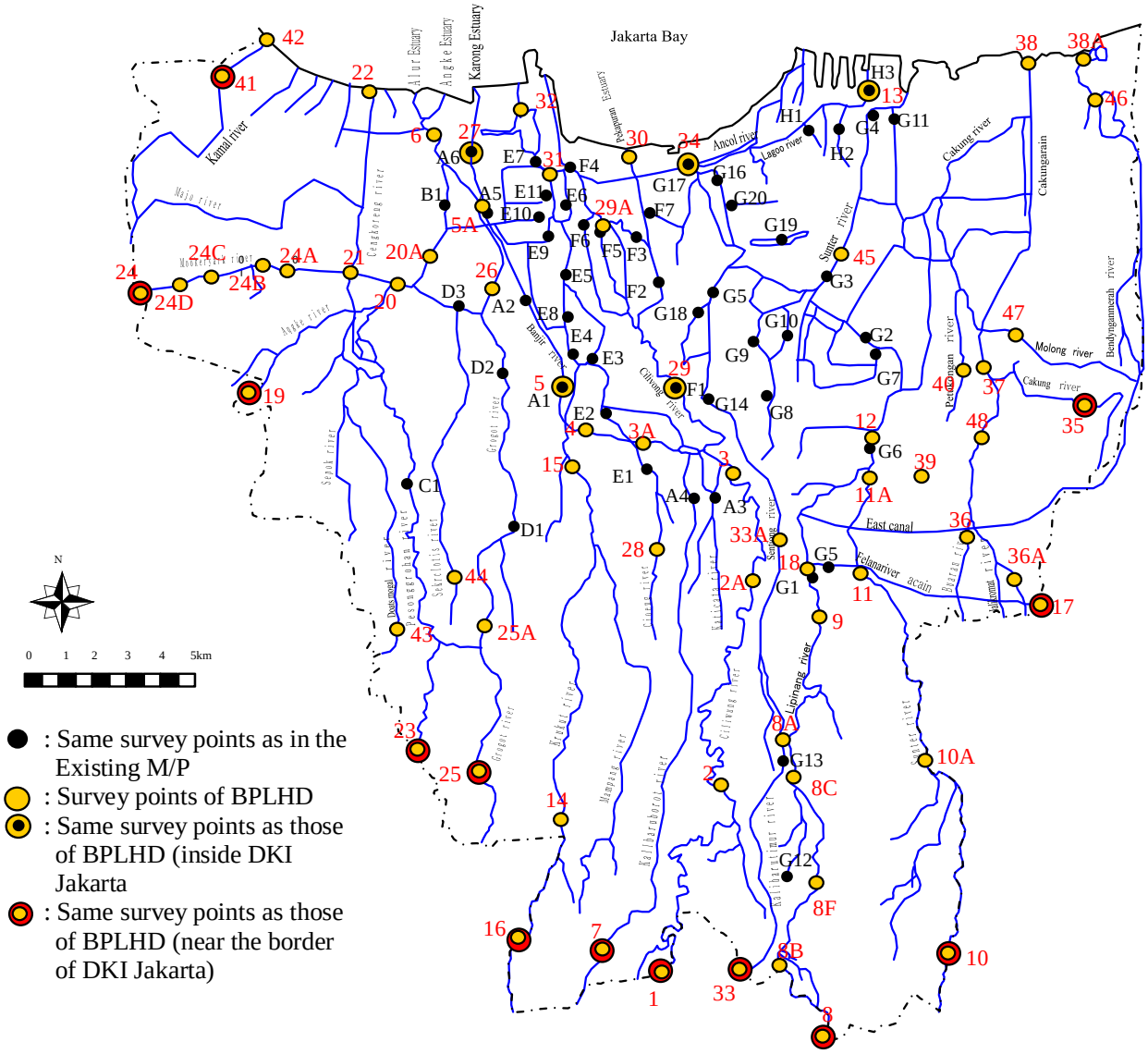
Table S/R-B3-5 Outline of Water Quality and Flow for Main Rivers measured by BPLHD

No.	Item	Contents
1	Frequency/Date of Measurement	Frequency: 14 times in total Date: Jun. 2006, Dec. 2006, Jun. 2007, Dec. 2007, Aug. 2008, Oct. 2008, Nov. 2008, Apr. 2009, Jul. 2009, Mar. 2010, May 2010, Aug. 2010, Oct 2010, Nov. 2010
		Water quality items measured: 36 items *2 **(1) General item** Electric Conductivity (EC), Total Dissolved Solid (TDS), Total Suspended Solid (TSS), Turbidity, Water Temperature, Color, Dissolved Oxygen (DO), pH, Salinity **(2) Heavy metal, Organic and Inorganic** Mercury (Hg), Iron (Fe), Cadmium (Cd), Chromium (Cr) (Total), Hexavalent Chromium (Cr^{6+}), Nickel (Ni), Zinc (Zn), Copper (Cu), Lead (Pb), Manganese (Mn), Ammonia (NH_3), Fluorine (F), Chloride (Cl), Free Chlorine (Cl_2), Nitrate (NO_3), Nitrite (NO_2), Phosphorus (PO_4), Sulphate (SO_4), Hydrogen Sulfide (H_2S), Phenol, Oil and Grease, Methylene Blue Active Substance, Organic ($KMnO_4$), BOD, CODcr **(3) Bacteria** Bacteria, Fecal Coliform

Note: 1. Refer to Figure S/R-B3-2 for locations of measuring point.
2. Refer to Attached 1 for measuring method for each water quality item

Source: Prepared by JICA Expert Team based on the data from BPLHD

All data collected from BPLHD by this survey shall refer to Table S/R-B3-6.



Source: JICA Expert Team

Figure S/R-B3-2 Location Measured of Water Quality Survey (65 Locations)

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (1/67)

Sampling Place 1 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	7.3	11.8				60.8	10.9	17.9	3.6							18.7	60.8	3.6	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	192	176	159	125	218	170	151	153	251	114	210	178	137	138	500	169	251	114	14	0
2	TDS	mg/L	87	88	89	56	56	122	59	55	78	76	105	50	81	78	500	77	122	50	14	0
3	TSS	mg/L	11	47	4	207	10	200	15	44	18	74	27	10	15	16	-	50	207	4	14	0
4	Turbidity	NTU	6	40	11	189	59	153	17	12	16	210	45	5	4	10	100	55	210	4	14	3
5	Temperature	℃	27	28	28	26	28	26	28	28	29	27	29	29	29	28	Normal Temp.	28	29	26	14	
6	Color	Pt-Co Scale								120	21						100	71	120	21	2	1
7	DO	mg/L	3.2	3.0	2.9	5.7	3.5	4.4	3.7	5.6	2.3	6.7	4.6	2.5	7.2	8.7	3.0	4.6	8.7	2.3	14	4
8	pH	-	6.3	7.9	7.1	7.6	8.2	7.4	6.3	7.2	7.5	7.5	6.6	7.7	8.2	7.8	6.0-8.5	7.4	8.2	6.3	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L	0.001											0	0	0	0.001	0.000	0.001	0.000	4	1
11	Fe	mg/L		0.2	0.2	0.3	0.5	0.5	0.3	0.4	0.4	0.6	0.6	0.5	0.0	0.5	2.0	0.4	0.6	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L				0.12	0.07	0.17	0.54	0.02	0.06	0.10	0.05	0.19	0.06	0.11	1.0	0.14	0.54	0.02	11	0
17	Cu	mg/L			0.01									0	0	0	0.10	0.003	0.010	0.000	4	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L					0.07	0.01		0.02	0.03	0.03	0.09	0.09	0.06	0.10	-	0.06	0.10	0.01	9	
20	NH_3	mg/L	0.16		0.27	0.46	0.41	0.31	0.19	0.19	0.33	0.36	0.12	0.12	0.26	0.29	1.0	0.27	0.46	0.12	13	0
21	F	mg/L							0.44			0.40	0.06		0	0.10	1.5	0.20	0.44	0.00	5	0
22	Cl^-	mg/L			29	17	29	10		14	19	19	19	19	5	15	250	18	29	5	11	0
23	Cl_2	mg/L							10		0.7				0		-	3.45	9.61	0.00	3	
24	NO_3	mg/L	1.20	2.40	1.52	1.59	2.01	1.74	2.24	2.03	2.26	2.17	1.59	1.52	1.59	1.98	10.0	1.85	2.40	1.20	14	0
25	NO_2	mg/L	0.06		0.09	0.03	0.17	0.06	0.05	0.05	0.31	0.10	0.05	0.06	0.07	0.09	1.0	0.09	0.31	0.03	13	0
	T-N	mg/L	1.43	2.40	1.88	2.08	2.59	2.11	2.49	2.27	2.90	2.63	1.76	1.70	1.92	2.36		2.18	2.90	1.43	14	0
26	PO_4	mg/L	0.07	0.38	0.09	0.03	0	0.10	0.03	0.04	0.05	0.05	0.24	0.17	0.07	0.02	0.50	0.12	0.38	0.02	14	0
27	SO_4	mg/L			7	10	20	28	14	8	22	5	16	4	10	10	100	13	28	4	12	0
28	H_2S	mg/L	0.10	0.09	0.06	0.41	0.09	0.12	0.11	0.25	0.09	0.06	0.07	0.12	0.11	0.05	0.10	0.12	0.41	0.05	14	7
29	Phenol	mg/L		0.01	0.02		0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.05	0.01	0.01	0.05	0.02	0.05	0.01	12	0
30	Oil and Grease	mg/L			0.19	0.12	0.02		0.04	0.02	0.13			0.16	0.00	0.00	<0	0.07	0.19	0.00	9	0
31	Active Substance	mg/L	0.05	0.15	0.02	0.04	0.10	0.08	0.05	0.11	0.03	0.01	0.03	0.06	0.01	0.04	1.0	0.06	0.15	0.01	14	0
32	COD_{Mn}	mg/L	20	31	27	27	12	25	30	11	31	10	45	40	11	15	15.0	24	45	10	14	10
33	BOD	mg/L	14	29	17	14	10	18	15	5	16	5	29	11	7	10	10.0	14	29	5	14	9
34	COD_{Cr}	mg/L	25	48	36	36	29	69	43	36	61	26	57	49	12	39	20.0	41	69	12	14	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.08	0.8	0.13	0.28	0.14	0.7	0.07	0.012	0.033	0.0079	1.3	3.5	0.08	0.3	0.001	0.53092	3.5	0.0079	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.017	0.17	0.028	0.028	0.033	0.31	0.033	0.0084	0.013	0.0049	1.4	0.11	0.08	0.028	0.002	0.16166	1.4	0.0049	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (2/67)

Sampling Place 2 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	8.2	13.0				36.8	21.2	17.0	7.0							17.2	36.8	7.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	213	181	176	122	270	150	164	160	247	141	219	170	175	170	500	183	270	122	14	0
2	TDS	mg/L	98	82	95	57	66	118	66	64	78	68	106	48	82	82	500	79	118	48	14	0
3	TSS	mg/L	18	56	5	225	10	33	10	67	39	38	18	10	11	22	-	40	225	5	14	0
4	Turbidity	NTU	2	43	12	198	38	21	15	17	15	102	75	19	12	36	100	43	198	2	14	2
5	Temperature	℃	28	29	29	26	29	27	28	29	29	26	26	29	29	28	Normal Temp.	28	29	26	14	
6	Color	Pt-Co Scale								125	20						100	73	125	20	2	1
7	DO	mg/L	2.2	6.1	2.2	3.9	2.7	3.0	3.4	4.2	2.7	8.6	5.3	7.7	7.5	7.9	3.0	4.8	8.6	2.2	14	4
8	pH	-	6.3	7.4	6.8	7.3	8.8	7.2	6.4	7.3	7.6	7.5	7.8	7.6	7.7	6.1	6.0-8.5	7.3	8.8	6.1	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L		0.6	0.2	0.4	0.5	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.0	0.4	2.0	0.4	0.6	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.13	0.09	1.95	0.02	0.10	0.01	0.06	0.05	0.05		1.0	0.27	1.95	0.01	9	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L					0.13	0.02		0.05	0.05	0.07	0.18	0.04	0.05	0.13	-	0.08	0.18	0.02	9	
20	NH_3	mg/L	0.67		0.33	0.63	0.74	0.36	0.33	0.28	0.64	0.49	0.95	0.41	0.51	0.35	1.0	0.51	0.95	0.28	13	0
21	F	mg/L			0.41			0.57	0.11			1.11	0.26		0.20		1.5	0.44	1.11	0.11	6	0
22	Cl^-	mg/L			40	9	24	10		17	34	19	19	19	10	19	250	20	40	9	11	0
23	Cl_2	mg/L							19		0.3				0		-	6.49	19.20	0.00	3	
24	NO_3	mg/L	1.34	2.70	2.03	1.86	1.88	1.34	2.31	2.07	3.10	2.14	2.19	1.92	1.95	2.43	10.0	2.09	3.10	1.34	14	0
25	NO_2	mg/L	0.10	0.27	0.20	0.06	0.09	0.08	0.08	0.05	0.07	0.05	0.20	0.09	0.09	0.12	-	0.11	0.27	0.05	14	0
	T-N	mg/L	2.11		2.56	2.55	2.71	1.78	2.71	2.40	3.81	2.68	3.34	2.42	2.55	2.90	1.0	2.66	3.81	1.78	13	13
26	PO_4	mg/L	0.10	0.49	0.14	0.06	0	0.07	0.06	0.05	0.04	0.07	0.14	0.11	0.08	0.03	0.50	0.12	0.49	0.03	14	0
27	SO_4	mg/L			8	10	24	19	14	13	14	9	19	14	2	13	100	13	24	2	12	0
28	H_2S	mg/L	0.03	0.12	0.06	0.74	0.14	0.07	0.10	0.33	0.16	0.05	0.07	0.24	0.18	0.50	0.10	0.20	0.74	0.03	14	9
29	Phenol	mg/L		0.01	0.01		0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.04	0.01	0.02	0.05	0.01	0.04	0.01	12	0
30	Oil and Grease	mg/L			0.41	0.21	0.02		0.04	0.08	0.07	0.04		0.36	0.24	0	<0	0.15	0.41	0.00	10	0
31	Active Substance	mg/L	0.07	0.18	0.09	0.04	0.09	0.13	0.05	0.07	0.06	0.03	0.02	0.07	0.04	0.05	1.0	0.07	0.18	0.02	14	0
32	COD_{Mn}	mg/L	16	10	13	34	16	14	30	30	17	12	12	10	11	17	15.0	17	34	10	14	7
33	BOD	mg/L	12	7	6	24	6	5	13	7	9	5	7	7	9	8	10.0	9	24	5	14	3
34	COD_{Cr}	mg/L	24	13	32	49	47	23	57	38	34	25	32	14	15	42	20.0	32	57	13	14	11
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.0009	0.11	0.14	11	0.11	0.79	0.17	0.33	0.049	0.0079	3.5	0.7	2.8	0.3	0.001	1.42913	11	0.0009	14	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.0005	0.03	0.07	1.1	0.031	0.046	0.11	0.13	0.023	0.0033	1.7	0.05	0.07	0.11	0.002	0.24813	1.7	0.0005	14	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (3/48)

Sampling Place 2A Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	11.7					48.7	33.2	37.5	18.1							29.9	48.7	11.7	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	335		243	138	305	186	186	152	278						500	228	335	138	8	0
2	TDS	mg/L	156		130	60	122	128	75	124	87						500	110	156	60	8	0
3	TSS	mg/L	27		10	358	11	66	18	111	30						-	79	358	10	8	0
4	Turbidity	NTU	19		16	319	60	74	14	19	20						100	67	319	14	8	1
5	Temperature	℃	29		29	27	29	28	29	29	29						Normal Temp.	29	29	27	8	
6	Color	Pt-Co Scale								180	15						100	98	180	15	2	1
7	DO	mg/L	0.5		1.1	2.7	1.8	1.1	0.9	2.3	0.6						3.0	1.4	2.7	0.5	8	8
8	pH	-	6.2		6.9	7.3	8.6	7.3	6.2	7.0	7.5						6.0-8.5	7.1	8.6	6.2	8	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.001	-	-	0.000	0	0
11	Fe	mg/L			0.7	0.3	0.8	0.5	0.4	0.5	0.6						2.0	0.5	0.8	0.3	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.27	0.09	0.09	0.05	0.44						1.0	0.19	0.44	0.05	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.15		0.23	0.18	0.06	0.04	0.37						-	0.17	0.37	0.04	6	
20	NH_3	mg/L	1.87		1.09	0.62	1.63	0.69	0.84	0.48	1.20						1.0	1.05	1.87	0.48	8	4
21	F	mg/L					0.69	0.61	0.13								1.5	0.48	0.69	0.13	3	0
22	Cl^-	mg/L			120	21	48	14		22	43						250	45	120	14	6	0
23	Cl_2	mg/L							19		0.2						-	9.69	19.20	0.19	2	
24	NO_3	mg/L	0.24		0.88	2.15	1.49	1.49	2.41	1.69	2.72						10.0	1.63	2.72	0.24	8	0
25	NO_2	mg/L	0.10		0.32	0.07	0.16	0.15	0.71	0.09	0.32						-	0.24	0.71	0.07	8	0
	T-N	mg/L	2.21		2.29	2.84	3.28	2.33	3.96	2.26	4.25						1.0	2.93	4.25	2.21	8	8
26	PO_4	mg/L	0.16		0.27	0.07	1	0.07	0.06	0.04	0.09						0.50	0.23	1.08	0.04	8	1
27	SO_4	mg/L			13	16	28	16	16	14	15						100	17	28	13	7	0
28	H_2S	mg/L	0.11		0.16	0.38	0.11	0.08	0.18	0.41	0.17						0.10	0.20	0.41	0.08	8	7
29	Phenol	mg/L			0.01		0.01	0.01	0.02	0.01	0.01						0.05	0.01	0.02	0.01	6	0
30	Oil and Grease	mg/L			0.03	0.11	0.10		0.02	0.10	0.05						<0	0.07	0.11	0.02	6	0
31	Active Substance	mg/L	0.31		0.22	0.03	0.11	0.10	0.08	0.09	0.05						1.0	0.12	0.31	0.03	8	0
32	COD_{Mn}	mg/L	46		46	37	22	30	11	19	20						15.0	29	46	11	8	7
33	BOD	mg/L	26		23	18	19	5	8	5	14						10.0	15	26	5	8	5
34	COD_{Cr}	mg/L	66		60	84	32	35	28	25	70						20.0	50	84	25	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	13		0.79	35	4.6	0.94	2.2	0.33	7.9						0.001	8.095	35	0.33	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	0.14		0.22	1.7	3.3	0.94	0.35	0.17	1.7						0.002	1.065	3.3	0.14	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (4/67)

Sampling Place 3 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	11.9	4.7				51.0	19.2	70.0	70.0	30.1				26.9		35.5	70.0	4.7	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	294	251	198	143	324	214	187	164	302	150	295	166	194	205	500	220	324	143	14	0
2	TDS	mg/L	131	117	131	61	135	135	76	66	100	74	124	48	87	102	500	99	135	48	14	0
3	TSS	mg/L	16	25	4	328	15	144	20	87	212	46	25	21	27	23	-	71	328	4	14	0
4	Turbidity	NTU	80	15	54	271	4	57	4	50	45	108	9	19	10	35	100	54	271	4	14	2
5	Temperature	℃	27	28	28	26	28	27	28	28	28	25	29	27	27	27	Normal Temp.	27	29	25	14	
6	Color	Pt-Co Scale								126	10						100	68	126	10	2	1
7	DO	mg/L	1.5	6.2	1.0	0.8	0.1	6.8	1.5	6.3	6.5	4.6	2.4	1.5	2.8	1.4	3.0	3.1	6.8	0.1	14	9
8	pH	-	6.6	7.2	7.1	6.7	7.5	7.3	7.2	7.3	7.9	6.4	8.1	7.1	7.1	6.6	6.0-8.5	7.1	8.1	6.4	14	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L			0.001									0	0	0	0.001	0.000	0.001	0.000	4	1
11	Fe	mg/L		2.0	0.3	0.4	0.6	1.1	0.4	0.5	1.3	0.3	0.7	0.6	0.0	0.5	2.0	0.7	2.0	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.02	0.07	0.05	0.37	0.04	0.01	0.06	0.06	0.05	0	1.0	0.07	0.37	0.00	10	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.07		0.20	0.30	0.09	0.06	0.43		0.31	0.17	0.17	0.23	-	0.20	0.43	0.06	10	
20	NH_3	mg/L	2.26		2.90	0.49	1.20	1.10	1.99	0.62	1.99	0.72	1.57	1.11	1.07	1.23	1.0	1.40	2.90	0.49	13	10
21	F	mg/L					0.52	0.35	0.10						0	0.30	1.5	0.25	0.52	0.00	5	0
22	Cl^-	mg/L			39	17	24	19		17	48	10	19	19	14	29	250	23	48	10	11	0
23	Cl_2	mg/L							48		0.3				0		-	16.11	48.06	0.00	3	
24	NO_3	mg/L	0.08	1.34	0.49	1.69	0.73	1.04	2.13	2.73	0.87	2.11	1.20	1.53	1.90	2.13	10.0	1.43	2.73	0.08	14	0
25	NO_2	mg/L	0.21	0.36	0.47	0.13	0.35	0.23	0.13	0.11	0.48	0.08	0.20	0.11	0.12	0.17	-	0.22	0.48	0.08	14	0
	T-N	mg/L	2.55		3.86	2.31	2.28	2.37	4.25	3.45	3.34	2.91	2.97	2.75	3.09	3.53	1.0	3.05	4.25	2.28	13	13
26	PO_4	mg/L	0.18	0.52	0.25	0.02	0	0.09	0.06	0.04	0.06	0.08	0.18	0.05	0.29	0.08	0.50	0.14	0.52	0.02	14	1
27	SO_4	mg/L			15	16	32	21	16	18	16	9	14	6	14	16	100	16	32	6	12	0
28	H_2S	mg/L	0.05	0.10	0.07	0.33	0.13	0.12	0.08	0.30	0.23	0.12	0.07	0.18	0.23	0.83	0.10	0.20	0.83	0.05	14	9
29	Phenol	mg/L		0.01	0.01		0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.03	0	0.02	0.05	0.01	0.03	0.00	12	0
30	Oil and Grease	mg/L			0.03	0.33	0.06		0.01	0.06	0.13	0.09		0.56	0.34	0	<0	0.16	0.56	0.00	10	0
31	Active Substance	mg/L	0.87	0.28	0.14	0.08	0.08	0.14	0.10	0.05	0.06	0.03	0.11	0.10	0.03	0.09	1.0	0.15	0.87	0.03	14	0
32	COD_{Mn}	mg/L	21	28	34	50	23	20	11	19	50	14	43	23	16	11	15.0	26	50	11	14	11
33	BOD	mg/L	17		19	26	18	16	4	5	15	6	17	9	11	10	10.0	13	26	4	13	8
34	COD_{Cr}	mg/L	25	37	62	93	56	30	15	30	78	18	59	32	32	29	20.0	43	93	15	14	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	1.7	2.2	3.3	1.1	9.4	1.1	0.94	0.7	0.079	0.79	1.3	2.2	1.7	170	0.001	14.0364	170	0.079	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	1.3	1.3	0.79	0.46	7	1.1	0.94	0.33	0.049	0.79	4.9	0.3	1.7	28	0.002	3.49707	28	0.049	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (5/67)

Sampling Place 3A Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	7.7					46.0	14.2	34.7	33.6	36.3				39.8		30.3	46.0	7.7	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	332		220	164	380	310	213	183	374	187	262	232	208	220	500	253	380	164	13	0
2	TDS	mg/L	145		147	72	185	147	86	70	101	77	136	70	95	105	500	110	185	70	13	0
3	TSS	mg/L	15		13	359	45	99	15	70	148	50	15	19	15	29	-	69	359	13	13	0
4	Turbidity	NTU	95		70	250	15	75	4	23	37	5	63	11	5	63	100	55	250	4	13	1
5	Temperature	℃	27		29	27	29	27	28	29	29	28	30	28	28	28	Normal Temp.	28	30	27	13	
6	Color	Pt-Co Scale								70	10						100	40	70	10	2	0
7	DO	mg/L	2.1		0.9	0.4	0.0	6.8	0.6	6.1	6.6	2.3	2.7	0.5	1.7	0.8	3.0	2.4	6.8	0.0	13	10
8	pH	-	6.8		6.9	6.8	7.5	7.5	7.1	7.5	7.8	7.4	7.8	7.7	7.7	6.9	6.0-8.5	7.3	7.8	6.8	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L			0.5	0.4	1.2	0.8	0.4	0.3	1.9	0.4	0.8	0.5	0.0	0.8	2.0	0.7	1.9	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.01	0.05	0.27	0.01	0.18	0.03	0.07	0.04	0.03	0	1.0	0.07	0.27	0.00	10	0
17	Cu	mg/L										0.05		0	0	0	0.10	0.013	0.050	0.000	4	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.09	0.09	0.23	0.23	0.14	0.08	0.38	0.05	0.39	0.28	0.25	0.29	-	0.21	0.39	0.05	12	
20	NH_3	mg/L	3.42		4.62	1.12	2.10	1.45	1.12	0.73	3.13	0.76	2.80	2.12	1.41	1.76	1.0	2.04	4.62	0.73	13	11
21	F	mg/L			0.11	0.07	0.91	0.16	0.20	0.19		0.16	0.12		0	1.25	1.5	0.32	1.25	0.00	10	0
22	Cl^-	mg/L			40	26	43	24		17	43	14	19	19	14	24	250	26	43	14	11	0
23	Cl_2	mg/L							43		0.8				0		-	14.69	43.25	0.00	3	
24	NO_3	mg/L			0.18	1.04	0.10	0.83	2.06	2.51		2.19	0.22	0.76	1.41	2.12	10.0	1.22	2.51	0.10	11	0
25	NO_2	mg/L			0.01	0.13	0.01	0.19	0.18	0.10	0.08	0.10	0.50	0.33	0.31	0.25	-	0.18	0.50	0.01	12	0
	T-N	mg/L			4.81	2.29	2.21	2.47	3.36	3.34	3.21	3.05	3.52	3.21	3.13	4.13	1.0	3.23	4.81	2.21	12	12
26	PO_4	mg/L	0.23		0.46	0.02	1	0.19	0.13	0.06	0.18	0.09	0.23	0.21	0.14	0.10	0.50	0.26	1.30	0.02	13	1
27	SO_4	mg/L			13	15	39	21	19	11	16	9	15	9	13	15	100	16	39	9	12	0
28	H_2S	mg/L	0.17		0.17	0.22	0.22	0.10	0.22	0.29	1.45	0.10	0.12	0.10	0.03	0.07	0.10	0.25	1.45	0.03	13	11
29	Phenol	mg/L			0.01		0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0	0.02	0.05	0.01	0.02	0.00	11	0
30	Oil and Grease	mg/L			0.02	0.52	0.08	0.67	0.04	0.10	0.08				0.26	0	<0	0.20	0.67	0.00	9	0
31	Active Substance	mg/L	0.99		0.15	0.15	0.11	0.20	0.76	0.22	0.09	0.07	0.47	0.09	0.02	0.08	1.0	0.26	0.99	0.02	13	0
32	COD_{Mn}	mg/L	40		19	23	34	53	14	25	66	12	20	49	20	15	15.0	30	66	12	13	11
33	BOD	mg/L	24		11	14	30	42	9	6	24	6	13	24	18	14	10.0	18	42	6	13	10
34	COD_{Cr}	mg/L	60		26	80	74	73	38	30	77	23	45	82	50	32	20.0	53	82	23	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	28		35	7.9	140	28	11	1.4	14	0.79	1.4	3.5	2.8	1.7	0.001	21.1915	140	0.79	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	2.8		14	1.1	94	2.2	2.3	0.46	1.7	0.49	1.1	0.9	0.35	0.7	0.002	9.39231	94	0.35	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (6/67)

Sampling Place 4 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	12.1	8.9				30.2	19.5	36.2	1.9	68.0				32.7		26.2	68.0	1.9	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	304	376	205	181	408	230	202	164	416	166	272	381	236	237	500	270	416	164	14	0
2	TDS	mg/L	145	150	139	86	189	152	86	85	133	65	142	87	103	118	500	120	189	65	14	0
3	TSS	mg/L	22	366	7	335	17	44	10	55	18	110	17	125	10	4	-	81	366	4	14	0
4	Turbidity	NTU	74	94	55	166	7	35	4	8	14	48	62	673	9	69	100	94	673	4	14	2
5	Temperature	℃	27	30	28	27	29	27	28	27	28	28	30	28	28	29	Normal Temp.	28	30	27	14	
6	Color	Pt-Co Scale								51	10						100	31	51	10	2	0
7	DO	mg/L	1.7	0.1	0.5	0.4	0.0	6.6	0.8	6.4	5.8	3.4	2.1		1.2	2.4	3.0	2.4	6.6	0.0	13	9
8	pH	-	7.0	7.2	7.0	6.8	7.5	7.6	7.4	7.0	7.9	7.3	7.4	7.6	6.9	7.0	6.0-8.5	7.3	7.9	6.8	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L		3.5	0.6	0.4	0.5	0.6	0.5	0.4	1.7	0.3	0.8	0.6	0.0	0.6	2.0	0.8	3.5	0.0	13	1
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.02		0.03	0.09	0.06	0.02	0.03	0.02	0.04	0.07	0.13	0	1.0	0.05	0.13	0.00	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.10	2.51	0.20	0.18	0.13	0.10	0.38	0.28	0.29	0.37	0.25	0.28	-	0.42	2.51	0.10	12	
20	NH_3	mg/L	2.78		4.27	1.72	5.75	1.33	1.59	0.74	2.71	0.47	0.59	5.31	3.31	2.57	1.0	2.55	5.75	0.47	13	10
21	F	mg/L			0.23		0.22	0.35	0.02	0.05			0.05			0.03	1.5	0.14	0.35	0.02	7	0
22	Cl^-	mg/L			37	4	34	19		14	58	14	24	43	22	24	250	27	58	4	11	0
23	Cl_2	mg/L							24		0.9						-	12.49	24.03	0.95	2	
24	NO_3	mg/L	0.04	1.12	0.21	1.91	0.07	0.93	1.82	2.51		2.60	0.04	0.66	1.38	1.45	10.0	1.13	2.60	0.04	13	0
25	NO_2	mg/L		0.35	0.01	0.09	0.01	0.18	0.14	0.13	0.02	0.12	0.37	0.36	0.26	0.32	-	0.18	0.37	0.01	13	0
	T-N	mg/L	2.82		4.49	3.72	5.83	2.44	3.55	3.38	2.73	3.19	1.00	6.33	4.95	4.34	1.0	3.75	6.33	1.00	13	13
26	PO_4	mg/L	0.18	0.29	0.33	0.06	1	0.08	0.08	0.09	0.18	0.04	0.19	0.36	0.21	0.19	0.50	0.20	0.53	0.04	14	1
27	SO_4	mg/L			13	13	41	29	18	10	22	9	17	22	18	17	100	19	41	9	12	0
28	H_2S	mg/L	0.09	0.10	0.12	0.37	0.24	0.17	0.06	0.17	0.14	0.10	0.09	0.66	0.17	0.09	0.10	0.18	0.66	0.06	14	9
29	Phenol	mg/L		0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0	0.02	0.05	0.01	0.02	0.00	13	0
30	Oil and Grease	mg/L			0.03	0.66	0.11	0.10	0.05	0.07	0.07		0.22	0.16	0.03	0	<0	0.14	0.66	0.00	11	0
31	Active Substance	mg/L	0.66	0.39	0.15	0.12	0.11	0.20	0.17	0.08	0.04	0.01	0.27	0.14	0.04	0.07	1.0	0.17	0.66	0.01	14	0
32	COD_{Mn}	mg/L	25	58	15	84	34	31	14	16	34	22	18	40	15	13	15.0	30	84	13	14	12
33	BOD	mg/L	19	29	11	42	28	10	8	8	13	7	10	16	13	11	10.0	16	42	7	14	10
34	COD_{Cr}	mg/L	31	82	42	147	82	46	21	17	61	27	35	57	39	39	20.0	52	147	17	14	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	2.2	1.7	3.5	1.7	13	0.24	0.33	0.094	16	0.49	1.7	2.2	2.8	1.7	0.001	3.40386	16	0.094	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.011	0.8	1.7	0.33	1.7	0.13	0.33	0.022	2.2	0.079	1.1	3.5	2.8	0.8	0.002	1.10729	3.5	0.011	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (7/67)

Sampling Place 5 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0					32.5	20.7	57.6	13.7	11.4				0.6		19.5	57.6	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	354		219	195	405	245	213	174	467	163	302	300	258	270	500	274	467	163	13	0
2	TDS	mg/L	152		149	91	194	176	88	68	150	70	148	124	114	135	500	128	194	68	13	0
3	TSS	mg/L	40		21	297	18	49	56	39	151	125	33	2,924	32	16	-	292	2,924	16	13	0
4	Turbidity	NTU	1		72	147	6	43	9	12	54	101	125	41	26	126	100	59	147	1	13	4
5	Temperature	℃	27		28	27	29	26	28	27	28	27	30	29	29	29	Normal Temp.	28	30	26	13	
6	Color	Pt-Co Scale								48	39						100	44	48	39	2	0
7	DO	mg/L	1.4		5.0	0.6	0.0	6.8	0.9	6.0	6.5	3.4	2.0		1.6	1.8	3.0	3.0	6.8	0.0	12	7
8	pH	-	6.8		7.0	7.0	7.6	7.5	7.1	6.9	7.6	7.4	7.5	7.4	6.5	7.0	6.0-8.5	7.2	7.6	6.5	13	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L			0.5	0.5	0.7	0.7	0.6	0.4	1.5	0.4	0.7	0.4	0.0	0.6	2.0	0.6	1.5	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0.08	0	0	-	0.027	0.080	0.000	3	1
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.01	0.07	0.13	0.02	0.93	0.01	0.04	0.01	0.08	0.06	1.0	0.14	0.93	0.01	10	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.01	0.06	0.21	0.18	0.15	0.08	0.47	0.15	0.33	0.56	0.32	0.41	-	0.24	0.56	0.01	12	
20	NH_3	mg/L	5.95		4.40	1.73	6.07	4.51	1.86	0.77	4.08	0.92	4.87	6.27	3.69	3.99	1.0	3.78	6.27	0.77	13	11
21	F	mg/L					0.49	0.55	0.05	0.13		0.50				0.20	1.5	0.32	0.55	0.05	6	0
22	Cl^-	mg/L			36	30	38	24		14	82	10	24	34	22	34	250	32	82	10	11	0
23	Cl_2	mg/L							29		0.9						-	14.89	28.84	0.93	2	
24	NO_3	mg/L	0.08		0.15	0.49	0.04	0.80	1.90	2.08		2.21		0.12	1.12	0.82	10.0	0.89	2.21	0.04	11	0
25	NO_2	mg/L			0.01	0.09	0.01	0.07	0.20	0.10	0.02	0.20	0.01	0.02	0.19	0.33	-	0.10	0.33	0.01	12	0
	T-N	mg/L	6.03		4.56	2.31	6.12	5.38	3.96	2.95	4.10	3.33	4.88	6.41	5.00	5.14	1.0	4.63	6.41	2.31	13	13
26	PO_4	mg/L	0.18		0.44	0.01	1	0.13	0.07	0.06	0.32	0.08	0.22	0.20	0.26	0.22	0.50	0.24	0.93	0.01	13	1
27	SO_4	mg/L			24	16	42	20	20	10	17	10	22	26	17	18	100	20	42	10	12	0
28	H_2S	mg/L	0.14		0.14	0.39	0.19	0.18	0.20	0.31	0.54	0.22	0.24	1.73	0.30	0.11	0.10	0.36	1.73	0.11	13	13
29	Phenol	mg/L			0.01	0.03	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0	0.03	0.05	0.02	0.03	0.00	12	0
30	Oil and Grease	mg/L				12.83	0.10	0.07	0.06	0.09	0.07	0.18		0.29	0.06	0	<0	1.37	12.83	0.00	10	0
31	Active Substance	mg/L	0.94		0.16	0.20	0.13	0.37	0.14	0.12	0.04	0.02	0.53	0.04	0.23	0.04	1.0	0.23	0.94	0.02	13	0
32	COD_{Mn}	mg/L	24		28	77	25	35	14	30	73	30	25	123	27	14	15.0	40	123	14	13	11
33	BOD	mg/L	15		15	45	23	10	6	7	42	15	14	85	21	13	10.0	24	85	6	13	11
34	COD_{Cr}	mg/L	39		56	95	78	62	43	36	103	35	28	358	56	23	20.0	78	358	23	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	9		11	3.1	35	11	1.7	0.33	3.3	0.0049	6.3	170	2.8	22	0.001	21.195	170	0.0049	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	7		7	0.79	4.9	0.94	0.07	0.049	3.3	0.079	4.6	9	2.2	14	0.002	4.14831	14	0.049	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (8/67)

Sampling Place 5A Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	24.8	6.6				41.4	29.3	57.0	17.5							29.4	57.0	6.6	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	332	296	437	206	395	323	267	236	453						500	327	453	206	9	0
2	TDS	mg/L	199	136	213	93	190	181	98	84	154						500	150	213	84	9	0
3	TSS	mg/L	39	25	39	317	20	35	24	18	25						-	60	317	18	9	0
4	Turbidity	NTU	10	5	15	91	19	39	86	132	126						100	58	132	5	9	2
5	Temperature	℃	27	29	28	28	28	27	28	28	29						Normal Temp.	28	29	27	9	
6	Color	Pt-Co Scale								25	55						100	40	55	25	2	0
7	DO	mg/L	2.3	0.1	0.0	2.1	0.4	1.1	1.1	0.00	0.0						3.0	0.9	2.3	0.0	8	8
8	pH	-	6.4	7.1	6.9	7.3	7.3	7.8	7.1	6.7	7.3						6.0-8.5	7.1	7.8	6.4	9	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.001	-	-	0.000	0	0
11	Fe	mg/L		4.8	1.2	0.4	1.4	1.1	0.4	0.4	1.1						2.0	1.4	4.8	0.4	8	1
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02	0.01	0.01	0.06	0.05	0.02	0.03						1.0	0.03	0.06	0.01	7	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.37	0.11	0.34	0.31	0.25	0.16	0.47						-	0.29	0.47	0.11	7	
20	NH_3	mg/L	9.00		7.65	1.85	5.48	2.41	2.00	0.82	2.13						1.0	3.92	9.00	0.82	8	7
21	F	mg/L			0.35	0.06	0.92	1.01	0.28								1.5	0.52	1.01	0.06	5	0
22	Cl^-	mg/L			54	43	34	24		24	53						250	38	54	24	6	0
23	Cl_2	mg/L							34		0.8						-	17.20	33.64	0.75	2	
24	NO_3	mg/L	0.12		0.16	0.55	0.14	0.15	0.26	1.53							10.0	0.41	1.53	0.12	7	0
25	NO_2	mg/L		0.02	0.01	0.04	0.01	0.01	0.26	0.15	0.02						-	0.06	0.26	0.01	8	0
	T-N	mg/L	9.12		7.82	2.44	5.63	2.57	2.52	2.50	2.14						1.0	4.34	9.12	2.14	8	8
26	PO_4	mg/L	0.25	0.44	0.49	0.02	1	0.31	0.13	0.06	0.77						0.50	0.34	0.77	0.02	9	2
27	SO_4	mg/L			15	19	43	29	20	13	21						100	23	43	13	7	0
28	H_2S	mg/L	0.30	0.16	0.47	0.24	0.22	0.23	0.10	0.25	1.61						0.10	0.40	1.61	0.10	9	9
29	Phenol	mg/L		0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01						0.05	0.01	0.02	0.01	8	0
30	Oil and Grease	mg/L			0.14	0.35	0.02		0.15	0.10	0.09						<0	0.14	0.35	0.02	6	0
31	Active Substance	mg/L	1.05	0.41	0.29	0.21	0.19	0.20	0.19	0.09	0.12						1.0	0.30	1.05	0.09	9	1
32	COD_{Mn}	mg/L	38	11	32	84	26	26	11	22	58						15.0	34	84	11	9	7
33	BOD	mg/L	24	7	29	28	15	15	7	5	27						10.0	17	29	5	9	6
34	COD_{Cr}	mg/L	58	15	45	105	40	50	14	42	73						20.0	49	105	14	9	7
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	8	280	13	3.3	35	2.4	2.2	0.07	79						0.001	46.9967	280	0.07	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	1.4	17	3.3	1.1	2.8	0.33	0.049	0.017	23						0.002	5.444	23	0.017	9	9

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (9/67)

Sampling Place 6 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	20.0	28.4				26.9	23.4	0.0	8.4	78.3				61.5		30.9	78.3	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	930	457	2,170	289	1,100	350	284	188	3,550	201	409	295	437	315	1,000	784	3,550	188	14	3
2	TDS	mg/L	421	210	1,048	128	523	180	106	89	1,240	84	163	77	213	158	200	331	1,240	77	14	6
3	TSS	mg/L	38	29	20	330	27	38	15	25	25	11	52	11	8	25	-	47	330	8	14	0
4	Turbidity	NTU	10	6	16	133	35	132	9	14	8	166	39	37	14	25	-	46	166	6	14	0
5	Temperature	℃	27	30	28	26	30	27	28	27	29	30	30	29	29	29	Normal Temp.	29	30	26	14	
6	Color	Pt-Co Scale								28	16						-	22	28	16	2	0
7	DO	mg/L	6.4	0.1	4.7	0.5	0.0	0.1	1.5	0.7	0.0	1.4	1.4	0.2	1.2	1.1	3.0	1.4	6.4	0.0	14	12
8	pH	-	7.0	6.9	7.0	6.8	7.4	7.0	7.7	6.1	7.0	7.4	7.9	7.2	8.5	7.0	6.0-8.5	7.2	8.5	6.1	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L	0.0010											0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L		5.0	1.0	0.6	1.3	1.1	0.5	0.8	1.2	0.5	1.0	0.7	0.0	0.8	-	1.1	5.0	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03		0.05	0.91	0.04	0.03	0.23	0.01		0.01	0.03	0.01	1.0	0.13	0.91	0.01	10	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.41	0.14	0.39	0.27	0.25	0.29	0.51	0.21	0.40	0.41	0.31	0.80	-	0.37	0.80	0.14	12	
20	NH_3	mg/L	7.83		5.83	3.09	8.04	3.01	2.59		6.33	1.24	4.84	4.56	2.53	3.03	-	4.41	8.04	1.24	12	0
21	F	mg/L			0.19	0.15	0.54	0.40								0.59	-	0.37	0.59	0.15	5	0
22	Cl^-	mg/L			541	34	211	24			58	14	29	24	29	39	-	100	541	14	10	0
23	Cl_2	mg/L							38		0.8						-	19.62	38.45	0.79	2	
24	NO_3	mg/L	0.11	0.08	0.10	0.57	0.13	0.27	0.16			1.87		0	0.57	0.24	-	0.38	1.87	0.08	11	0
25	NO_2	mg/L		0.02	0.01	0.03	0.02	0.01	0.48			0.17	0.01	0.03	0.20	0.08	-	0.10	0.48	0.01	11	0
	T-N	mg/L	7.94		5.94	3.69	8.19	3.29	3.23		6.33	3.28	4.85	4.70	3.30	3.35	-	4.84	8.19	3.23	12	0
26	PO_4	mg/L	0.94	0.67	0.86	0.10	0.97	0.24	0.19	0.06	0.86	0.06	0.25	0.66	0.17	0.18	0.50	0.44	0.97	0.06	14	6
27	SO_4	mg/L			70	18	74	58	20	13	117	9	19	19	17	21	100	38	117	9	12	1
28	H_2S	mg/L	0.50	0.28	0.23	0.29	0.98	0.18	0.10		0.08	0.11	0.27	0.09	0.03	0.08	-	0.25	0.98	0.03	13	0
29	Phenol	mg/L		0.01	0.01	0.02	0.01	0.02	0.02		0.02	0.02	0.01	0.02	0.01	0.03	-	0.02	0.03	0.01	12	0
30	Oil and Grease	mg/L			0.13	5.60	0.17		0.10	0.08	0.12	0.04		1.32	0.19	0	<0	0.78	5.60	0.00	10	0
31	Active Substance	mg/L	1.82	0.79	0.21	0.48	0.18	0.12	0.21	0.09	0.03	0.05	0.28	0.42	0.27	0.09	0.50	0.36	1.82	0.03	14	2
32	COD_{Mn}	mg/L	29	29	32	72	43	22	14	25	58	26	25	38	11	26	25.0	32	72	11	14	9
33	BOD	mg/L	15	17	23	21	32	18	8	12	49	15	19	16	7	16	20.0	19	49	7	14	4
34	COD_{Cr}	mg/L	49	49	80	146	76	35	28	53	101	87	74	57	12	43	30.0	64	146	12	14	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	3.5	28	21	16	46	28	4.9	1.3	130	0.33	9.4	0.9	17	22	0.02	23.4521	130	0.33	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	3.5	1.7	12	2.2	13	14	1.3	0.17	22	0.11	0.7	1.7	0.7	1.7	0.004	5.34143	22	0.11	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (10/67)

Sampling Place 7 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2					1.5	1.1	0.8	0.5	2.2				0.0		0.9	2.2	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	215		244	188	286	187	199	180	252	196	162	170	185	215	500	206	286	162	13	0
2	TDS	mg/L	99		134	90	125	115	82	73	87	96	94	47	90	119	500	96	134	47	13	0
3	TSS	mg/L	27		39	129	43	201	22	37	66	23	105	65	19	36	-	62	201	19	13	0
4	Turbidity	NTU	5		38	128	207	193	14	4	45	67	259	22	3	18	100	77	259	3	13	4
5	Temperature	℃	28		29	28	28	26	29	28	30	30	30	30	31	30	Normal Temp.	29	31	26	13	
6	Color	Pt-Co Scale								25	350						100	188	350	25	2	1
7	DO	mg/L	3.2		1.1	4.5	1.7	4.4	3.0	4.0	5.3	6.6	7.3	4.4	7.0	2.0	3.0	4.2	7.3	1.1	13	4
8	pH	-	6.3		6.9	7.3	8.2	7.7	6.1	7.0	8.9	7.2	6.7	7.9	7.9	7.4	6.0-8.5	7.4	8.9	6.1	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L			0.001									0	0	0	0.001	0.000	0.001	0.000	4	1
11	Fe	mg/L			0.5	0.2	0.6	0.9	0.4	0.6	0.5	0.4	0.4	0.3	0.0	1.1	2.0	0.5	1.1	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L													0		0.050	0.000	0.000	0.000	1	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.08	0.14	1.40	0.02	0.20	0.23	0.05	0.26	0.07	0.05	1.0	0.25	1.40	0.02	10	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.64		0.40	0.08	0.22	0.15	0.30	0.29	0.08	0.33	0.46	0.66	-	0.33	0.66	0.08	11	
20	NH_3	mg/L	1.08		0.52	0.94	1.60	0.73	1.14	0.50	1.00	0.87	0.44	0.71	1.51	3.46	1.0	1.12	3.46	0.44	13	6
21	F	mg/L			0.02		0.21	0.22	0.09	0.22		0.14			0.01		1.5	0.13	0.22	0.01	7	0
22	Cl^-	mg/L			43	30	48	19		17	58	19	19	14	19	29	250	29	58	14	11	0
23	Cl_2	mg/L							10		0.7						-	5.17	9.61	0.73	2	
24	NO_3	mg/L	0.38		0.15	1.37	0.47	1.41	1.26	1.73	1.62	1.72	0.86	1.57	0.94	1.25	10.0	1.13	1.73	0.15	13	0
25	NO_2	mg/L	0.05		0.01	0.05	0.04	0.09	0.72	0.10	0.03	0.10	0.08	0.15	0.12	0.17	-	0.13	0.72	0.01	13	0
	T-N	mg/L	1.51		0.68	2.36	2.11	2.23	3.12	2.32	2.65	2.69	1.38	2.43	2.57	4.88	1.0	2.38	4.88	0.68	13	12
26	PO_4	mg/L	0.02		0.12	0.01	0	0.09	0.01	0.04	0.03	0.03	0.03	0.01	0.03	0.04	0.50	0.04	0.12	0.01	13	0
27	SO_4	mg/L			7	14	24	16	17	10	6	9	12	16	11	18	100	13	24	6	12	0
28	H_2S	mg/L	0.12		0.35	0.25	0.20	0.16	0.11	0.22	0.43	0.06	0.55	0.37	0.16	0.13	0.10	0.24	0.55	0.06	13	12
29	Phenol	mg/L			0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.03	0.05	0.02	0.03	0.01	12	0
30	Oil and Grease	mg/L			0.27	0.14	0.26	0.04	0.10	0.05	0.20	0.15	1.19	1.67	0.13	0	<0	0.35	1.67	0.00	12	0
31	Active Substance	mg/L	0.11		0.09	0.06	0.06	0.09	0.04	0.08	0.94	0.01		0.09	0.21	0.08	1.0	0.15	0.94	0.01	12	0
32	COD_{Mn}	mg/L	19		35	18	85	39	10	17	56	26	27	31	14	13	15.0	30	85	10	13	10
33	BOD	mg/L	14		16	18	45	19	7	5	30	17	18	17	9	9	10.0	17	45	5	13	9
34	COD_{Cr}	mg/L	33		60	95	131	67	13	46	99	53	42	62	40	28	20.0	59	131	13	13	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.17		170	1.1	2.3	240	0.14	0.14	1.4	0.11	0.79	2.8	0.5	0.3	0.001	32.2885	240	0.11	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.17		170	0.13	1.3	28	0.14	0.07	0.28	0.07	0.22	0.22	0.07	0.13	0.002	15.4462	170	0.07	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (11/67)

g Place 8 Environmental Grade D

Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
Flow Rate																					
Flow Rate	m^3/sec	2.0	0.6				2.3	10.3	1.7	0.0	1.6				2.6		2.6	10.3	0.0	8	
Quality																					
Physical																					
EC	µS/cm	204	208	301	516	416	356	240	242	243	192	200	214	218	206	1,000	268	516	192	14	0
TDS	mg/L	109	102	149	248	180	188	89	94	79	90	102	62	110	113	200	122	248	62	14	1
TSS	mg/L	30	20	19	20	27	45	16	24	25	20	23	19	11	19	-	23	45	11	14	0
Turbidity	NTU	8	13	10	33	34	165	10	12	3	39	30	2	2	4	-	26	165	2	14	0
Temperature	℃	28	29	29	28	28	30	28	29	29	29	29	30	27	28	Normal Temp.	29	30	27	14	
Color	Pt-Co Scale								20	57						-	39	57	20	2	0
DO	mg/L	1.3	0.8	5.6	0.9	7.1	1.0	6.5	5.9	0.9	0.9	1.8	2.8	2.5	2.5	3.0	2.9	7.1	0.8	14	10
pH	-	6.4	7.7	7.0	7.2	7.3	6.9	7.3	7.2	7.9	7.0	5.7	7.5	7.8	7.5	6.0-8.5	7.2	7.9	5.7	14	0
Salinity																-	-	-	-	0	0
Chemical																					
Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
Fe	mg/L		3.8	2.2	0.9	3.0	1.9	1.0	1.0	1.7	0.9	1.4	1.4	0.0	1.2	-	1.6	3.8	0.0	13	0
Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
Zn	mg/L			0.06	0.06	0.07	0.09	0.24	0.03	0.05	0.12	0.08	0.06	0.05	0.04	1.0	0.08	0.24	0.03	12	0
Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
Mg	mg/L			0.54	0.17	0.73	0.39	0.27	0.49	0.61	0.42	0.55	0.58	0.50	0.65	-	0.49	0.73	0.17	12	
NH_3	mg/L	1.91		8.50	6.38	6.58	2.54	1.93		2.90	2.30	2.71	5.55	1.93	2.94	-	3.85	8.50	1.91	12	0
F	mg/L						0.66	0.16			0.18	0.08			1.09	-	0.43	1.09	0.08	5	0
Cl^-	mg/L			36	94	48	43			67	14	14	24	24	31	-	40	94	14	10	0
Cl_2	mg/L							29		0.8						-	14.84	28.84	0.84	2	
NO_3	mg/L	0.21	0.16	0.20	0.21	0.25	0.27	1.34		0.09	1.33	0.15	0	1.22	1.13	-	0.52	1.34	0.09	13	0
NO_2	mg/L		0.02	0.01	0.01	0.02	0.06	1.07		0.06	0.21	0.05	0.02	0.14	0.13	-	0.15	1.07	0.01	12	0
T-N	mg/L	2.11		8.71	6.60	6.85	2.87	4.34		3.04	3.84	2.91	5.79	3.29	4.20	-	4.55	8.71	2.11	12	0
PO_4	mg/L	0.06	0.39	3.60	0.18	0.56	0.11	0.05	0.05	0.10	0.12	0.13	0.11	0.05	0.07	0.50	0.40	3.60	0.05	14	2
SO_4	mg/L			2	16	7	44	18	9	3	8	14	8	14	12	100	13	44	2	12	0
H_2S	mg/L	0.06	0.19	0.09	0.21	0.17	0.15	0.21		0.13	0.10	0.04	0.11	0.18	0.06	-	0.13	0.21	0.04	13	0
Phenol	mg/L		0.01	0.01	0.01	0.01	0.02	0.02		0.01	0.02	0.01	0.05	0	0.03	-	0.02	0.05	0.00	12	0
Oil and Grease	mg/L			0.02	0.14	0.10		0.15	0.04	0.08			0.03	0.14	0	<0	0.08	0.15	0.00	9	0
Active Substance	mg/L	0.21	0.37	0.17	0.55	0.16	0.98	0.14	0.08	0.12	0.05	0.02	0.32	0.43	0.04	0.50	0.26	0.98	0.02	14	2
COD_{Mn}	mg/L	10	15	22	19	30	12	32	18	12	17	13	18	13	17	25.0	18	32	10	14	2
BOD	mg/L	5	8	12	13	15	8	18	7	9	10	10	9	8	15	20.0	11	18	5	14	0
COD_{Cr}	mg/L	16	22	40	55	62	31	43	24	38	34	28	31	35	23	30.0	35	62	16	14	9
Micro-biology																					
Total Coliforms	$\times 10^6$No./100mL	0.3	4	1.7	17	0.35	0.79	17	22	0.049	0.13	0.094	0.7	1.3	0.5	0.02	4.70807	22	0.049	14	14
Fecal Coliforms	$\times 10^6$No./100mL	0.008	2.4	0.4	0.33	0.14	0.79	0.094	0.94	0.017	0.049	0.033	1.7	0.08	0.01	0.004	0.49936	2.4	0.008	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (12/67)

Sampling Place 8A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	1.4					1.8	2.5	3.7	0.3	3.8				3.6		2.4	3.8	0.3	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	425		980	794	1,305	979	531	312	842	523	461	556	373	330	1,000	647	1,305	312	13	1
2	TDS	mg/L	199		476	342	637	118	191		299	257	230	147	188	174	200	272	637	118	12	6
3	TSS	mg/L	44		49	133	267	57	15	30	172	58	75	28	13	56	-	77	267	13	13	0
4	Turbidity	NTU	23		37	63	49	175	18	30	14	103	148	11	3	24	-	54	175	3	13	0
5	Temperature	℃	27		28	27	28	28	27	27	28	28	29	29	27	28	Normal Temp.	28	29	27	13	
6	Color	Pt-Co Scale								25	>500						-	25	25	25	1	1
7	DO	mg/L	1.0		0.00	0.00	7.4	0.0	6.5	6.3	1.2	1.3	0.4	0	1.0	1.7	3.0	2.4	7.4	0.0	11	8
8	pH	-	6.9		8.8	8.7	8.0	8.6	8.0	5.9	8.7	7.9	5.9	7.4	8.4	7.8	6.0-8.5	7.8	8.8	5.9	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L			2.0	1.3	2.1	2.0	1.5	1.0	2.1	1.5	1.6	1.2	0.0	1.3	-	1.5	2.1	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.04	0.01	0.13	0.06	0.82	0.02	0.07	0.10	0.11	0.02	0.13	0.10	1.0	0.13	0.82	0.01	12	0
17	Cu	mg/L											0.18	0	0	0	0.10	0.045	0.180	0.000	4	1
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.83	0.56	0.76	0.54	0.46	0.52	0.66	0.54	0.92	0.89	0.99	0.81	-	0.71	0.99	0.46	12	
20	NH_3	mg/L	3.33		12.50	8.36	11.72	3.38	0.39		7.09	8.22	2.52	8.41	4.23	4.81	-	6.25	12.50	0.39	12	0
21	F	mg/L			1.04				0.25			0.42				0.81	-	0.63	1.04	0.25	4	0
22	Cl^-	mg/L			189	128	125	53			77	53	46	68	24	40	-	80	189	24	10	0
23	Cl_2	mg/L							43		0.4			0.01			-	14.55	43.25	0.01	3	
24	NO_3	mg/L	0.17		0.30	0.30	0.19	0.18	0.19			0.09		0		0.67	-	0.25	0.67	0.09	9	0
25	NO_2	mg/L			0.02	0.03	0.09	0.07	0.75		0.05	0.01	0.02	0.04	0.01	0.16	-	0.11	0.75	0.01	11	0
	T-N	mg/L	3.50		12.82	8.69	12.00	3.63	1.33		7.14	8.32	2.54	8.60	4.24	5.64	-	6.54	12.82	1.33	12	0
26	PO_4	mg/L	0.45		0.72	1.63	0.21	1.27	0.31	0.34	0.82	1.02	0.21	1.03	0.22	0.27	0.50	0.65	1.63	0.21	13	6
27	SO_4	mg/L			6	37	150	44	81	12	65	24	29	31	25	20	100	44	150	6	12	1
28	H_2S	mg/L	0.45		2.90	0.13	11.37	0.62	0.37		6.06	0.97	0.29	2.33	0.34	0.51	-	2.19	11.37	0.13	12	0
29	Phenol	mg/L			0.01		0.01	0.02	0.01		0.01	0.02	0.02	<0.013	0.01	0.04	-	0.02	0.04	0.01	9	1
30	Oil and Grease	mg/L			0.65	0.67	1.07	0.16	0.17	0.06	0.47	0.20			0.19	0	<0	0.36	1.07	0.00	10	0
31	Active Substance	mg/L	0.95		1.16	1.24	0.03	1.19	0.27	0.46	0.51	0.49	0.66	0.97	0.29	0.49	0.50	0.67	1.24	0.03	13	7
32	COD_{Mn}	mg/L	41		167	111	473	215	37	39	127	64	49	65	21	32	25.0	111	473	21	13	12
33	BOD	mg/L	21		107	90	124	152	27	24	87	59	45	42	19	31	20.0	64	152	19	13	12
34	COD_{Cr}	mg/L	99		168	380	800	442	68	50	139	123	76	175	43	94	30.0	204	800	43	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	30		7	2800000	330	17	33	35	280	2.8	210	3.5	280	22	0.02	215481	2800000	2.8	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.006		1.3	28000	23	1.3	4.9	28	220	1.2	1.1	70	1.1	1.7	0.004	2181.05	28000	0.006	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (13/67)

Sampling Place 8B Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.4					1.8	3.3	0.3	0.6							1.7	3.3	0.3	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	367		484	407	675	421	208	183	400						1,000	393	675	183	8	0
2	TDS	mg/L	170		242	195	320	195	74	67	147						200	176	320	67	8	2
3	TSS	mg/L	20		25	15	41	25	25	25	39						-	27	41	15	8	0
4	Turbidity	NTU	19		22	14	32	64	21	40	9						-	28	64	9	8	0
5	Temperature	℃	27		28	27	28	27	26	27	28						Normal Temp.	27	28	26	8	
6	Color	Pt-Co Scale								55	60						-	58	60	55	2	0
7	DO	mg/L	0.3		2.8	0.7	7.4	0.4	7.1	6.4	1.0						3.0	3.3	7.4	0.3	8	5
8	pH	-	6.3		7.2	7.8	7.5	7.0	7.5	6.1	8.0						6.0-8.5	7.2	8.0	6.1	8	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.1	0.6	1.0	1.0	0.4	0.4	1.4						-	0.7	1.4	0.1	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.11	0.03	15.20	0.03	0.07						1.0	3.09	15.20	0.03	5	1
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L				0.20	0.47	0.29	0.06	0.04	0.47						-	0.25	0.47	0.04	6	
20	NH_3	mg/L	2.62		5.32	5.60	7.90	1.63	0.60		3.61						-	3.90	7.90	0.60	7	0
21	F	mg/L				0.30		1.08									-	0.69	1.08	0.30	2	0
22	Cl^-	mg/L			49	47	53	43			53						-	49	53	43	5	0
23	Cl_2	mg/L							38		0.5						-	19.46	38.45	0.48	2	
24	NO_3	mg/L	0.13		0.22	0.10	0.11	0.31	1.67								-	0.42	1.67	0.10	6	0
25	NO_2	mg/L			0.01	0.01	0.01	0.13	0.61		0.12						-	0.15	0.61	0.01	6	0
	T-N	mg/L	2.75		5.55	5.71	8.02	2.07	2.88		3.73						-	4.39	8.02	2.07	7	0
26	PO_4	mg/L	0.29		0.91	0.16	0.60	0.06	0.04	0.04	0.14						0.50	0.28	0.91	0.04	8	2
27	SO_4	mg/L			28	20	74	53	20	11	17						100	32	74	11	7	0
28	H_2S	mg/L	0.23		0.26	0.03	0.41	0.10	0.17		0.72						-	0.27	0.72	0.03	7	0
29	Phenol	mg/L			0.01		0.01	0.01	0.02		0.01						-	0.01	0.02	0.01	5	0
30	Oil and Grease	mg/L			0.09	0.85	0.38	0.11	0.13	0.09	0.15						<0	0.26	0.85	0.09	7	0
31	Active Substance	mg/L	0.76		0.13	0.57	0.10	0.15	0.04	0.06	0.25						0.50	0.26	0.76	0.04	8	2
32	COD_{Mn}	mg/L	37		39	16	54	21	15	28	60						25.0	34	60	15	8	5
33	BOD	mg/L	17		21	15	25	17	7	7	51						20.0	20	51	7	8	3
34	COD_{Cr}	mg/L	68		70	17	122	40	19	53	107						30.0	62	122	17	8	6
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.22		2.2	0.79	2.8	0.49	0.017	0.07	0.49						0.02	0.88463	2.8	0.017	8	7
36	Fecal Coliforms	$\times 10^6$No./100mL	0.0006		1.4	0.33	1.1	0.017	0.0033	0.049	0.49						0.004	0.42374	1.4	0.0006	8	6

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (14/67)

Sampling Place 8C Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	1.4	2.1				14.7	3.7	0.7	6.4							4.8	14.7	0.7	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	594	920	1,120	737	1,620	1,035	529	442	753						1,000	861	1,620	442	9	3
2	TDS	mg/L	238	411	537	350	835	305	183	169	278						200	367	835	169	9	7
3	TSS	mg/L	61	100	131	222	150	105	66	139	185						-	129	222	61	9	0
4	Turbidity	NTU	32	70	86	72	73	271	14	26	17						-	73	271	14	9	0
5	Temperature	℃	27	29	28	28	29	28	27	28	29						Normal Temp.	28	29	27	9	
6	Color	Pt-Co Scale								88	>500						-	88	88	88	1	1
7	DO	mg/L	0.2	0.3	2.8	0.5	7.5	0.3	6.8	5.9	0.4						3.0	2.7	7.5	0.2	9	6
8	pH	-	5.9	9.6	8.7	7.8	10.1	9.0	7.2	6.4	9.0						6.0-8.5	8.2	10.1	5.9	9	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L		3.4	1.8	1.1	1.5	1.0	1.4	1.3	2.2						-	1.7	3.4	1.0	8	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.03	0.01	0.16	0.05	1.88	0.05	0.07						1.0	0.32	1.88	0.01	7	1
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.69	0.53	0.21	0.54	0.54	0.66	0.71						-	0.55	0.71	0.21	7	
20	NH_3	mg/L	4.63		6.71	5.48	9.93	5.84	1.05		7.70						-	5.91	9.93	1.05	7	0
21	F	mg/L			0.19	0.09											-	0.14	0.19	0.09	2	0
22	Cl^-	mg/L			119	51	178	77			91						-	103	178	51	5	0
23	Cl_2	mg/L							87		0.7						-	43.63	86.51	0.75	2	
24	NO_3	mg/L	0.13	0.24	0.40	0.21	0.30	0.31	0.40								-	0.28	0.40	0.13	7	0
25	NO_2	mg/L		0.06	0.02	0.05	0.09	0.03	0.03		0.05						-	0.05	0.09	0.02	7	0
	T-N	mg/L	4.76		7.13	5.74	10.32	6.18	1.48		7.75						-	6.19	10.32	1.48	7	0
26	PO_4	mg/L	0.56	0.59	2.95	0.43	0.43	1.25	0.08	0.80	0.93						0.50	0.89	2.95	0.08	9	6
27	SO_4	mg/L			29	21	216	77	16	21	43						100	61	216	16	7	1
28	H_2S	mg/L	1.23	2.33	17.07	1.99	16.02	0.35	0.52		2.32						-	5.23	17.07	0.35	8	0
29	Phenol	mg/L		0.01	0.02		0.01		0.01		0.01						-	0.01	0.02	0.01	5	0
30	Oil and Grease	mg/L			0.65	0.55	1.32	0.54	0.36	0.21	0.37						<0	0.57	1.32	0.21	7	0
31	Active Substance	mg/L	1.92	1.75	0.39	0.76	0.30	0.94	0.28	0.59	0.22						0.50	0.79	1.92	0.22	9	5
32	COD_{Mn}	mg/L	53	204	198	129	209	348	232	114	146						25.0	181	348	53	9	9
33	BOD	mg/L	28	100	107	120	119	150	155	109	76						20.0	107	155	28	9	9
34	COD_{Cr}	mg/L	99	352	423	562	460	638	442	147	218						30.0	371	638	99	9	9
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	90	2.8	280	35000	0.7	3.5	70	22	170						0.02	3959.89	35000	0.7	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	28	1.1	1.1	170	0.7	1.7	6.3	22	14						0.004	27.2111	170	0.7	9	9

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (15/67)

Sampling Place 8F Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2					1.3	1.2	1.7	3.8							1.6	3.8	0.2	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	419		531	469	774	680	358	349	556						1,000	517	774	349	8	0
2	TDS	mg/L	195		263	228	356	115	134	133	189						200	202	356	115	8	3
3	TSS	mg/L	28		20	26	37	25	15	25	20						-	25	37	15	8	0
4	Turbidity	NTU	17		30	12	35	151	13	10	9						-	34	151	9	8	0
5	Temperature	℃	28		28	28	29	29	27	29	29						Normal Temp.	28	29	27	8	
6	Color	Pt-Co Scale								50	60						-	55	60	50	2	0
7	DO	mg/L	0.3		1.0	0.00		1.7	6.6	5.9	0.7						3.0	2.7	6.6	0.3	6	4
8	pH	-	6.5		7.0	7.5	7.2	7.3	7.5	6.6	8.1						6.0-8.5	7.2	8.1	6.5	8	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			1.6	0.5	1.7	2.0	1.0	1.1	1.7						-	1.4	2.0	0.5	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02		0.09	0.07	0.23	0.05	0.16						1.0	0.10	0.23	0.02	6	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.74	0.28	0.66	0.55	0.31	0.54	0.87						-	0.56	0.87	0.28	7	
20	NH_3	mg/L	3.18		7.80	10.33	10.60	0.64	2.74		5.00						-	5.75	10.60	0.64	7	0
21	F	mg/L			0.63			0.76	0.34								-	0.58	0.76	0.34	3	0
22	Cl^-	mg/L			56	64	72	82			91						-	73	91	56	5	0
23	Cl_2	mg/L							53		0.4						-	26.63	52.87	0.38	2	
24	NO_3	mg/L	0.07		0.24	0.19	0.16	0.17	0.91								-	0.29	0.91	0.07	6	0
25	NO_2	mg/L			0.01	0.02	0.03	0.01	1.53		0.04						-	0.27	1.53	0.01	6	0
	T-N	mg/L	3.25		8.05	10.54	10.79	0.82	5.17		5.04						-	6.24	10.79	0.82	7	0
26	PO_4	mg/L	0.48		3.00	0.76	1.05	1.25	0.28	0.17	0.81						0.50	0.97	3.00	0.17	8	5
27	SO_4	mg/L			12	23	153	147	40	15	19						100	59	153	12	7	2
28	H_2S	mg/L	0.17		1.49	0.35	6.57	0.21	0.16		0.85						-	1.40	6.57	0.16	7	0
29	Phenol	mg/L			0.01		0.01	0.02	0.20		0.01						-	0.05	0.20	0.01	5	0
30	Oil and Grease	mg/L			0.41	0.15	0.70	0.04	0.08	0.04	0.17						<0	0.23	0.70	0.04	7	0
31	Active Substance	mg/L	1.77		2.20	0.82	0.28	0.30	0.34	0.31	0.08						0.50	0.76	2.20	0.08	8	3
32	COD_{Mn}	mg/L	31		65	28	50	42	21	23	81						25.0	43	81	21	8	6
33	BOD	mg/L	15		35	25	30	25	13	17	73						20.0	29	73	13	8	5
34	COD_{Cr}	mg/L	70		130	49	98	65	77	38	111						30.0	80	130	38	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	160		1600	350	35000	920000	4.6	1.4	28						0.02	119643	920000	1.4	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	17		9.4	70	1700	17000	1.1	0.23	11						0.004	2351.09	17000	0.23	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (16/67)

Sampling Place 9 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.4	2.7				7.3	3.4	10.8	7.5	3.5				3.3		5.1	10.8	2.4	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	622	727	630	278	1,000	336	640	318	910	486	556	578	378	375	1,000	559	1,000	278	14	1
2	TDS	mg/L	270	328	424	131	445	111	255	128	308	227	246	163	187	188	200	244	445	111	14	8
3	TSS	mg/L	37	52	91	244	41	63	22	32	31	35	108	17	10	10	-	57	244	10	14	0
4	Turbidity	NTU	173	34	160	136	9	47	9	25	42	111	13	82	60	131	-	74	173	9	14	0
5	Temperature	℃	26	29	27	26	28	26	29	28	29	29	31	29	29	29	Normal Temp.	28	31	26	14	
6	Color	Pt-Co Scale								45	129						-	87	129	45	2	0
7	DO	mg/L	1.2	5.9	0.7	0.4		7.1	0.0	6.1	6.5	0.1	0.4	0			3.0	2.6	7.1	0.0	11	7
8	pH	-	7.3	7.9	7.4	6.9	7.8	7.6	7.3	7.4	8.2	7.6	6.9	7.2	7.0	6.6	6.0-8.5	7.4	8.2	6.6	14	0
9	Salinity										0.04						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L		8.7	0.9	0.3	0.7	1.7	1.8	1.1	0.9	1.3	1.0	0.6	0.1	1.4	-	1.6	8.7	0.1	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.02		0.03	0.26	0.09	0.05	0.03	0.01	1.27	0.02	0.02	0.01	1.0	0.16	1.27	0.01	11	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.67	0.04	0.43	0.30	0.51	0.54	0.76	0.57	0.79	0.75	1.02	0.89	-	0.61	1.02	0.04	12	
20	NH_3	mg/L	4.73		10.65	4.40	14.41	2.70	6.46		5.49	3.88	4.75	15.67	3.80	4.13	-	6.76	15.67	2.70	12	0
21	F	mg/L						0.31				0.52					-	0.42	0.52	0.31	2	0
22	Cl^-	mg/L			115	26	87	26			67	38	43	63	29	48	-	54	115	26	10	0
23	Cl_2	mg/L							48		0.7						-	24.37	48.06	0.68	2	
24	NO_3	mg/L		0.09	0.20	0.44	0.10	0.68	0.15			0.10	0.54	0		0.04	-	0.27	0.68	0.04	10	0
25	NO_2	mg/L		0.04	0.02	0.13	0.02	0.19	0.02		0.02	0.01	0.01	0.03	0.00	0.03	-	0.04	0.19	0.00	12	0
	T-N	mg/L			10.87	4.97	14.53	3.57	6.62		5.51	3.99	5.30	16.08	3.80	4.20	-	7.22	16.08	3.57	11	0
26	PO_4	mg/L	0.93	0.48	3.63	0.04	2.88	0.24	1.09	0.12	1.44	0.71	0.84	1.46	0.31	0.31	0.50	1.03	3.63	0.04	14	8
27	SO_4	mg/L			11	38	68	18..52	89	22	37	35	12	31	26	25	100	36	89	11	11	0
28	H_2S	mg/L	1.40	1.48	18.79	0.22	7.91	0.19	1.54		9.41	0.66	1.58	1.88	0.61	1.41	-	3.62	18.79	0.19	13	0
29	Phenol	mg/L		0.01	0.02		0.01	0.02	0.02		0.01	0.02	0.01	0.05	0	0.05	-	0.02	0.05	0.00	11	0
30	Oil and Grease	mg/L			0.22	0.28	0.25	0.04	0.23	0.12	0.18	0.15			0.16	0	<0	0.16	0.28	0.00	10	0
31	Active Substance	mg/L	2.19	2.14	1.89	0.45	0.50	0.14	0.34	0.48	1.12	0.92	0.52	1.25	0.19	0.99	0.50	0.94	2.19	0.14	14	9
32	COD_{Mn}	mg/L	48	88	73	78	99	47	75	42	87	48	52	57	31	48	25.0	62	99	31	14	14
33	BOD	mg/L	30	64	61	22	72	21	47	36	44	35	47	46	21	24	20.0	41	72	21	14	14
34	COD_{Cr}	mg/L	82	119	178	90	103	75	115	61	158	80	94	96	51	82	30.0	99	178	51	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	2.4	9000	1600	22	160	54	17	460	170	2.4	110	350	1700	2.8	0.02	975.043	9000	2.4	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.08	9000	920	11	28	11	11	130	130	7.9	1.1	0.7	2.8	2.2	0.004	732.556	9000	0.08	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (17/67)

Sampling Place 10 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	4.1	1.0				1.8	8.0	4.1	1.8	5.8				1.1		3.5	8.0	1.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	133	139	163	188	248	175	139	139	177	128	133	81	136	131	1,000	151	248	81	14	0
2	TDS	mg/L	62	65	79	90	114	86	56	55	69	66	70	40	59	78	200	71	114	40	14	0
3	TSS	mg/L	33	21	19	20	18	20	15	25	15	30	39	18	27	26	-	23	39	15	14	0
4	Turbidity	NTU	27	20	19	10	24	106	17	22	4	84	75	4	5	12	-	30	106	4	14	0
5	Temperature	℃	28	29	28	28	28	29	28	29	29	29	29	30	28	28	Normal Temp.	28	30	28	14	
6	Color	Pt-Co Scale								58	21						-	40	58	21	2	0
7	DO	mg/L	3.0	1.2	5.7	1.4	7.5	0.1	6.4	6.0	0.5	0.5	4.1	3.7	7.6	5.5	3.0	3.8	7.6	0.1	14	6
8	pH	-	6.7	8.4	6.9	7.5	6.9	6.8	7.4	7.2	7.8	7.1	6.2	7.7	8.0	7.7	6.0-8.5	7.3	8.4	6.2	14	0
9	Salinity																-	#DIV/0!	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L											0.00	0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L		0.7	0.4	0.1	2.0	0.7	0.7	0.6	0.6	0.5	0.7	0.5	0.0	0.4	-	0.6	2.0	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	#DIV/0!	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.08	0.03	1.72	0.02	0.13	0.13	0.11	0.03	0.08	0.01	1.0	0.23	1.72	0.01	10	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.03		0.61	0.19	0.06	0.10	0.44	0.15	0.18	0.24	0.16	0.24	-	0.22	0.61	0.03	11	
20	NH_3	mg/L	0.23		0.76	0.87	2.54	0.54	0.31		0.99	0.61	0.51	0.43	0.43	0.41	-	0.72	2.54	0.23	12	0
21	F	mg/L				0.08	0.32				0.25					0.81	-	0.36	0.81	0.08	4	0
22	Cl^-	mg/L			25	47	38	12			38	7	10	10	10	28	-	22	47	7	10	0
23	Cl_2	mg/L							14		0.1						-	7.24	14.42	0.06	2	
24	NO_3	mg/L	0.50	0.64	0.54	0.31	0.04	0.56	1.52		0.52	1.86	1.30	1	1	1.76	-	0.92	1.86	0.04	13	0
25	NO_2	mg/L		0.20	0.20	0.09	0.01	0.10			0.09	0.04	0.06	0.08	0.04	0.09	-	0.09	0.20	0.01	11	0
	T-N	mg/L	0.73		1.50	1.27	2.59	1.20	1.83		1.60	2.51	1.87	1.90	1.50	2.26	-	1.73	2.59	0.73	12	0
26	PO_4	mg/L	0.10	0.35	0.09	0.05	0.39	0.07	0.02	0.04	0.09	0.07	0.06	0.02	0.03	0.01	0.50	0.10	0.39	0.01	14	0
27	SO_4	mg/L			2	12	4	22	12	8	1	6	12	11	11	10	100	9	22	1	12	0
28	H_2S	mg/L	0.11	0.22	0.18	0.05	0.36	0.13	0.10		0.20	0.08	0.16	0.15	0.39	0.02	-	0.16	0.39	0.02	13	0
29	Phenol	mg/L		0.01	0.02	0.02	0.03	0.02	0.02		0.01	0.02	0.01	0.05	0	0.04	-	0.02	0.05	0.00	12	0
30	Oil and Grease	mg/L			0.02	0.06	0.19	0.08	0.04	0.04	0.06			0.20	0.46	0	<0	0.11	0.46	0.00	10	0
31	Active Substance	mg/L	0.07	0.22	0.09	0.06	0.10	0.45	0.06	0.07	0.09	0.02		0.10	0.26	0.09	0.50	0.13	0.45	0.02	13	0
32	COD_{Mn}	mg/L	17	20	15	11	39	16	20	10	37	10	11	16	12	9	25.0	17	39	9	14	2
33	BOD	mg/L	11	13	11	11	24	10	15	4	16	6	8	8	5	5	20.0	11	24	4	14	1
34	COD_{Cr}	mg/L	31	37	42	32	69	31	34	15	61	14	23	26	14	15	30.0	32	69	14	14	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.03	0.24	0.79	0.49	2.8	1.1	7	0.46	0.49	0.23	0.79	0.3	1.3	0.8	0.02	1.20143	7	0.03	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.005	0.05	0.79	0.49	1.4	0.14	0.14	0.46	0.33	0.023	0.33	0.08	0.05	0.11	0.004	0.31414	1.4	0.005	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (18/67)

Sampling Place 10A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.7					4.9	2.2	12.7	2.6							5.0	12.7	2.2	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	369		244	237	399	319	293	199	342						1,000	300	399	199	8	0
2	TDS	mg/L	84		122	112	172	189	86	78	109						200	119	189	78	8	0
3	TSS	mg/L	64		26	17	21	28	29	60	26						-	34	64	17	8	0
4	Turbidity	NTU	27		21	18	20	129	27	35	8						-	35	129	8	8	0
5	Temperature	℃	29		27	27	27	27	27	28	27						Normal Temp.	27	29	27	8	
6	Color	Pt-Co Scale								74	55						-	65	74	55	2	0
7	DO	mg/L	2.7		6.0	0.4	7.7	1.1	6.4	5.6	0.1						3.0	3.7	7.7	0.1	8	4
8	pH	-	6.5		7.0	6.3	7.3	6.5	7.7	6.2	8.1						6.0-8.5	6.9	8.1	6.2	8	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.5	0.2	3.0	1.4	0.8	0.8	1.3						-	1.1	3.0	0.2	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.05	0.04	2.06	0.03	0.02						1.0	0.44	2.06	0.02	5	1
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.03		1.15	0.67	0.46	0.40	1.19						-	0.65	1.19	0.03	6	
20	NH_3	mg/L	1.16		0.82	3.90	13.49	0.46	1.57		3.92						-	3.62	13.49	0.46	7	0
21	F	mg/L						0.32	0.01								-	0.17	0.32	0.01	2	0
22	Cl^-	mg/L			28	26	29	29			53						-	33	53	26	5	0
23	Cl_2	mg/L							19		0.0						-	9.62	19.22	0.03	2	
24	NO_3	mg/L	0.39		0.21	0.14	0.13	0.34	1.12		1.12						-	0.49	1.12	0.13	7	0
25	NO_2	mg/L			0.03	0.02	0.01	0.09	0.99		0.03						-	0.20	0.99	0.01	6	0
	T-N	mg/L	1.55		1.06	4.06	13.63	0.89	3.69		5.07						-	4.28	13.63	0.89	7	0
26	PO_4	mg/L	0.16		0.29	0.12	0.45	0.16	0.08	0.07	0.21						0.50	0.19	0.45	0.07	8	0
27	SO_4	mg/L			3	10	6	13	21	8	2						100	9	21	2	7	0
28	H_2S	mg/L	0.18		0.22	0.08	0.42	0.14	0.24		0.28						-	0.22	0.42	0.08	7	0
29	Phenol	mg/L			0.01	0.02		0.02	0.02		0.02						-	0.02	0.02	0.01	5	0
30	Oil and Grease	mg/L			0.09	0.08	0.30	0.08	0.10	0.04	0.15						<0	0.12	0.30	0.04	7	0
31	Active Substance	mg/L	0.05		0.07	0.09	0.21	0.13	0.05	0.05	0.65						0.50	0.16	0.65	0.05	8	1
32	COD_{Mn}	mg/L	11		26	12	33	24	29	22	28						25.0	23	33	11	8	4
33	BOD	mg/L	7		10	12	23	17	14	8	10						20.0	13	23	7	8	1
34	COD_{Cr}	mg/L	16		46	14	61	48	48	27	31						30.0	36	61	14	8	5
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.17		11	1.1	22	1.3	0.43	0.49	2.8						0.02	4.91125	22	0.17	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	0.07		1.7	0.79	13	0.49	0.079	0.079	1.7						0.004	2.2385	13	0.07	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (19/67)

Sampling Place 11 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	4.2	1.4				2.0	6.4	1.4	1.0							2.7	6.4	1.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	143	286	273	290	504	276	246	239	476						1,000	304	504	143	9	0
2	TDS	mg/L	87	128	135	134	230	187	87	82	156						200	136	230	82	9	1
3	TSS	mg/L	71	25	55	21	20	26	31	40	45						-	37	71	20	9	0
4	Turbidity	NTU	15	15	24	32	14	7	105	189	37						-	48	189	7	9	0
5	Temperature	℃	28	30	29	28	30	29	28	29	28						Normal Temp.	29	30	28	9	
6	Color	Pt-Co Scale								64	64						-	64	64	64	2	0
7	DO	mg/L	0.5	5.8	0.3	0.6		0.8	0.1	0.1	6.3						3.0	1.8	6.3	0.1	8	6
8	pH	-	6.3	7.1	6.8	6.9	7.5	7.3	7.0	6.7	7.7						6.0-8.5	7.0	7.7	6.3	9	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L		3.5	0.5	0.3	1.5	1.4	0.8	0.6	2.0						-	1.3	3.5	0.3	8	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.01	0.04	1.79	0.02	0.02						1.0	0.38	1.79	0.01	5	1
17	Cu	mg/L			0.01												0.10	0.010	0.010	0.010	1	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.05	0.07	1.20	0.75	0.37	0.50	1.46						-	0.63	1.46	0.05	7	
20	NH_3	mg/L	0.99		3.86	3.38	8.77	0.51	1.86		4.02						-	3.34	8.77	0.51	7	0
21	F	mg/L					0.11	0.03	0.29								-	0.14	0.29	0.03	3	0
22	Cl^-	mg/L			31	34	96	22			53						-	47	96	22	5	0
23	Cl_2	mg/L							29		0.6						-	14.71	28.84	0.59	2	
24	NO_3	mg/L	0.27	0.10	0.18	0.19	0.12	0.37	0.89								-	0.30	0.89	0.10	7	0
25	NO_2	mg/L		0.04	0.01	0.01	0.03	0.05	0.13		0.06						-	0.05	0.13	0.01	7	0
	T-N	mg/L	1.26		4.05	3.58	8.92	0.93	2.88		4.08						-	3.67	8.92	0.93	7	0
26	PO_4	mg/L	0.13	0.41	0.23	0.17	0.90	0.16	0.05	0.08	0.24						0.50	0.26	0.90	0.05	9	1
27	SO_4	mg/L			12	14	8	54	23	9	10						100	19	54	8	7	0
28	H_2S	mg/L	0.18	0.08	0.17	0.15	0.30	0.10	0.09		0.20						-	0.16	0.30	0.08	8	0
29	Phenol	mg/L		0.01	0.01	0.01	0.01	0.02	0.02		0.02						-	0.01	0.02	0.01	7	0
30	Oil and Grease	mg/L			0.12	0.12	0.35	0.09	0.04	0.07	0.19						<0	0.14	0.35	0.04	7	0
31	Active Substance	mg/L	0.09	0.46	0.10	0.60	0.18	0.89	0.16	0.07	0.70						0.50	0.36	0.89	0.07	9	3
32	COD_{Mn}	mg/L	17	20	24	21	54	23	17	18	34						25.0	25	54	17	9	2
33	BOD	mg/L	14	11	18	19	23	5	6	14	14						20.0	14	23	5	9	1
34	COD_{Cr}	mg/L	27	34	26	44	62	31	24	25	53						30.0	36	62	24	9	5
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.13	0.22	0.79	5.4	92	2.8	1.3	1.7	2.8						0.02	11.9044	92	0.13	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	0.13	0.035	0.24	1.7	3.1	0.7	0.17	0.17	0.12						0.004	0.70722	3.1	0.035	9	9

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (20/67)

Sampling Place 11A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.8					2.3	4.4	5.0	0.2							2.9	5.0	0.2	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	176		362	351	625	327	293	274	476						1,000	360	625	176	8	0
2	TDS	mg/L	109		182	166	277	111	103	86	156						200	149	277	86	8	1
3	TSS	mg/L	42		28	25	25	30	15	68	28						-	33	68	15	8	0
4	Turbidity	NTU	10		40	30	12	8	133	153	38						-	53	153	8	8	0
5	Temperature	℃	28		29	28	29	28	27	29	28						Normal Temp.	28	29	27	8	
6	Color	Pt-Co Scale								95	42						-	69	95	42	2	0
7	DO	mg/L	0.4		0.4	0.4	0.0	1.2	0.1	0.3	6.5						3.0	1.2	6.5	0.0	8	7
8	pH	-	6.5		6.7	6.9	7.4	7.4	7.1	6.6	7.8						6.0-8.5	7.0	7.8	6.5	8	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L	0.0009														0.005	0.001	0.001	0.001	1	0
11	Fe	mg/L			0.6	0.3	1.8	1.5	0.8	0.9	0.1						-	0.9	1.8	0.1	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02		0.08	0.39	0.06	0.03							1.0	0.11	0.39	0.02	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.04	0.18	0.15	0.72	0.43	0.63	0.02						-	0.31	0.72	0.02	7	
20	NH_3	mg/L	1.93		5.24	3.32	10.78	2.98	2.74		0.38						-	3.91	10.78	0.38	7	0
21	F	mg/L			0.31			0.88									-	0.60	0.88	0.31	2	0
22	Cl^-	mg/L			41	43	111	26			67						-	57	111	26	5	0
23	Cl_2	mg/L							24		0.8						-	12.44	24.03	0.85	2	
24	NO_3	mg/L	0.07		0.13	0.13	0.16	0.15	0.67								-	0.22	0.67	0.07	6	0
25	NO_2	mg/L			0.01	0.02	0.03	0.01	0.35		0.01						-	0.07	0.35	0.01	6	0
	T-N	mg/L	1.99		5.38	3.47	10.97	3.14	3.76		0.40						-	4.16	10.97	0.40	7	0
26	PO_4	mg/L	0.19		0.59	0.33	1.19	0.30	0.14	0.13	0.67						0.50	0.44	1.19	0.13	8	3
27	SO_4	mg/L			7	21	48	14	26	9	11						100	19	48	7	7	0
28	H_2S	mg/L	0.30		0.27	0.30	0.61	0.10	0.20		0.59						-	0.34	0.61	0.10	7	0
29	Phenol	mg/L			0.01	0.02	0.01	0.02	0.02		0.01						-	0.02	0.02	0.01	6	0
30	Oil and Grease	mg/L			0.17	0.05	0.62	0.16	0.08	0.07	0.23						<0	0.20	0.62	0.05	7	0
31	Active Substance	mg/L	1.12		0.32	0.86	0.26	0.46	0.22	0.21	1.43						0.50	0.61	1.43	0.21	8	3
32	COD_{Mn}	mg/L	27		40	66	72	31	17	25	58						25.0	42	72	17	8	7
33	BOD	mg/L	13		22	57	54	30	10	10	39						20.0	29	57	10	8	5
34	COD_{Cr}	mg/L	43		96	95	112	50	36	41	83						30.0	70	112	36	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.7		49	35	1600	920	22	1.4	14						0.02	330.263	1600	0.7	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	0.11		17	9.4	130	35	2.8	1.4	0.17						0.004	24.485	130	0.11	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (21/67)

Sampling Place 12 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.8					1.9	13.5	42.9	1.1	5.4				9.2		11.0	42.9	1.1	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	286		482	459	845	454	420	364	668	514	579	516	527	460	1,000	506	845	286	13	0
2	TDS	mg/L	173		222	218	396	101	150	145	219	262	293	151	257	230	200	217	396	101	13	8
3	TSS	mg/L	77		184	132	105	25	28	990	56	353	447	284	330	327	-	257	990	25	13	0
4	Turbidity	NTU	21		261	43	17	11	208	999	68	676	834	338	153	747	-	336	999	11	13	0
5	Temperature	℃	28		29	28	29	28	27	29	28	26	27	29	29	29	Normal Temp.	28	29	26	13	
6	Color	Pt-Co Scale								>500	108						-	108	108	108	1	1
7	DO	mg/L	0.3		2.1	0.4		0.7	1.3	0.1	6.3	0		2.2		5.3	3.0	1.9	6.3	0.1	10	8
8	pH	-	6.7		6.9	7.2	8.0	7.1	7.1	6.5	7.7	7.4	6.9	7.4	6.9	6.5	6.0-8.5	7.1	8.0	6.5	13	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L			0.0	0.4	0.7	1.0	0.8	0.9	0.1	0.8	0.7	0.3	0.0	0.5	-	0.5	1.0	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L											0.02	0	0	0.11	-	0.033	0.110	0.000	4	1
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.02	0.02	0.04	0.03	0.05	0.04		0.01	0.09	0.22	0.05	0	1.0	0.05	0.22	0.00	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			1.32	0.44	0.55	0.45	0.47	0.66	0.60	0.58	0.67	0.52	0.51	0.74	-	0.63	1.32	0.44	12	
20	NH_3	mg/L	3.27		5.28	9.56	15.95	4.47	4.20		9.55	11.45	12.12	10.70	11.49	6.31	-	8.70	15.95	3.27	12	0
21	F	mg/L				0.19			0.04								-	0.12	0.19	0.04	2	0
22	Cl^-	mg/L			45	34	72	29			77	41	48	48	43	53	-	49	77	29	10	0
23	Cl_2	mg/L							24		0.9						-	12.47	24.03	0.91	2	
24	NO_3	mg/L	0.04		0.50	0.17	0.18	0.16	0.25			0.44	0.04	0		0.52	-	0.27	0.52	0.04	10	0
25	NO_2	mg/L			0.01		0.02	0.03	0.04			0.02	0.01	0.03	0.01	0.03	-	0.02	0.04	0.01	9	0
	T-N	mg/L	3.31		5.79	9.73	16.15	4.66	4.50		9.55	11.91	12.17	11.12	11.50	6.86	-	8.94	16.15	3.31	12	0
26	PO_4	mg/L	0.50		0.50	0.49	1.63	0.67	0.32	0.13	0.95	1.14	0.57	0.52	0.92	0.26	0.50	0.66	1.63	0.13	13	9
27	SO_4	mg/L			36	35	60	61	44	20	19	30	30	50	34	48	100	39	61	19	12	0
28	H_2S	mg/L	0.42		1.49	0.53	10.81	0.11	0.31		0.98	1.95	1.54	1.52	1.02	0.92	-	1.80	10.81	0.11	12	0
29	Phenol	mg/L			0.01		0.03	0.02	0.03		0.01	0.03	0.03	0	0.02	0.04	-	0.02	0.04	0.00	10	0
30	Oil and Grease	mg/L			0.14	0.08	0.88	0.27	0.17	0.07	0.41	0.24		0.80	0.28	0	<0	0.30	0.88	0.00	11	0
31	Active Substance	mg/L	1.14		2.43	0.87	0.06	1.11	0.22	0.05	0.55	0.79	0.26	0.31	0.08	0.38	0.50	0.64	2.43	0.05	13	6
32	COD_{Mn}	mg/L	53		58	45	89	47	30	50	63	68	81	69	58	54	25.0	59	89	30	13	13
33	BOD	mg/L	28		41	44	58	26	19	24	49	53	80	56	50	51	20.0	44	80	19	13	12
34	COD_{Cr}	mg/L	99		88	88	108	73	47	90	115	122	179	165	102	89	30.0	105	179	47	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.5		2800	49	94	17	92	49	110	0.016	170	3500	3500	28000	0.02	2952.42	28000	0.016	13	12
36	Fecal Coliforms	$\times 10^6$No./100mL	0.5		220	33	70	11	35	9.4	14	150	140	280	220	3500	0.004	360.223	3500	0.5	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (22/67)

Sampling Place 13 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	15.1	0.0				11.5	29.7	67.1	28.6	13.3				0.0		20.7	67.1	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	425	836		716	2,580	4,480	574	566	2,370	10,500	9,800	1,035	3,410	1,680	1,000	2,998	10,500	425	13	8
2	TDS	mg/L	255	372	2,010	329	1,235	1,142	173	190	806	4,120	3,810	266	1,828	728	200	1,233	4,120	173	14	12
3	TSS	mg/L	53	29	50	43	51	38	31	45	25	73	106	28	16	26	-	44	106	16	14	0
4	Turbidity	NTU	11	121		45	9	11	156	159	32	11	13	33	54	7	-	51	159	7	13	0
5	Temperature	℃	27	30		29	28	28	27	28	28	30	31	30	30	30	Normal Temp.	29	31	27	13	
6	Color	Pt-Co Scale								98	105						-	102	105	98	2	0
7	DO	mg/L	0.7	0.9		0.4		0.6	1.2	0.00	6.6	0.2		0			3.0	1.3	6.6	0.0	8	7
8	pH	-	6.7	7.0		7.5	7.4	6.8	7.1	6.3	7.6	7.3	6.8	7.2	7.4	7.6	6.0-8.5	7.1	7.6	6.3	13	0
9	Salinity										0.11						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L	0.0004											0	0	0	0.005	0.000	0.000	0.000	4	0
11	Fe	mg/L		8.7	0.1	0.5	0.3	0.6	0.1	1.0	0.5	0.4	0.3	0.5	0.0	0.8	-	1.1	8.7	0.0	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L									0.07			0	0	0	0.10	0.018	0.070	0.000	4	0
16	Zn	mg/L				0.04	0.04	0.02	0.16	0.02	0.03	0.01	0.02	0.07	0.17	0.03	1.0	0.06	0.17	0.01	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.54	0.24	0.49	0.33	0.45	0.69	0.85	0.50	0.46	0.52	0.48	0.68	-	0.52	0.85	0.24	12	
20	NH_3	mg/L	5.28		17.75	11.52	14.76	5.93	5.07		17.20	13.52	14.50	19.14	11.60	14.60	-	12.57	19.14	5.07	12	0
21	F	mg/L			0.63	0.68										0.98	-	0.76	0.98	0.63	3	0
22	Cl^-	mg/L			70	89	447	1,778			418	2,570	2,451	193	868	530	-	941	2,570	70	10	0
23	Cl_2	mg/L							43		0.7						-	21.96	43.25	0.66	2	
24	NO_3	mg/L	0.06	0.05	0.22	0.14	0.09	0.13	0.16			0.14	0.01	0		0.11	-	0.11	0.22	0.01	11	0
25	NO_2	mg/L		0.03	0.01	0.01	0.02	0.03	0.01		0.02	0.03	0.02	0.04	0.02	0.01	-	0.02	0.04	0.01	12	0
	T-N	mg/L	5.34		17.98	11.67	14.87	6.09	5.24		17.22	13.69	14.53	19.29	11.62	14.72	-	12.69	19.29	5.24	12	0
26	PO_4	mg/L	0.77	0.30	3.20	0.91	1.44	0.91	0.41	0.44	0.94	1.33	1.00	1.47	1.03	0.65	0.50	1.06	3.20	0.30	14	11
27	SO_4	mg/L			240	37	140	115	17	21	82	439	42	58	168	67	100	119	439	17	12	5
28	H_2S	mg/L	0.48	1.61	1.19	0.56	18.51	0.74	0.13		4.81	4.62	8.94	1.56	1.26	7.70	-	4.01	18.51	0.13	13	0
29	Phenol	mg/L		0.01	0.01	0.02	0.01	0.02	0.02		0.01	0.03	0.18	0.04	0.01	0.04	-	0.03	0.18	0.01	12	0
30	Oil and Grease	mg/L			3.61	0.09	1.14	0.13	0.19	0.15	0.59	0.29		0.65		0	<0	0.68	3.61	0.00	10	0
31	Active Substance	mg/L	2.31	1.72	0.76	1.38	0.39	1.26	0.22	1.10	1.15	0.39	1.44	1.56	0.81	1.37	0.50	1.13	2.31	0.22	14	11
32	COD_{Mn}	mg/L	41	25	72	26	59	49	25	59	62	74	76	73	43	47	25.0	52	76	25	14	12
33	BOD	mg/L	29	14	52	26	25	40	19	31	49	66	63	60	34	31	20.0	38	66	14	14	12
34	COD_{Cr}	mg/L	78	65	104	54	83	85	70	91	105	154	134	144	71	88	30.0	95	154	54	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	160	8	2800	1700	79	160	22	130	17	0.23	4.3	140	220	110	0.02	396.466	2800	0.23	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	90	3	35	170	22	22	7	28	17	0.23	1.5	50	220	50	0.004	51.1236	220	0.23	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (23/67)

Sampling Place 14 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.0	1.5				2.4	2.3	3.7	2.9	6.9				4.1		3.2	6.9	1.5	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	186	181	160	134	229	203	200	175	235	136	162	180	210	177	500	183	235	134	14	0
2	TDS	mg/L	84	90	85	65	62	90	79	79	70	104	79	48	90	81	500	79	104	48	14	0
3	TSS	mg/L	24	37	56	308	10	129	30	70	262	149	99	79	34	39	-	95	308	10	14	0
4	Turbidity	NTU	3	32	41	230	101	98	29	17	205	392	103	17	9	18	100	92	392	3	14	5
5	Temperature	℃	26	29	27	26	27	26	28	27	27	27	28	27	28	27	Normal Temp.	27	29	26	14	
6	Color	Pt-Co Scale								86	205						100	146	205	86	2	1
7	DO	mg/L	2.6	2.4	2.2	3.7	2.5	3.0	2.8	3.5	2.5	4.5	7.3	3.1	5.7	6.6	3.0	3.7	7.3	2.2	14	7
8	pH	-	6.7	7.6	7.2	7.0	8.7	7.6	6.9	7.2	7.5	7.6	7.5	8.0	7.8	7.8	6.0-8.5	7.5	8.7	6.7	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L		0.9	0.8	0.4	0.7	0.8	0.6	0.8	0.4	1.6	0.5	0.9	0.8	0.7	2.0	0.8	1.6	0.4	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.03	0.06	0.07	0.04	0.13	0.02	0.05	0.04	0.06	0.06	1.0	0.06	0.13	0.02	10	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.04		0.17	0.10	0.12	0.06	0.34	0.02	0.09	0.12	0.16	0.27	-	0.14	0.34	0.02	11	
20	NH_3	mg/L	0.31		0.68	0.72	0.76	1.46	0.54	0.25	1.14	0.33	0.28	0.21	0.57	0.55	1.0	0.60	1.46	0.21	13	2
21	F	mg/L					0.14	0.48			0.75					0.18	1.5	0.39	0.75	0.14	4	0
22	Cl^-	mg/L			23	21	38	14		12	53	7	12	19	10	29	250	22	53	7	11	0
23	Cl_2	mg/L							34		0.5						-	17.07	33.64	0.50	2	
24	NO_3	mg/L	2.22	2.01	1.78	1.70	1.94	1.67	2.77	2.50	0.16	2.33	2.25	1.72	2.84	2.73	10.0	2.04	2.84	0.16	14	0
25	NO_2	mg/L	0.06	0.36	0.11	0.03	0.11	0.11	0.07	0.07	0.34	0.04	0.10	0.07	0.10	0.16	-	0.12	0.36	0.03	14	0
	T-N	mg/L	2.59		2.57	2.45	2.81	3.24	3.37	2.83	1.64	2.70	2.63	2.00	3.51	3.44	1.0	2.75	3.51	1.64	13	13
26	PO_4	mg/L	0.10	0.51	0.07	0.06	0	0.12	0.02	0.04	0.03	0.05	0.06	0.02	0.06	0.02	0.50	0.09	0.51	0.02	14	1
27	SO_4	mg/L			10	21	9	77	12	9	17	10	13	17	10	7	100	18	77	7	12	0
28	H_2S	mg/L	0.11	0.17	3.17	0.47	0.18	0.22	0.11	0.35	0.26	0.33	0.45	0.40	0.18	0.16	0.10	0.47	3.17	0.11	14	14
29	Phenol	mg/L		0.01	0.01		0.01	0.02	0.02	0.01	0.01		0.02	0.03	0.02	0.03	0.05	0.02	0.03	0.01	11	0
30	Oil and Grease	mg/L			0.01	0.11	0.15		0.02	0.08	0.07			0.74	0.08	0	<0	0.14	0.74	0.00	9	0
31	Active Substance	mg/L	0.08	0.16	0.05	0.07	0.08	0.07	0.05	0.07	0.09	0.01	0.01	0.09	0.13	0.10	1.0	0.07	0.16	0.01	14	0
32	COD_{Mn}	mg/L	15	10	14	36	10	27	10	17	38	28	22	30	24	10	15.0	21	38	10	14	9
33	BOD	mg/L	9	7	6	17	4	10	6	5	20	17	11	17	18	9	10.0	11	20	4	14	7
34	COD_{Cr}	mg/L	25	20	36	42	23	29	13	23	63	53	42	56	44	19	20.0	35	63	13	14	11
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.24	0.5	0.79	0.33	0.79	0.49	0.49	0.28	0.13	0.22	0.07	0	0.5	0.23	0.001	0.36143	0.79	0	14	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.13	0.08	0.13	0.079	0.79	0.22	0.49	0.11	0.049	0.17	0.049	0	0.11	0.08	0.002	0.17764	0.79	0	14	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (24/67)

Sampling Place 15 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	3.1	3.1				6.9	12.9	11.9	4.2	14.0				4.6		7.6	14.0	3.1	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	323	417	406	244	559	310	393	315	507	290	305	352	388	375	500	370	559	244	14	2
2	TDS	mg/L	200	190	202	110	260	180	139	119	196	171	154	103	189	98	500	165	260	98	14	0
3	TSS	mg/L	156	203	50	206	61	20	15	18	491	198	36	672	43	81	-	161	672	15	14	0
4	Turbidity	NTU	14	41	8	41	29	36	255	63	64	132	46	>999	50	13	100	61	255	8	13	2
5	Temperature	℃	27	29	27	29	28	26	28	28	28	28	29	28	27	29	Normal Temp.	28	29	26	14	
6	Color	Pt-Co Scale								75	>500						100	75	75	75	1	0
7	DO	mg/L	1.9	0.0	0.4	0.5	0.2	1.2	0.1	0.00	0.1	2.4	1.9	1.1	1.4	0.9	3.0	0.9	2.4	0.0	13	13
8	pH	-	6.6	7.1	7.5	7.2	7.6	7.9	7.3	6.8	7.4	7.9	7.6	6.8	6.6	7.8	6.0-8.5	7.3	7.9	6.6	14	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L		6.3	1.1	0.5	0.8	0.1	0.9	0.6	0.8	0.7	0.7	0.4	0.5	0.8	2.0	1.1	6.3	0.1	13	1
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03		0.02	0.02	0.04	0.02	0.13	0.06	0.02	0.06	0.01	0.02	1.0	0.04	0.13	0.01	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.50		0.48	0.10	0.42	0.33	0.70	0.27	0.41	0.44	0.32	0.57	-	0.41	0.70	0.10	11	
20	NH_3	mg/L	17.55		6.65	1.99	11.13	4.25	6.93	1.71	4.81	2.59	3.15	7.27	2.28	5.30	1.0	5.82	17.55	1.71	13	13
21	F	mg/L			1.99		0.02	0.53		0.58	0.12	0.11	0.07		0.04	1.52	1.5	0.55	1.99	0.02	9	2
22	Cl^-	mg/L			48	17	53	22		29	67	22	24	34	19	34	250	33	67	17	11	0
23	Cl_2	mg/L							34		0.4						-	17.01	33.64	0.38	2	
24	NO_3	mg/L	0.30	0.16	0.26	1.27	0.16	0.20	3.28	1.51	0.13	1.77	0.01	0.39	0.96	0.33	10.0	0.77	3.28	0.01	14	0
25	NO_2	mg/L		0.02	0.01	0.32	0.03	0.01	0.52	0.14	0.04	0.19	0.01	0.01	0.15	0.02	-	0.11	0.52	0.01	13	0
	T-N	mg/L	17.85		6.92	3.58	11.32	4.46	10.72	3.36	4.97	4.55	3.17	7.67	3.39	5.65	1.0	6.74	17.85	3.17	13	13
26	PO_4	mg/L	0.47	0.90	0.93	0.06	1	0.36	0.26	0.14	0.70	0.25	0.28	0.38	0.26	0.32	0.50	0.47	1.27	0.06	14	4
27	SO_4	mg/L			17	22	45	3	24	14	98	14	18	50	15	22	100	28	98	3	12	0
28	H_2S	mg/L	0.40	0.74	0.51	0.21	0.72	0.20	0.38	0.08	1.00	0.64	0.20	2.92	0.31	0.31	0.10	0.62	2.92	0.08	14	13
29	Phenol	mg/L		0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0	0.02	0.04	0.05	0.01	0.04	0.00	13	0
30	Oil and Grease	mg/L			0.13	0.17	0.15		0.15	0.07	0.14	0.12			0.15	0	<0	0.12	0.17	0.00	9	0
31	Active Substance	mg/L	1.05	0.47	0.67	0.29	0.17	0.72	0.20	0.10	0.34	0.10	0.08	0.06	0.08	0.16	1.0	0.32	1.05	0.06	14	1
32	COD_{Mn}	mg/L	32	20	32	21	46	27	30	13	82	27	19	47	20	22	15.0	31	82	13	14	13
33	BOD	mg/L	25	16	24	17	31	20	21	11	77	14	13	28	17	17	10.0	24	77	11	14	14
34	COD_{Cr}	mg/L	76	46	60	32	95	31	94	17	173	43	34	73	34	46	20.0	61	173	17	14	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	16	70	920	9.2	11	13	17	2.8	54	0.33	4.9	2.8	1.7	2.2	0.001	80.3521	920	0.33	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	5	13	170	2.4	2.3	0.46	1.4	1.1	22	0.11	1.1	1.7	3.5	0.8	0.002	16.0621	170	0.11	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (25/67)

Sampling Place 16 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.1					1.6	0.3	1.1	0.6							0.7	1.6	0.1	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	195		173	146	303	179	207	156	265						500	203	303	146	8	0
2	TDS	mg/L	89		92	70	80	76	83	66	86						500	80	92	66	8	0
3	TSS	mg/L	13		21	127	20	142	15	30	18						-	48	142	13	8	0
4	Turbidity	NTU	10		5	138	49	131	10	8	8						100	45	138	5	8	2
5	Temperature	℃	26		27	26	26	26	27	27	27						Normal Temp.	26	27	26	8	
6	Color	Pt-Co Scale								60	59						100	60	60	59	2	0
7	DO	mg/L	0.8		1.6	3.2	1.1	3.3	1.2	2.7	0.6						3.0	1.8	3.3	0.6	8	6
8	pH	-	6.4		7.2	7.2	8.1	7.3	6.2	7.0	7.5						6.0-8.5	7.1	8.1	6.2	8	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.001	-	-	0.000	0	0
11	Fe	mg/L			1.3	0.4	0.9	0.8	0.8	0.5	1.3						2.0	0.9	1.3	0.4	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.05	0.03	0.05	0.02	0.07						1.0	0.04	0.07	0.02	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.14		1.38	0.04	0.28	0.05	0.36						-	0.37	1.38	0.04	6	
20	NH_3	mg/L	0.85		1.02	0.47	1.56	1.19	1.14	0.38	1.24						1.0	0.98	1.56	0.38	8	5
21	F	mg/L			0.47		0.25	0.46	0.03	0.05	0.08						1.5	0.22	0.47	0.03	6	0
22	Cl^-	mg/L			25	17	53	12		10	38						250	26	53	10	6	0
23	Cl_2	mg/L							14		0.8						-	7.62	14.42	0.82	2	
24	NO_3	mg/L	0.33		0.15	1.82	0.09	1.50	0.81	1.75	1.56						10.0	1.00	1.82	0.09	8	0
25	NO_2	mg/L				0.02		0.13	1.27	0.14	0.08						-	0.33	1.27	0.02	5	0
	T-N	mg/L	1.18		1.17	2.31	1.65	2.82	3.21	2.26	2.87						1.0	2.18	3.21	1.17	8	8
26	PO_4	mg/L	0.16		0.51	0.05	0	0.16	0.02	0.04	0.78						0.50	0.24	0.78	0.02	8	2
27	SO_4	mg/L			3	15	13	20	8	9	14						100	12	20	3	7	0
28	H_2S	mg/L	0.04		0.16	0.25	0.12	0.16	0.52	0.17	0.13						0.10	0.19	0.52	0.04	8	7
29	Phenol	mg/L			0.01		0.01	0.01	0.02	0.01	0.02						0.05	0.01	0.02	0.01	6	0
30	Oil and Grease	mg/L			0.03	0.41	0.15		0.02	0.12	0.06						<0	0.13	0.41	0.02	6	0
31	Active Substance	mg/L	0.32		0.25	0.22	0.21	0.14	0.10	0.09	0.25						1.0	0.20	0.32	0.09	8	0
32	COD_{Mn}	mg/L	24		29	19	23	37	11	12	29						15.0	23	37	11	8	6
33	BOD	mg/L	17		20	13	16	17	8	10	11						10.0	14	20	8	8	7
34	COD_{Cr}	mg/L	41		40	29	51	76	18	17	53						20.0	41	76	17	8	6
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.24		0.7	0.49	0.17	2.2	0.7	0.79	0.11						0.001	0.675	2.2	0.11	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	0.13		0.11	0.22	0.13	1.7	0.11	0.79	0.07						0.002	0.4075	1.7	0.07	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (26/67)

Sampling Place 17 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	14.6	19.8				0.0	0.0	20.7	0.0	32.5				23.9		13.9	32.5	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	284	412	252	267	616	334	240	283	436	209	436	204	256	246	500	320	616	204	14	1
2	TDS	mg/L	121	187	168	117	151	184	97	113	137	104	194	86	133	97	500	135	194	86	14	0
3	TSS	mg/L	46	97	38	455	18	97	435	175	18	290	52	353	61	69	-	157	455	18	14	0
4	Turbidity	NTU	200	62	118	917	25	101	435	34	10	615	11	475	90	182	100	234	917	10	14	8
5	Temperature	℃	28	30	29	29	29	28	28	30	29	29	31	28	29	29	Normal Temp.	29	31	28	14	
6	Color	Pt-Co Scale								210	70						100	140	210	70	2	1
7	DO	mg/L	1.0	5.6	1.8	3.3	2.3	3.1	4.3	3.8	1.8	3.9	4.8	3.2	6.8	5.1	3.0	3.6	6.8	1.0	14	4
8	pH	-	7.0	7.4	7.0	7.5	7.8	7.9	6.3	7.4	7.7	7.5	7.1	7.2	7.3	6.4	6.0-8.5	7.3	7.9	6.3	14	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.001	0.000	-	0.000	3	0
11	Fe	mg/L		2.4	0.1	0.4	0.3	0.4	1.3	0.5	0.2	0.6	0.7	0.7	0.3	0.4	2.0	0.6	2.4	0.1	13	1
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.02	0.03	0.19	0.02	0.03	0.02	0.03	0.02	0.05	0	1.0	0.04	0.19	0.00	10	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.08	0.01	0.19	0.05	0.11	0.14	0.20	0.08	0.41	0.07	0.17	0.24	-	0.15	0.41	0.01	12	
20	NH_3	mg/L	0.24		0.64	0.58	1.56	0.39	0.38	0.57	0.81	0.12	0.68	0.40	0.55	0.58	1.0	0.58	1.56	0.12	13	1
21	F	mg/L			0.33		0.40		0.01	0.22			0.11			1.43	1.5	0.42	1.43	0.01	6	0
22	Cl^-	mg/L			14	13	29	14		12	29	10	17	14	10	22	250	17	29	10	11	0
23	Cl_2	mg/L							5		0.1						-	2.43	4.81	0.06	2	
24	NO_3	mg/L	0.65	1.39	0.58	1.14	0.42	1.26	3.28	1.17	2.34	1.38	0.63	1.48	1.09	1.29	10.0	1.29	3.28	0.42	14	0
25	NO_2	mg/L		0.20	0.09	0.05	0.05	0.06	0.01	0.06	0.03	0.05	0.10	0.07	0.04	0.06	-	0.07	0.20	0.01	13	0
	T-N	mg/L	0.88		1.31	1.77	2.03	1.71	3.67	1.79	3.19	1.55	1.41	1.95	1.68	1.93	1.0	1.91	3.67	0.88	13	12
26	PO_4	mg/L	0.26	0.40	0.06	0.07	0	0.07	0.08	0.02	0.03	0.06	0.03	0.05	0.05	0.01	0.50	0.09	0.40	0.01	14	0
27	SO_4	mg/L			62	57	219	72	45	46	69	38	98	51	45	42	100	70	219	38	12	1
28	H_2S	mg/L	0.05	0.34	0.06	1.19	0.16	0.05	0.45	0.13	0.06	0.07	0.19	3.55	0.20	0.15	0.10	0.47	3.55	0.05	14	9
29	Phenol	mg/L		0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02		0.02	0	0.02	0.04	0.05	0.01	0.04	0.00	12	0
30	Oil and Grease	mg/L			0.05	0.68	0.12	0.04	0.04	0.02	0.11		0.36	0.49	0.06	0	<0	0.18	0.68	0.00	11	0
31	Active Substance	mg/L	0.03	0.17	0.09	0.04	0.13	0.05	0.03	0.05	0.09	0.06		0.09	0.14	0.05	1.0	0.08	0.17	0.03	13	0
32	COD_{Mn}	mg/L	8	22	13	17	20	12	17	21	11	19	15	19	13	10	15.0	15	22	8	14	8
33	BOD	mg/L	4	13	8	6	18	3	8	5	7	12	13	7	9	8	10.0	9	18	3	14	4
34	COD_{Cr}	mg/L	12	67	14	32	49	30	25	38	48	20	45	29	15	23	20.0	32	67	12	14	10
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.03	0.11	0.13	0.079	0.079	0.11	0.033	0.017	0.11	0.049	0.07	0.22	140	0.5	0.001	10.1098	140	0.017	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.007	0.024	0.017	0.049	0.033	0.033	0.0049	0.017	0.022	0.0094	0.013	0.07	0.14	0.3	0.002	0.05281	0.3	0.0049	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (27/67)

Sampling Place 18 Environmental Grade B

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	6.3	10.8				5.0	7.7	5.2	6.9							7.0	10.8	5.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	192	380	338	252	644	323	273	297	416						500	346	644	192	9	1
2	TDS	mg/L	118	170	168	117	170	176	98	107	132						500	139	176	98	9	0
3	TSS	mg/L	63	92	30	653	25	75	350	119	15						-	158	653	15	9	0
4	Turbidity	NTU	11	34	20	440	4	22	725	241	7						100	167	725	4	9	3
5	Temperature	℃	29	30	29	28	30	30	28	30	29						Normal Temp.	29	30	28	9	
6	Color	Pt-Co Scale								48	21						100	35	48	21	2	0
7	DO	mg/L	2.8	5.8	1.9	2.7	3.0	2.5	0.3	0.1	6.3						3.0	2.8	6.3	0.1	9	7
8	pH	-	6.4	6.9	6.8	6.7	7.5	7.5	7.3	6.9	7.9						6.0-8.5	7.1	7.9	6.4	9	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.001	-	-	0.000	0	0
11	Fe	mg/L		0.8	0.1	0.3	0.3	0.2	0.7	0.5							2.0	0.4	0.8	0.1	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L				0.01	0.04	0.02	0.92	0.03							1.0	0.20	0.92	0.01	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.08		0.27	0.51	0.10	0.10							-	0.21	0.51	0.08	5	
20	NH_3	mg/L	0.31		0.62	0.57	2.03	0.85	0.39	0.42	0.71						1.0	0.74	2.03	0.31	8	1
21	F	mg/L			0.23		0.10	0.44		0.01							1.5	0.19	0.44	0.01	4	0
22	Cl^-	mg/L			30	19	29	14		10	43						250	24	43	10	6	0
23	Cl_2	mg/L							14		0.6						-	7.52	14.42	0.62	2	
24	NO_3	mg/L	0.65	1.59	0.59	1.51	0.35	1.29	1.74	2.52	0.50						10.0	1.20	2.52	0.35	9	0
25	NO_2	mg/L		0.20	0.11	0.05	0.09	0.11	0.07	0.07	0.07						-	0.10	0.20	0.05	8	0
	T-N	mg/L	0.97		1.32	2.13	2.47	2.25	2.21	3.01	1.28						1.0	1.96	3.01	0.97	8	7
26	PO_4	mg/L	0.18	0.44	0.05	0.06	0	0.05	0.01	0.02	0.02						0.50	0.10	0.44	0.01	9	0
27	SO_4	mg/L			60	61	229	69	43	35	69						100	81	229	35	7	1
28	H_2S	mg/L	0.06	0.12	0.24	1.47	0.13	0.08	0.45	0.14	0.06						0.10	0.31	1.47	0.06	9	6
29	Phenol	mg/L		0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01						0.05	0.01	0.02	0.01	8	0
30	Oil and Grease	mg/L			0.11	0.07	0.12	0.09	0.01	0.02	0.06						<0	0.07	0.12	0.01	7	0
31	Active Substance	mg/L	0.15	0.15	0.09	0.05	0.05	0.06	0.02	0.04	0.04						1.0	0.07	0.15	0.02	9	0
32	COD_{Mn}	mg/L	10	13	13	15	18	11	18	18	11						15.0	14	18	10	9	4
33	BOD	mg/L	9	8	9	14	8	5	8	10	6						10.0	8	14	5	9	2
34	COD_{Cr}	mg/L	14	22	22	29	45	14	28	23	50						20.0	27	50	14	9	7
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.05	0.08	0.094	0.049	0.046	0.0024	0.33	0.07	0.07						0.001	0.08793	0.33	0.0024	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	0.008	0.024	0.014	0.033	0.046	0.0024	0.33	0.017	0.0011						0.002	0.05283	0.33	0.0011	9	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (28/67)

Sampling Place 19 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	9.2	20.8				15.7	14.9	17.3	19.8	27.5				7.7		16.6	27.5	7.7	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	259	192	320	194	383	347	240	250	342	218	265	247	221	227	750	265	383	192	14	0
2	TDS	mg/L	124	79	160	85	161	177	89	110	121	92	136	72	114	79	500	114	177	72	14	0
3	TSS	mg/L	30	235	138	156	17	67	40	25	305	96	45	84	25	81	-	96	305	17	14	0
4	Turbidity	NTU	31	144	129	379	30	266	20	21	65	42	130	27	11	282	100	112	379	11	14	6
5	Temperature	℃	28	27	29	27	29	28	29	29	30	29	30	29	29	30	Normal Temp.	29	30	27	14	
6	Color	Pt-Co Scale								25	114						-	70	114	25	2	0
7	DO	mg/L	6.1	1.8	2.6	2.1	0.1	0.5	1.5	1.2	0.3	3.7	1.6	1.3	2.3	1.5	3.0	1.9	6.1	0.1	14	12
8	pH	-	6.9	5.9	7.0	6.7	7.3	6.9	6.9	6.2	7.5	7.6	7.7	7.2	7.4	7.0	6.0-8.5	7.0	7.7	5.9	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L		0.8	0.9	0.5	1.2	1.0	0.7	0.8	1.9	0.6	1.0	0.7	0.8	0.8	-	0.9	1.9	0.5	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03	0.02	0.03	0.56	0.16	0.03	0.34	0.02	0.04	0.08	0.05	0	0.050	0.11	0.56	0.00	12	5
17	Cu	mg/L												0	0	0	0.020	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.39		0.60	0.51	0.37	0.50	0.98	0.26	0.68	0.44	0.51	0.52	-	0.52	0.98	0.26	11	
20	NH_3	mg/L	2.05		5.06	1.95	5.63	3.43	1.25	1.92	4.37	0.93	3.10	2.44	1.84	0.89	2.0	2.68	5.63	0.89	13	7
21	F	mg/L	0.20		0.26		1.38			0.15		0.44					-	0.49	1.38	0.15	5	0
22	Cl^-	mg/L			42	19	19	24		24	53	19	26	29	19	30	20.0	28	53	19	11	7
23	Cl_2	mg/L							24		0.9						0.003	12.45	24.03	0.88	2	
24	NO_3	mg/L	0.31	3.02	0.25	1.75	0.13	0.57	1.70		1.04	1.86	0.55	2	1.38	2.05	-	1.24	3.02	0.13	13	0
25	NO_2	mg/L	0.05	0.93		0.12		0.11	0.56	0.12	0.01	0.20	0.39	0.11	0.14	0.03	-	0.23	0.93	0.01	12	0
	T-N	mg/L	2.40		5.31	3.82	5.76	4.11	3.50	2.03	5.42	2.99	4.04	4.06	3.36	2.97	1.0	3.83	5.76	2.03	13	13
26	PO_4	mg/L	0.29	0.25	0.68	0.13	0.62	0.72	0.13	0.17	0.18	0.14	0.23	0.17	0.24	0.07	0.50	0.29	0.72	0.07	14	3
27	SO_4	mg/L			18	25	24	3	16	12	22	11	11	21	13	27	50.0	17	27	3	12	0
28	H_2S	mg/L	0.123	0.543	1.48	0.26	0.16	0.25	0.20	0.26	0.29	0.28	0.30	0.40	0.22	0.37	0.002	0.37	1.48	0.12	14	14
29	Phenol	mg/L	0.016	0.019	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.04	<0	0.02	0.04	0.01	14	0
30	Oil and Grease	mg/L			0.77	0.29	0.06	0.05	0.01	0.07	0.34		0.10			0	1.0	0.19	0.77	0.00	9	0
31	Active Substance	mg/L	0.31	0.13	0.27	0.08	0.13	0.72	0.07	0.07	0.21	0.03	0.61	0.08	0.18	0.07	0.50	0.21	0.72	0.03	14	2
32	COD_{Mn}	mg/L	24	31	85	16	31	72	47	28	61	17	27	42	21	51	25.0	39	85	16	14	10
33	BOD	mg/L	15	19	30	11	25	40	26	12	26	12	20	32	11	48	20.0	23	48	11	14	8
34	COD_{Cr}	mg/L	29	79	102	36	61	114	66	63	89	26	49	61	66	116	30.0	68	116	26	14	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.17	0.5	22	2.2	1.4	54	17	1.7	0.17	0.46	1.1	1.1	1.1	1.1	0.02	7.42857	54	0.17	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.011	0.08	2.8	0.46	0.07	14	0.49	0.17	0.17	0.049	2.3	0.22	0.13	0.5	0.004	1.53214	14	0.011	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (29/67)

Sampling Place 20 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	5.3	3.9				0.0	2.0	0.0	0.0							1.9	5.3	0.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	723	194	806	223	935	694	276	758	940						1,000	616	940	194	9	0
2	TDS	mg/L	349	86	401	99	225	317	104	307	316						200	245	401	86	9	6
3	TSS	mg/L	51	69	90	30	42	38	20	15	18						-	41	90	15	9	0
4	Turbidity	NTU	10	41	28	165	51	156	11	35	10						-	56	165	10	9	0
5	Temperature	℃	27	28	29	26	30	27	28	29	29						Normal Temp.	28	30	26	9	
6	Color	Pt-Co Scale								55	304						-	180	304	55	2	0
7	DO	mg/L	6.2	0.7	5.1	2.3	0.9	0.4	0.4	1.3	0.4						3.0	2.0	6.2	0.4	9	7
8	pH	-	7.0	7.1	7.1	7.1	7.5	7.1	6.9	6.2	7.5						6.0-8.5	7.0	7.5	6.2	9	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L		2.2	0.3	0.4	0.6	0.4	0.7	0.4	0.2						-	0.7	2.2	0.2	8	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02	0.01	0.11	0.04	0.12	0.04	0.03						1.0	0.05	0.12	0.01	7	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.46		0.54	0.34	0.39	0.47	0.50						-	0.45	0.54	0.34	6	
20	NH_3	mg/L	14.40		19.75	1.81	15.22	8.42	1.79		6.69						-	9.73	19.75	1.79	7	0
21	F	mg/L	1.05						1.07		0.04						-	0.72	1.07	0.04	3	0
22	Cl^-	mg/L			93	14	120	58			34						-	64	120	14	5	0
23	Cl_2	mg/L							24		0.9						-	12.45	24.03	0.87	2	
24	NO_3	mg/L	0.23	1.71	0.19	1.89	0.12	0.45	1.05		0.21						-	0.73	1.89	0.12	8	0
25	NO_2	mg/L		0.34	0.02	0.24	0.03	0.03	0.23		0.01						-	0.13	0.34	0.01	7	0
	T-N	mg/L	14.63		19.96	3.94	15.37	8.90	3.07		6.91						-	10.40	19.96	3.07	7	0
26	PO_4	mg/L	1.98	0.40	4.45	0.18	3.39	1.44	0.20	2.07	2.04						0.50	1.79	4.45	0.18	9	6
27	SO_4	mg/L			36	31	81	74	24	30	47						100	46	81	24	7	0
28	H_2S	mg/L	18.33	0.39	22.06	0.14	1.09	0.50	0.19		5.21						-	5.99	22.06	0.14	8	0
29	Phenol	mg/L	0.01	0.02	0.02		0.01	0.01	0.02		0.01						-	0.01	0.02	0.01	7	0
30	Oil and Grease	mg/L			0.63	0.13	0.43	0.23	0.10	0.13	1.14						<0	0.40	1.14	0.10	7	0
31	Active Substance	mg/L	2.58	0.29	2.25	0.41	0.38	1.75	0.10	2.11	1.92						0.50	1.31	2.58	0.10	9	5
32	COD_{Mn}	mg/L	94	15	54	11	89	49	16	61	57						25.0	49	94	11	9	6
33	BOD	mg/L	68	9	45	11	53	39	7	48	43						20.0	36	68	7	9	6
34	COD_{Cr}	mg/L	102	26	60	17	143	81	23	76	95						30.0	69	143	17	9	6
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	1.7	0.5	17	5.4	35	160	0.79	140	280						0.02	71.1544	280	0.5	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	1.3	0.17	11	0.94	35	160	0.28	94	170						0.004	52.5211	170	0.17	9	9

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (30/67)

Sampling Place 20A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0					0.0	0.0	0.0	0.0	0.0				0.0		0.0	0.0	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	732		819	327	408	718	960	792	960	619	724	764	674	652	1,000	704	960	327	13	0
2	TDS	mg/L	356		406	146	282	330	359	325	318	234	363	222	348	193	200	299	406	146	13	11
3	TSS	mg/L	48		97	39	48	30	22	25	48	45	55	25	18	25	-	40	97	18	13	0
4	Turbidity	NTU	13		30	194	41	145	26	37	11	28	132	20	19	202	-	69	202	11	13	0
5	Temperature	℃	28		29	26	30	27	28	29	29	30	31	31	31	32	Normal Temp.	29	32	26	13	
6	Color	Pt-Co Scale								83	304						-	194	304	83	2	0
7	DO	mg/L	6.1		3.5	1.9	0.1	0.3	0.2	1.3	0.4	0.9		0			3.0	1.5	6.1	0.0	10	8
8	pH	-	7.0		7.1	7.1	7.5	7.0	6.9	6.2	7.4	7.5	7.3	7.3	6.8	6.9	6.0-8.5	7.1	7.5	6.2	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L			0.4	0.2	0.3	0.4	0.7	0.6	0.2	0.3	0.3	0.5	0.9	0.8	-	0.5	0.9	0.2	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03		0.02	0.04	0.30	0.06	0.07	0.02	0.03	0.11	0.04	0.02	1.0	0.07	0.30	0.02	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.50		0.55	0.28	0.55	0.48	0.52	0.42	0.42	0.64	0.42	0.52	-	0.48	0.64	0.28	11	
20	NH_3	mg/L	16.93		19.98	2.48	9.06	1.68	12.75		3.99	13.63	18.27	24.67	14.87	15.34	-	12.80	24.67	1.68	12	0
21	F	mg/L	0.68						0.80			0.31					-	0.60	0.80	0.31	3	0
22	Cl^-	mg/L			99	33	87	67			77	48	62	77	58	68	-	68	99	33	10	0
23	Cl_2	mg/L							101		0.9			0.01		0.01	-	25.46	100.93	0.01	4	
24	NO_3	mg/L	0.23		0.27	2.36	0.17	0.10	0.20		0.19	0.11		0		0.23	-	0.41	2.36	0.10	10	0
25	NO_2	mg/L			0.02	0.11	0.03	0.02	0.01		0.01	0.01	0.04	0.05	0.01	0.04	-	0.03	0.11	0.01	11	0
	T-N	mg/L	17.15		20.27	4.95	9.26	1.80	12.96		4.19	13.75	18.31	24.93	14.88	15.61	-	13.17	24.93	1.80	12	0
26	PO_4	mg/L	2.10		4.80	0.13	3.52	1.43	2.37	1.39	1.95	2.05	0.92	1.77	1.56	0.95	0.50	1.92	4.80	0.13	13	12
27	SO_4	mg/L			31	43	109	5	94	31	47	29	10	65	42	50	100	46	109	5	12	1
28	H_2S	mg/L	18.62		25.86	0.12	0.95	0.32	6.39		3.52	2.64	6.06	7.76	3.75	3.69	-	6.64	25.86	0.12	12	0
29	Phenol	mg/L	0.02		0.01		0.01	0.01	0.02			0.01	0.03	0.05	0.02	0.06	-	0.02	0.06	0.01	10	0
30	Oil and Grease	mg/L			0.60	0.17	0.10	0.26	0.78	0.15	0.89	0.43		0.24	0.11	0	<0	0.34	0.89	0.00	11	0
31	Active Substance	mg/L	3.25		1.83	0.32	0.49	1.75	0.17	1.53	0.97	0.11	1.84	0.32	1.58	1.41	0.50	1.20	3.25	0.11	13	8
32	COD_{Mn}	mg/L	147		55	24	75	49	75	70	63	42	56	102	65	48	25.0	67	147	24	13	12
33	BOD	mg/L	133		47	18	40	46	60	56	59	36	38	64	43	43	20.0	53	133	18	13	12
34	COD_{Cr}	mg/L	159		83	54	103	73	103	80	93	78	71	141	91	106	30.0	95	159	54	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	1.7		350	17	17	1600	54	2.8	11	5.4	0.7	220	2.8	1.1	0.02	175.654	1600	0.7	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	1.7		170	4.6	7	540	7.9	0.7	7.9	3.5	70	22	1.1	0.7	0.004	64.3923	540	0.7	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (31/67)

Sampling Place 21 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	10.2	0.8				21.3	38.7	0.0	12.4	24.7				12.4		15.1	38.7	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	304	191	333	183	405	370	240	273	437	212	327	256	208	226	750	283	437	183	14	0
2	TDS	mg/L	148	87	166	81	172	188	89	188	144	89	162	74	106	83	500	127	188	74	14	0
3	TSS	mg/L	20	115	25	68	25	20	20	55	31	65	39	25	22	16	-	39	115	16	14	0
4	Turbidity	NTU	20	78	15	3	24	107	12	36	9	33	103	11	8	76	100	38	107	3	14	2
5	Temperature	℃	27	27	28	26	29	28	29	29	29	29	30	29	29	29	Normal Temp.	28	30	26	14	
6	Color	Pt-Co Scale								65	60						-	63	65	60	2	0
7	DO	mg/L	6.2	0.9	3.7	1.1	0.9	0.6	1.0	1.3	0.3	1.9	0	1.2	1.3	2.3	3.0	1.6	6.2	0.2	14	12
8	pH	-	6.8	6.2	7.0	7.0	7.1	7.0	6.8	6.3	7.3	7.7	7.3	7.6	7.4	7.1	6.0-8.5	7.0	7.7	6.2	14	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L		1.9	1.3	0.3	1.4	1.2	0.7	0.9	1.9	0.7	1.3	0.9	0.7	0.8	-	1.1	1.9	0.3	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.08	0.05	0.02	0.02	0.17	0.04	0.07	0.14	0.02	0.01	0.050	0.06	0.17	0.01	10	5
17	Cu	mg/L			0.02									0	0	0	0.020	0.005	0.020	0.000	4	1
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.57		0.58	0.59	0.37	0.45	0.93	0.32	0.66	0.64	0.46	0.63	-	0.56	0.93	0.32	11	
20	NH_3	mg/L	3.38		4.98	1.07	3.50	0.72	1.36	2.81	4.09	2.77	4.29	2.83	1.32	1.56	2.0	2.67	4.98	0.72	13	8
21	F	mg/L	0.08		0.42		0.04	0.71	0.08	0.24		0.04					-	0.23	0.71	0.04	7	0
22	Cl^-	mg/L			41	28	34	31		22	82	14	26	29	19	34	20.0	33	82	14	11	9
23	Cl_2	mg/L							19	0.46	1.0						0.003	6.87	19.20	0.46	3	
24	NO_3	mg/L	0.18	2.61	0.19	1.34	0.10	0.21	1.74		0.25	1.49	0.04	1	1.37	1.24	-	0.88	2.61	0.04	13	0
25	NO_2	mg/L		0.22		0.15	0.01	0.01	0.64	0.22	0.01	0.13	0.01	0.49	0.17	0.24	-	0.19	0.64	0.01	12	0
	T-N	mg/L	3.56		5.17	2.56	3.61	0.94	3.73	3.03	4.35	4.39	4.34	3.95	2.86	3.04	1.0	3.50	5.17	0.94	13	12
26	PO_4	mg/L	0.33	0.71	0.81	0.03	0.58	0.48	0.14	0.26	0.44	0.19	0.41	0.14	0.22	0.11	0.50	0.35	0.81	0.03	14	3
27	SO_4	mg/L			18	19	44	3	20	15	19	11	18	24	13	18	50.0	18	44	3	12	0
28	H_2S	mg/L	0.180	0.537	0.33	0.14	1.59	0.19	0.11	0.42	7.02	0.32	0.84	0.24	0.28	0.11	0.002	0.88	7.02	0.11	14	14
29	Phenol	mg/L	0.015		0.01	0.02	0.01	0.02	0.02	0.01		0.01	0.03	0	0.02	0.05	<0	0.02	0.05	0.00	12	0
30	Oil and Grease	mg/L			0.14	0.14	0.06		0.06	0.09	0.17	0.04		0.43	0.18	0	1.0	0.13	0.43	0.00	10	0
31	Active Substance	mg/L	1.00	0.18	0.17	0.15	0.11	0.30	0.04	0.09	0.13	0.02	0.60	0.19	0.25	0.22	0.50	0.25	1.00	0.02	14	2
32	COD_{Mn}	mg/L	28	14	18	16	37	27	10	30	34	19	262	25	25	34	25.0	41	262	10	14	9
33	BOD	mg/L	19	8	10	11	24	15	4	12	15	9	21	20	18	13	20.0	14	24	4	14	3
34	COD_{Cr}	mg/L	45	49	32	37	57	48	16	32	53	19	57	45	51	39	30.0	42	57	16	14	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.17	7	7.9	0.7	28	1.7	0.07	2.8	92	4.9	2.2	1.7	2.2	1.3	0.02	10.9029	92	0.07	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.11	0.8	1.4	0.33	7.9	0.094	0.017	0.94	28	0.79	3.3	0.05	0.9	1.3	0.004	3.28079	28	0.017	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (32/67)

Sampling Place 22 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	19.9	49.9				65.2	134.2	38.0	27.6	77.4				149.1		70.2	149.1	19.9	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	265	311	6,470	478	4,795	1,830	1,680	2,310	5,070	2,030	5,650	796	950	940	1,000	2,398	6,470	265	14	8
2	TDS	mg/L	1,556	145	3,500	221	2,430	1,550	668	945	1,695	896	2,490	223	425	435	200	1,227	3,500	145	14	13
3	TSS	mg/L	19	35	25	534	25	35	25	32	19	73	33	30	15	25	-	66	534	15	14	0
4	Turbidity	NTU	6	8	5	153	29	32	112	145	117	129	17	46	20	60	-	63	153	5	14	0
5	Temperature	℃	28	30	29	26	31	28	29	30	31	31	31	30	31	30	Normal Temp.	30	31	26	14	
6	Color	Pt-Co Scale								74	73						-	74	74	73	2	0
7	DO	mg/L	2.8	0.2	0.1	1.0	0.7	1.9	0.0	0.00	1.5	0.2	0.6	0			3.0	0.8	2.8	0.0	11	11
8	pH	-	6.4	6.9	6.8	7.0	7.5	7.6	7.0	6.9	7.2	4.4	7.8	7.1	8.1	6.9	6.0-8.5	7.0	8.1	4.4	14	0
9	Salinity										0.26						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L		3.3	1.0	0.9	0.7	0.2	0.8	1.0	0.7	1.6	1.1	0.8	1.0	1.0	-	1.1	3.3	0.2	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.01		0.04	0.08	0.23	0.13	0.19	0.05	0.03	0.01	0.03	0	1.0	0.07	0.23	0.00	11	0
17	Cu	mg/L			0.01									0	0	0	0.10	0.003	0.010	0.000	4	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.64	0.22	0.41	0.44	0.51	0.56	0.76	0.57	0.67	0.59	0.62	0.84	-	0.57	0.84	0.22	12	
20	NH_3	mg/L	3.49		5.58	4.08	6.89	5.45	0.48		0.98	6.22	5.47	8.03	5.10	4.77	-	4.71	8.03	0.48	12	0
21	F	mg/L	0.20		0.08		0.07	0.19	0.07			0.36					-	0.16	0.36	0.07	6	0
22	Cl^-	mg/L			1,981	84	457	433			1,879	62	1,682	145	193	241	-	716	1,981	62	10	0
23	Cl_2	mg/L							428		0.5			0.01			-	142.72	427.70	0.01	3	
24	NO_3	mg/L	0.20	0.13	0.18	1.65	0.06	0.19	0.21		0.12	0.38		0		0.08	-	0.30	1.65	0.06	11	0
25	NO_2	mg/L		0.01		0.32	0.02	0.01	0.01		0.01	0.04	0.01	0.04	0.01	0.02	-	0.04	0.32	0.01	11	0
	T-N	mg/L	3.68		5.76	6.05	6.97	5.65	0.70		1.11	6.64	5.48	8.13	5.11	4.87	-	5.01	8.13	0.70	12	0
26	PO_4	mg/L	0.64	0.52	0.95	0.06	0.97	0.74	0.27	0.40	0.04	0.22	0.42	0.67	0.39	0.43	0.50	0.48	0.97	0.04	14	6
27	SO_4	mg/L			134	26	307	6	95	102	183	63	207	60	51	50	100	107	307	6	12	5
28	H_2S	mg/L	2.84	0.25	0.56	0.61	0.89	0.18	0.38		0.98	0.25	1.95	3.73	0.25	0.64	-	1.04	3.73	0.18	13	0
29	Phenol	mg/L	0.01		0.02		0.01	0.20	0.02		0.01	0.01	0.12	0.02	0	0.03	-	0.04	0.20	0.00	11	0
30	Oil and Grease	mg/L			0.17	0.45	0.04	0.09	0.26	0.08	0.28	0.11				0	<0	0.16	0.45	0.00	9	0
31	Active Substance	mg/L	1.63	0.21	1.02	0.41	0.31	0.44	0.09	0.65	0.25	0.54	0.24	0.04	0.43	0.47	0.50	0.48	1.63	0.04	14	4
32	COD_{Mn}	mg/L	43	14	35	72	40	37	20	40	50	29	35	36	17	25	25.0	35	72	14	14	10
33	BOD	mg/L	36	9	28	57	24	30	17	32	33	18	24	17	15	20	20.0	26	57	9	14	9
34	COD_{Cr}	mg/L	90	21	84	111	61	69	47	85	83	67	64	68	42	57	30.0	68	111	21	14	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	5	22	7	17	3.5	160	9.2	79	160	2.3	6.3	280	2.8	2.8	0.02	54.0643	280	2.3	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	17	2.2	0.49	0.7	0.79	92	9.2	2.8	2.8	0.23	2.3	14	1.7	1.1	0.004	10.5221	92	0.23	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (33/67)

Sampling Place 23 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	11.7					21.2	20.8	28.0	15.5	22.0				10.1		18.5	28.0	10.1	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	138		139	105	182	155	145	130	138	89	144	135	121	122	750	134	182	89	13	0
2	TDS	mg/L	129		69	48	87	99	56	59	58	61	71	88	65	61	500	73	129	48	13	0
3	TSS	mg/L	25		51	362	18	108	46	392	106	242	37	64	36	46	-	118	392	18	13	0
4	Turbidity	NTU	14		25	823	15	304	27	306	14	388	38	11	11	19	100	153	823	11	13	4
5	Temperature	℃	28		28	26	27	28	29	29	30	28	29	28	28	29	Normal Temp.	28	30	26	13	
6	Color	Pt-Co Scale								>500	120						-	120	120	120	1	1
7	DO	mg/L	6.3		4.2	4.3	4.4	2.6	4.8	3.7	3.2	3.8	6.0	4.1	9.4	9.4	3.0	5.1	9.4	2.6	13	1
8	pH	-	7.1		7.1	7.2	7.2	7.2	7.2	6.6	7.4	6.9	7.4	7.9	7.5	7.5	6.0-8.5	7.2	7.9	6.6	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L			0.4	0.4	0.5	0.4	0.5	1.1	0.4	0.4	0.5	0.6	0.5	0.6	-	0.5	1.1	0.4	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.01	0.02	0.06	0.03	0.34	0.06	0.07	0.04	0.05	0.11	0.050	0.08	0.34	0.01	10	6
17	Cu	mg/L												0	0	0	0.020	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L					0.07		0.03	0.11	0.04	0.07	0.09	0.13	0.13	0.14	-	0.09	0.14	0.03	9	
20	NH_3	mg/L	0.33		3.88	0.68	0.15	0.16	0.21	0.39	0.52	0.12	0.19	0.08	0.24	0.19	2.0	0.55	3.88	0.08	13	1
21	F	mg/L	0.20				1.53										-	0.87	1.53	0.20	2	0
22	Cl^-	mg/L			17	9	14	12		12	58	5	10	19	10	20	20.0	17	58	5	11	2
23	Cl_2	mg/L							19	0.76	0.7						0.003	6.90	19.20	0.72	3	
24	NO_3	mg/L	2.15		1.83	1.98	1.70	1.88	2.71		2.39	2.31	2.01	2	1.89	2.16	-	2.09	2.71	1.70	12	0
25	NO_2	mg/L			0.02	0.04	0.04	0.02	0.01	0.04	0.01	0.02	0.04	0.04	0.02	0.04	-	0.03	0.04	0.01	12	0
	T-N	mg/L	2.48		5.73	2.70	1.89	2.06	2.92	0.43	2.91	2.45	2.24	2.25	2.15	2.39	1.0	2.51	5.73	0.43	13	12
26	PO_4	mg/L	0.10		0.10	0.08	0.24	0.06	0.01	0.03	0.84	0.16	0.08	0.01	0.05	0.03	0.50	0.14	0.84	0.01	13	1
27	SO_4	mg/L			3	28	3	6	12	12	14	4	11	7	4	6	50.0	9	28	3	12	0
28	H_2S	mg/L	0.069		0.27	0.98	0.13	0.15	0.16	0.44	5.81	0.29	1.36	0.27	0.12	0.11	0.002	0.78	5.81	0.07	13	13
29	Phenol	mg/L	0.016		0.01		0.01	0.01	0.02	0.01		0.01	0.05	0.02	0.02	0.04	<0	0.02	0.05	0.01	11	0
30	Oil and Grease	mg/L			0.05	0.55	2.19		0.05	0.10	0.22	0.04			0.04	0	1.0	0.36	2.19	0.00	9	1
31	Active Substance	mg/L	0.25		0.05	0.05	0.05	0.06	0.09	0.04	0.03	0.11	0.04	0.09	0.07	0.06	0.50	0.08	0.25	0.03	13	0
32	COD_{Mn}	mg/L	10		9	19	8	16	11	26	23	19	20	27	12	7	25.0	16	27	7	13	2
33	BOD	mg/L	7		7	12	5	7	7	20	13	12	13	11	7	3	20.0	10	20	3	13	0
34	COD_{Cr}	mg/L	12		12	29	21	29	18	65	51	27	32	42	30	22	30.0	30	65	12	13	4
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.14		0.49	0.7	2.2	1.7	0.079	0.33	0.49	0.049	0.07	0.5	0.28	0.3	0.02	0.56369	2.2	0.049	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.15		0.11	0.7	0.35	0.22	0.033	0.079	0.17	0.033	0.046	0.03	0.07	0.05	0.004	0.157	0.7	0.03	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (34/67)

Sampling Place 24 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.7	5.2				6.4	10.6	3.0		2.5				0.0		4.3	10.6	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	456	317	797	241	306	290	307	497	886	549	571	483	730	662	750	507	886	241	14	2
2	TDS	mg/L	131	145	413	110	138	160	113	194	329	245	283	142	375	286	500	219	413	110	14	0
3	TSS	mg/L	40	234	55	30	40	53	35	37	55	28	50	15	35	11	-	51	234	11	14	0
4	Turbidity	NTU	55	133	16	36	31	42	46	8	204	8	69	201	40	14	100	64	204	8	14	3
5	Temperature	℃	28	29	29	28	28	29	27	29	30	31	30	29	28	29	Normal Temp.	29	31	27	14	
6	Color	Pt-Co Scale								109	285						-	197	285	109	2	0
7	DO	mg/L	0.6	0.6	1.1	1.8	0.9	0.8	1.2	1.1	0.2		0	1.2		0.2	3.0	0.8	1.8	0.2	12	12
8	pH	-	7.0	6.2	7.2	7.4	7.3	7.3	6.9	6.4	7.5	7.6	7.8	7.2	8.4	7.7	6.0-8.5	7.3	8.4	6.2	14	0
9	Salinity										0.03						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L		4.5	0.8	0.1	1.1	0.7	1.0	0.9	0.5	0.6	0.6	0.7	1.2	0.8	-	1.0	4.5	0.1	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.09		0.06	0.06	0.04	0.03	0.61	0.14	0.02	0.06	0.04	0.03	0.050	0.11	0.61	0.02	11	6
17	Cu	mg/L			0.01									0	0	0	0.020	0.003	0.010	0.000	4	0
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.57		0.20	0.15	0.25	0.51	0.66	0.42	0.43	0.55	0.64	0.67	-	0.46	0.67	0.15	11	
20	NH_3	mg/L	3.65		12.75	2.70	3.44	2.41	2.47	1.78	22.10	6.12	9.50	9.23	10.90	12.08	2.0	7.62	22.10	1.78	13	12
21	F	mg/L				0.36	0.16									1.35	-	0.62	1.35	0.16	3	0
22	Cl^-	mg/L			96	28	24	67		43	62	38	46	48	48	53	20.0	50	96	24	11	11
23	Cl_2	mg/L							38	1.25	1.7						0.003	13.79	38.45	1.25	3	
24	NO_3	mg/L	0.26	0.18	0.20	0.94	1.36	0.94	2.65		0.23	0.19	0.04	0		0.27	-	0.62	2.65	0.04	12	0
25	NO_2	mg/L		0.01	0.10	0.08	0.31	0.05	0.03		0.03	0.01	0.01	0.03	0.01	0.01	-	0.06	0.31	0.01	12	0
	T-N	mg/L	3.90		13.05	3.72	5.11	3.40	5.15	1.78	22.36	6.32	9.55	9.38	10.91	12.36	1.0	8.23	22.36	1.78	13	13
26	PO_4	mg/L	0.66	0.42	2.80	0.18	0.31	0.30	0.26	0.62	1.78	0.79	0.71	0.83	1.34	0.82	0.50	0.84	2.80	0.18	14	9
27	SO_4	mg/L			75	24	24	38	37	39	78	44	48	20	59	49	50.0	45	78	20	12	3
28	H_2S	mg/L	0.289	0.652	2.95	0.08	0.32	0.16	0.24	0.32	0.36	0.30	0.50	0.48	1.35	1.62	0.002	0.69	2.95	0.08	14	14
29	Phenol	mg/L	0.016		0.01	0.01	0.01	0.01	0.02	0.01		0.01	0.04	0	0.02	0.06	<0	0.02	0.06	0.00	12	0
30	Oil and Grease	mg/L			0.51	0.59	0.15	0.17	0.10	0.07	0.64	0.19			0.01	0	1.0	0.24	0.64	0.00	10	0
31	Active Substance	mg/L	1.98	0.65	1.66	0.18	0.07	0.43	0.08	1.05	1.13	0.19	1.35	0.42	1.33	1.60	0.50	0.87	1.98	0.07	14	8
32	COD_{Mn}	mg/L	38	51	68	14	23	36	38	46	77	32	66	95	69	55	25.0	51	95	14	14	12
33	BOD	mg/L	28	26	30	10	20	24	22	30	29	21	59	58	58	48	20.0	33	59	10	14	12
34	COD_{Cr}	mg/L	66	128	79	19	31	52	51	63	164	64	90	127	102	100	30.0	81	164	19	14	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	7	11	1100	2.2	2.2	920	14	7	280	54	1.6	350	280	90	0.02	222.786	1100	1.6	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	3	11	280	1.3	0.46	920	2.2	0.35	280	14	1.6	11	1.1	23	0.004	110.644	920	0.35	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (35/67)

Sampling Place 24A Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.0	0.0	16.1	0.0	0.0				0.0		2.0	16.1	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	400	187	687	347	660	236	529	562	782	502	746	611	267	217	750	481	782	187	14	1
2	TDS	mg/L	190	83	343	159	295	140	153	205	281	207	346	180	139	155	500	205	346	83	14	0
3	TSS	mg/L	35	80	31	25	20	35	25	20	211	27	103	15	10	19	-	47	211	10	14	0
4	Turbidity	NTU	31	40	9	22	19	16	24	16	307	8	60	162	20	4	100	53	307	4	14	2
5	Temperature	℃	28	28	29	28	29	28	28	29	30	30	31	30	29	29	Normal Temp.	29	31	28	14	
6	Color	Pt-Co Scale								86	442						-	264	442	86	2	0
7	DO	mg/L	0.3	0.6	1.3	0.4	0.2	0.7	0.7	0.3	0.4		0.2	-	0.7	2.8	3.0	0.7	2.8	0.0	13	13
8	pH	-	6.5	6.2	6.9	7.1	7.2	7.1	7.1	6.1	7.0	7.1	7.2	6.6	8.6	7.0	6.0-8.5	7.0	8.6	6.1	14	0
9	Salinity										0.03						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L		1.8	0.7	0.3	0.9	1.0	1.0	0.7	1.9	0.7	0.6	0.7	0.8	0.8	-	0.9	1.9	0.3	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L											0.03	0	0	0	0.10	0.008	0.030	0.000	4	0
16	Zn	mg/L			0.05		0.04	0.38	0.18	0.04	0.04	0.03	0.03	0.18	0.02	0.56	0.050	0.14	0.56	0.02	11	5
17	Cu	mg/L												0	0	0	0.020	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.54	0.01	0.29	0.44	0.40	0.41	0.81	0.40	0.56	0.58	0.44	0.62	-	0.46	0.81	0.01	12	
20	NH_3	mg/L	2.66		5.19	2.65	4.85	1.68	2.65	5.55	10.45	4.57	10.94	9.28	2.30	2.42	2.0	5.01	10.94	1.68	13	12
21	F	mg/L						0.23		0.44					0.14	1.53	-	0.58	1.53	0.14	4	0
22	Cl^-	mg/L			72	91	87	14		38	168	34	62	58	19	29	20.0	61	168	14	11	9
23	Cl_2	mg/L							53	0.38	1.3						0.003	18.19	52.87	0.38	3	
24	NO_3	mg/L	0.11	2.54	0.14	0.08	0.17	0.65	1.61		0.12			0	1.29	1.25	-	0.73	2.54	0.08	11	0
25	NO_2	mg/L		0.31	0.01	0.02	0.02	0.34	0.04	0.01	0.03	0.01	0.02	0.04	0.33	0.16	-	0.10	0.34	0.01	13	0
	T-N	mg/L	2.77		5.34	2.75	5.04	2.67	4.30	5.56	10.60	4.58	10.96	9.41	3.92	3.83	1.0	5.52	10.96	2.67	13	13
26	PO_4	mg/L	0.48	0.35	1.73	0.33	0.62	0.18	0.30	0.68	0.84	0.72	0.70	0.55	0.19	0.12	0.50	0.56	1.73	0.12	14	7
27	SO_4	mg/L			49	40	97	19	61	42	51	29	70	30	16	14	50.0	43	97	14	12	4
28	H_2S	mg/L	0.635	0.493	3.91	0.24	9.74	0.21	0.39	0.39	0.25	3.19	9.31	8.94	0.23	0.09	0.002	2.72	9.74	0.09	14	14
29	Phenol	mg/L	0.018	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.04	0.02	0.02	0.07	<0	0.02	0.07	0.01	14	0
30	Oil and Grease	mg/L			0.07	0.13	0.59	0.16	0.15	0.15	0.13	0.10	0.04			0	1.0	0.15	0.59	0.00	10	0
31	Active Substance	mg/L	1.75	0.14	1.71	0.76	0.36	0.12	0.09	0.95	0.52	0.15	1.07	0.96	0.15	0.21	0.50	0.64	1.75	0.09	14	7
32	COD_{Mn}	mg/L	39	12	81	27	28	17	27	67	50	57	87	126	43	10	25.0	48	126	10	14	11
33	BOD	mg/L	25	9	63	17	15	14	15	54	32	49	69	69	17	7	20.0	32	69	7	14	7
34	COD_{Cr}	mg/L	76	21	87	56	56	27	43	75	101	72	171	147	66	43	30.0	74	171	21	14	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	35	0.22	140	150	3500	1.3	14	230	0.22	35	1.1	110	1.1	1.3	0.02	301.374	3500	0.22	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	22	0.07	17	17	35	0.28	14	22	0.11	2.2	0.22	1.4	0.11	1.1	0.004	9.46357	35	0.07	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (36/67)

Sampling Place 24B Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0					0.0	0.0	7.3	0.0							1.5	7.3	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	360		663	287	467	526	514	493	556						750	483	663	287	8	0
2	TDS	mg/L	168		334	139	207	279	182	189	205						500	213	334	139	8	0
3	TSS	mg/L	35		58	37	15	52	28	30	288						-	68	288	15	8	0
4	Turbidity	NTU	35		13	30	24	31	33	7	628						100	100	628	7	8	1
5	Temperature	℃	28		29	27	28	29	28	28	30						Normal Temp.	28	30	27	8	
6	Color	Pt-Co Scale								85	283						-	184	283	85	2	0
7	DO	mg/L	0.0		0.3	0.4	0.1	0.2	0.7	0.7	0.2						3.0	0.3	0.7	0.0	8	8
8	pH	-	6.3		6.6	6.9	6.6	6.8	6.8	5.9	7.1						6.0-8.5	6.6	7.1	5.9	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.002	-	-	0.000	0	0
11	Fe	mg/L			0.9	0.6	0.7	0.9	1.3	0.9	2.4						-	1.1	2.4	0.6	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.07		0.05	0.06	0.06	0.01	1.30						0.050	0.26	1.30	0.01	6	5
17	Cu	mg/L															0.020	-	0.000	0.000	0	0
18	Pb	mg/L															0.030	-	0.000	0.000	0	0
19	Mg	mg/L			0.40	0.09	0.29	0.27	0.39	0.44	0.60						-	0.36	0.60	0.09	7	
20	NH_3	mg/L	2.12		4.11	1.47	2.78	4.37	4.54	4.01	5.06						2.0	3.56	5.06	1.47	8	7
21	F	mg/L	0.09														-	0.09	0.09	0.09	1	0
22	Cl^-	mg/L			57	68	24	41		36	82						20.0	51	82	24	6	6
23	Cl_2	mg/L							43	0.98	1.4						0.003	15.20	43.25	0.98	3	
24	NO_3	mg/L	0.17		0.16	0.11	0.06	0.15	2.23		0.12						-	0.43	2.23	0.06	7	0
25	NO_2	mg/L			0.09	0.01	0.03	0.03	0.01	0.01	0.01						-	0.03	0.09	0.01	7	0
	T-N	mg/L	2.28		4.36	1.59	2.87	4.55	6.78	4.02	5.19						1.0	3.95	6.78	1.59	8	8
26	PO_4	mg/L	0.33		1.15	0.14	0.28	0.49	0.49	0.43	0.61						0.50	0.49	1.15	0.14	8	2
27	SO_4	mg/L			62	32	83	59	67	34	53						50.0	56	83	32	7	5
28	H_2S	mg/L	0.592		16.99	0.39	8.72	0.24	1.80	0.41	1.53						0.002	3.83	16.99	0.24	8	8
29	Phenol	mg/L	0.014		0.01		0.01	0.02	0.02	0.01	0.02						<0	0.01	0.02	0.01	7	0
30	Oil and Grease	mg/L			0.07	0.22	0.32	0.24	0.19	0.11	0.34						1.0	0.21	0.34	0.07	7	0
31	Active Substance	mg/L			0.91	0.94	0.40	0.70	0.13	0.67	0.55						0.50	0.61	0.94	0.13	7	5
32	COD_{Mn}	mg/L	33		101	25	36	86	37	75	60						25.0	57	101	25	8	7
33	BOD	mg/L	26		93	23	28	70	25	63	60						20.0	48	93	23	8	8
34	COD_{Cr}	mg/L	64		180	69	78	108	89	93	109						30.0	99	180	64	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	17		9200	17	17	2400	170	35	1600						0.02	1682	9200	17	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	3		1700	4.9	2.8	2400	4.9	35	35						0.004	523.2	2400	2.8	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (37/67)

Sampling Place 24C Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	4.7					8.0	8.2	16.3	0.0							7.4	16.3	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	339		624	338	325	489	494	474	572						750	457	624	325	8	0
2	TDS	mg/L	157		312	149	149	271	184	179	209						500	201	312	149	8	0
3	TSS	mg/L	42		82	41	65	35	47	56	84						-	57	84	35	8	0
4	Turbidity	NTU	44		17	32	27	34	52	20	195						100	52	195	17	8	1
5	Temperature	℃	28		29	28	28	28	27	29	29						Normal Temp.	28	29	27	8	
6	Color	Pt-Co Scale								200	381						-	291	381	200	2	0
7	DO	mg/L	0.1		0.6	0.2	0.3	0.6	0.6	0.3	0.2						3.0	0.4	0.6	0.1	8	8
8	pH	-	6.6		6.5	7.0	7.0	6.9	6.7	5.7	6.9						6.0-8.5	6.7	7.0	5.7	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.002	-	-	0.000	0	0
11	Fe	mg/L			0.4	1.7	1.4	1.3	1.2	0.9	0.6						-	1.1	1.7	0.4	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.04	0.05	0.07	0.09	0.06	0.02	0.33						0.050	0.09	0.33	0.02	7	5
17	Cu	mg/L															0.020	-	0.000	0.000	0	0
18	Pb	mg/L															0.030	-	0.000	0.000	0	0
19	Mg	mg/L			0.15	0.19	0.23	0.27	0.37	0.42	0.54						-	0.31	0.54	0.15	7	
20	NH_3	mg/L	0.15		3.39	4.02	4.36	4.02	3.54	1.22	6.30						2.0	3.37	6.30	0.15	8	6
21	F	mg/L															-	-	0.00	0.00	0	0
22	Cl^-	mg/L			67	40	29	17		34	43						20.0	38	67	17	6	5
23	Cl_2	mg/L							38	0.44	1.7						0.003	13.52	38.45	0.44	3	
24	NO_3	mg/L	0.27		0.19	0.20	0.06	0.11	2.40		0.21						-	0.49	2.40	0.06	7	0
25	NO_2	mg/L			0.04		0.01	0.04	0.01	0.01	0.05						-	0.03	0.05	0.01	6	0
	T-N	mg/L	0.42		3.62	4.22	4.43	4.17	5.94	1.22	6.56						1.0	3.82	6.56	0.42	8	7
26	PO_4	mg/L	0.10		0.59	0.08	0.22	0.33	0.45	0.16	0.83						0.50	0.35	0.83	0.08	8	2
27	SO_4	mg/L			54	33	56	59	70	28	24						50.0	46	70	24	7	4
28	H_2S	mg/L	1.068		11.65	0.54	1.07	0.29	0.81	0.35	4.88						0.002	2.58	11.65	0.29	8	8
29	Phenol	mg/L	0.012		0.01		0.01	0.02	0.03	0.01	0.02						<0	0.01	0.03	0.01	7	0
30	Oil and Grease	mg/L			0.03	0.19	0.28	0.17	0.16	0.11	0.47						1.0	0.20	0.47	0.03	7	0
31	Active Substance	mg/L			1.04	0.48	0.07	0.78	0.12	0.61	0.53						0.50	0.52	1.04	0.07	7	4
32	COD_{Mn}	mg/L	100		110	29	47	96	53	168	68						25.0	84	168	29	8	8
33	BOD	mg/L	60		90	29	35	63	43	151	60						20.0	66	151	29	8	8
34	COD_{Cr}	mg/L	118		320	74	68	129	79	181	118						30.0	136	320	68	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	8		17	9.2	7	33	35	22	170						0.02	37.65	170	7	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	0.9		17	2.2	1.7	24	21	11	130						0.004	25.975	130	0.9	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (38/67)

Sampling Place 24D Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	1.5					9.4	10.0	2.2	0.0							4.6	10.0	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	441		635	261	315	448	579	492	607						750	472	635	261	8	0
2	TDS	mg/L	203		316	114	138	245	219	188	215						500	205	316	114	8	0
3	TSS	mg/L	60		62	47	40	52	30	100	70						-	58	100	30	8	0
4	Turbidity	NTU	42		15	37	37	30	44	41	232						100	60	232	15	8	1
5	Temperature	℃	28		30	28	29	28	27	29	30						Normal Temp.	29	30	27	8	
6	Color	Pt-Co Scale								158	279						-	219	279	158	2	0
7	DO	mg/L	0.1		0.1	0.4	0.2	0.3	0.5	0.7	0.3						3.0	0.3	0.7	0.1	8	8
8	pH	-	6.6		6.8	7.2	7.1	7.2	6.8	6.2	6.9						6.0-8.5	6.9	7.2	6.2	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.002	-	-	0.000	0	0
11	Fe	mg/L			1.0	0.5	1.0	1.4	1.5	0.8	0.7						-	1.0	1.5	0.5	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L					0.01										0.10	0.010	0.010	0.010	1	0
16	Zn	mg/L			0.10	0.01	0.06	0.16	0.04	0.01	0.33						0.050	0.10	0.33	0.01	7	4
17	Cu	mg/L															0.020	-	0.000	0.000	0	0
18	Pb	mg/L															0.030	-	0.000	0.000	0	0
19	Mg	mg/L			0.43	0.15	0.25	0.29	0.49	0.49	0.54						-	0.38	0.54	0.15	7	
20	NH_3	mg/L	0.96		5.42	0.59	1.03	4.29	4.54	2.75	7.88						2.0	3.43	7.88	0.59	8	5
21	F	mg/L	0.05														-	0.05	0.05	0.05	1	0
22	Cl^-	mg/L			62	68	14	60		31	48						20.0	47	68	14	6	5
23	Cl_2	mg/L							48	1.07	1.4						0.003	16.85	48.06	1.07	3	
24	NO_3	mg/L	0.20		0.19	0.21	1.09	0.18	2.01		0.20						-	0.58	2.01	0.18	7	0
25	NO_2	mg/L			0.02	0.01	0.01	0.03	0.02	0.01	0.05						-	0.02	0.05	0.01	7	0
	T-N	mg/L	1.16		5.63	0.81	2.13	4.50	6.57	2.75	8.12						1.0	3.96	8.12	0.81	8	7
26	PO_4	mg/L	0.02		1.88	0.01	0.11	0.22	0.58	0.17	0.84						0.50	0.48	1.88	0.01	8	3
27	SO_4	mg/L			49	28	58	40	67	40	19						50.0	43	67	19	7	2
28	H_2S	mg/L	0.840		4.37	0.33	0.45	0.26	0.56	0.33	1.18						0.002	1.04	4.37	0.26	8	8
29	Phenol	mg/L			0.02	0.01	0.02	0.03	0.02	0.01	0.02						<0	0.02	0.03	0.01	7	0
30	Oil and Grease	mg/L				0.13	0.24	0.34	0.19	0.13	0.26						1.0	0.22	0.34	0.13	6	0
31	Active Substance	mg/L			1.06	0.40	0.22	0.74	0.09	0.60	0.96						0.50	0.58	1.06	0.09	7	4
32	COD_{Mn}	mg/L	155		64	29	68	114	62	187	105						25.0	98	187	29	8	8
33	BOD	mg/L	74		55	28	49	92	59	155	93						20.0	76	155	28	8	8
34	COD_{Cr}	mg/L	163		69	66	82	154	87	204	178						30.0	125	204	66	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	9		3500	7.9	13	920	3.5	22	54						0.02	566.175	3500	3.5	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	1.4		3500	1.7	4.9	240	0.35	0.22	22						0.004	471.321	3500	0.22	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (39/67)

Sampling Place 25 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2	1.1				1.2	1.7	2.7	1.1	2.6				3.1		1.7	3.1	0.2	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	184	172	173	265	218	176	195	178	248	138	183	189	165	170	750	189	265	138	14	0
2	TDS	mg/L	41	84	84	119	97	111	79	70	74	74	88	88	90	85	500	84	119	41	14	0
3	TSS	mg/L	28	40	48	167	10	47	20	25	51	75	30	23	18	16	-	43	167	10	14	0
4	Turbidity	NTU	11	39	19	159	12	21	17	8	147	190	36	5	7	7	100	48	190	5	14	3
5	Temperature	℃	27	29	28	26	28	26	28	27	27	28	29	28	28	28	Normal Temp.	28	29	26	14	
6	Color	Pt-Co Scale								46	50						-	48	50	46	2	0
7	DO	mg/L	2.7	4.0	3.2	7.0	2.8	4.4	6.5	3.8	1.2	3.3	6.1	3.2	6.7	5.0	3.0	4.3	7.0	1.2	14	3
8	pH	-	7.3	7.9	6.8	7.5	8.0	7.0	7.6	6.9	7.5	7.1	7.3	7.9	7.4	7.4	6.0-8.5	7.4	8.0	6.8	14	0
9	Salinity										0.00						-	-	-	-	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L		0.8	0.5	0.4	0.7	0.7	0.5	0.5	0.5	0.4	0.6	0.8	0.7	0.7	-	0.6	0.8	0.4	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L				0.35	0.01	0.12	0.53	0.01	0.18	0.06	0.10	0.09	0.07	0.08	0.050	0.15	0.53	0.01	11	9
17	Cu	mg/L											0.04	0	0	0	0.020	0.010	0.040	0.000	4	1
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.05		0.30	0.22	0.14	0.08	0.81	0.11	0.24	0.29	0.16	0.29	-	0.24	0.81	0.05	11	
20	NH_3	mg/L	0.71		0.52	0.54	0.92	1.11	0.79	0.44	2.26	0.46	3.20	0.84	0.70	0.62	2.0	1.01	3.20	0.44	13	2
21	F	mg/L	0.05				1.46	0.36		0.08						1.07	-	0.60	1.46	0.05	5	0
22	Cl^-	mg/L			21	84	29	12		19	38	10	14	24	14	23	20.0	26	84	10	11	6
23	Cl_2	mg/L							19		0.4						0.003	9.80	19.20	0.40	2	
24	NO_3	mg/L	2.89	2.72	1.99	1.92	2.77	2.10	2.07		2.43	2.20	2.24	2	2.35	2.91	-	2.37	2.91	1.92	13	0
25	NO_2	mg/L	0.16	0.31	0.11	0.07	0.16	0.13	0.15	0.06	0.41	0.09	0.17	0.16	0.09	0.18	-	0.16	0.41	0.06	14	0
	T-N	mg/L	3.77		2.62	2.53	3.85	3.34	3.02	0.50	5.09	2.75	5.61	3.21	3.14	3.71	1.0	3.32	5.61	0.50	13	12
26	PO_4	mg/L	0.19	0.31	0.38	0.09	0.23	0.09	0.07	0.07	0.08	0.10	0.13	0.09	0.08	0.06	0.50	0.14	0.38	0.06	14	0
27	SO_4	mg/L			3	20	4	2	14	8	16	8	11	5	9	8	50.0	9	20	2	12	0
28	H_2S	mg/L	0.063	0.177	0.18	0.46	0.14	0.12	0.18	0.20	5.68	0.22	0.22	0.15	0.18	0.08	0.002	0.57	5.68	0.06	14	14
29	Phenol	mg/L		0.00	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.04	0	0.01	0.06	<0	0.02	0.06	0.00	13	0
30	Oil and Grease	mg/L				0.23	0.05		0.06	0.04	0.43	0.04		0	0.07	0	1.0	0.10	0.43	0.00	9	0
31	Active Substance	mg/L		0.23	0.08	0.09	0.05	0.07	0.07	0.06	0.06	0.12	0.12	0.34	0.16	0.15	0.50	0.12	0.34	0.05	13	0
32	COD_{Mn}	mg/L	13	16	10	15	12	24	21	17	22	22	13	28	10	10	25.0	17	28	10	14	1
33	BOD	mg/L	7	9	6	8	5	17	14	6	14	13	8	13	6	5	20.0	9	17	5	14	0
34	COD_{Cr}	mg/L	16	26	16	29	28	56	34	22	36	34	32	62	11	42	30.0	32	62	11	14	7
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.8	14	0.7	0.94	1.6	2.8	92	2.2	1.3	0.79	2.2	1.7	1.4	1.1	0.02	8.82357	92	0.7	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	0.3	0.9	0.31	0.22	0.24	1.3	0.17	0.7	1.3	0.12	0.7	0.17	1.1	0.17	0.004	0.55	1.3	0.12	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (40/67)

Sampling Place 25A Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	1.0					1.3	6.1	3.2	1.6	3.6				2.8		2.8	6.1	1.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	248		218	182	333	328	244	227	271	172	230	239	212	122	750	233	333	122	13	0
2	TDS	mg/L	118		88	82	146	189	91	171	80	86	111	64	110	72	500	108	189	64	13	0
3	TSS	mg/L	19		25	106	25	1,144	25	38	47	51	19	20	20	18	-	120	1,144	18	13	0
4	Turbidity	NTU	11		5	98	39	696	9	9	239	157	17	2	5	19	100	100	696	2	13	3
5	Temperature	℃	26		28	27	27	26	28	28	27	28	30	29	29	29	Normal Temp.	28	30	26	13	
6	Color	Pt-Co Scale								51	60						-	56	60	51	2	0
7	DO	mg/L	2.1		1.6	6.9	0.4	2.7	6.4	2.8	0.3	1.5	4.0	1.3	2.7	2.6	3.0	2.7	6.9	0.3	13	10
8	pH	-	7.3		6.8	7.4	7.9	7.2	7.6	6.9	7.5	7.0	7.4	7.6	7.4	7.5	6.0-8.5	7.3	7.9	6.8	13	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.002	0.000	-	0.000	3	0
11	Fe	mg/L			0.6	0.4	1.6	0.3	0.6	0.6	0.8	0.8	1.0	1.0	0.8	0.8	-	0.8	1.6	0.3	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03	0.35	0.10	0.21	0.04	0.01	0.27	0.05	0.30	0.02	0.03	0.11	0.050	0.13	0.35	0.01	12	7
17	Cu	mg/L											0.03	0	0	0	0.020	0.008	0.030	0.000	4	1
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.07		0.64		0.20	0.22	0.76	0.21	0.52	0.46	0.28	0.54	-	0.39	0.76	0.07	10	
20	NH_3	mg/L	1.84		2.40	1.23	3.96	9.49	1.36	1.04	1.60	1.17	1.87	2.01	1.54	2.26	2.0	2.44	9.49	1.04	13	5
21	F	mg/L	0.25		0.23		0.85		0.25	0.13		0.53				0.03	-	0.32	0.85	0.03	7	0
22	Cl^-	mg/L			23	109	43	24		19	24	14	17	24	14	24	20.0	31	109	14	11	7
23	Cl_2	mg/L							14		1.0			0			0.003	5.15	14.42	0.00	3	
24	NO_3	mg/L	0.41		0.62	1.60	0.24	1.47	3.72		1.83	1.95	1.84	1		1.76	-	1.48	3.72	0.24	11	0
25	NO_2	mg/L	0.05		0.14	0.13	0.01	0.33	1.24	0.13	0.31	0.46	0.28	0.28	0.14	0.16	-	0.28	1.24	0.01	13	0
	T-N	mg/L	2.30		3.16	2.96	4.21	11.29	6.32	1.17	3.73	3.58	3.99	3.10	1.68	4.18	1.0	3.97	11.29	1.17	13	13
26	PO_4	mg/L	0.22		0.38	0.10	0.71	1.26	0.02	0.10	0.09	0.15	0.25	0.19	0.16	0.17	0.50	0.29	1.26	0.02	13	2
27	SO_4	mg/L			2	19	3	26	16	10	20	8	12	4	11	14	50.0	12	26	2	12	0
28	H_2S	mg/L	0.064		0.06	0.35	0.23	0.40	0.21	0.24	5.15	0.19	0.07	0.06	0.13	0.06	0.002	0.55	5.15	0.06	13	13
29	Phenol	mg/L	0.019		0.01		0.02	0.02	0.02		0.01	0.02	0.04	0	0.02	0.04	<0	0.02	0.04	0.00	11	0
30	Oil and Grease	mg/L				0.77	0.06	8.74	0.06	0.07	0.27	0.04	0.17	0	0.21	0	1.0	0.94	8.74	0.00	11	1
31	Active Substance	mg/L			0.11	0.18	0.36	0.20	0.08	0.09	0.05	0.10	0.42	0.19	0.13	0.07	0.50	0.17	0.42	0.05	12	0
32	COD_{Mn}	mg/L	18		25	15	23	751	20	14	27	10	13	23	16	17	25.0	75	751	10	13	3
33	BOD	mg/L	10		13	10	19	329	11	5	11	8	6	10	8	13	20.0	35	329	5	13	1
34	COD_{Cr}	mg/L	35		42	24	53	1,067	28	16	42	22	22	59	40	31	30.0	114	1,067	16	13	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.13		28	1.3	4.9	1.7	0.023	1.4	3.5	0.33	0.13	2.8	1.7	2.2	0.02	3.701	28	0.023	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	0.014		17	0.49	3.3	0.22	0.013	0.46	1.3	0.079	0.079	1.4	0.3	1.1	0.004	1.98115	17	0.013	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (41/67)

Sampling Place 26 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.3	0.0				0.5	2.0	1.2	2.1							1.0	2.1	0.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	779	956	793	517	1,040	511	851	596	874						750	768	1,040	511	9	6
2	TDS	mg/L	383	456	404	238	458	266	311	235	265						500	335	458	235	9	0
3	TSS	mg/L	89	36	86	25	86	25	35	25	183						-	66	183	25	9	0
4	Turbidity	NTU	37	10	24	25	77	11	30	10	198						100	47	198	10	9	1
5	Temperature	℃	28	29	29	27	29	27	28	29	29						Normal Temp.	28	29	27	9	
6	Color	Pt-Co Scale								51	290						-	171	290	51	2	0
7	DO	mg/L	1.0	0.0	0.6	6.9	0.0	1.0	5.8	1.4	0.0						3.0	1.9	6.9	0.0	9	7
8	pH	-	7.2	7.2	6.9	7.5	7.9	7.3	7.7	7.2	7.7						6.0-8.5	7.4	7.9	6.9	9	0
9	Salinity										0.03						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.002	-	-	0.000	0	0
11	Fe	mg/L		14.8	0.4	0.1	0.2	0.1	0.6	0.5	0.2						-	2.1	14.8	0.1	8	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02	0.11	0.02	0.07	0.06	0.03	0.12						0.050	0.06	0.12	0.02	7	4
17	Cu	mg/L															0.020	-	0.000	0.000	0	0
18	Pb	mg/L															0.030	-	0.000	0.000	0	0
19	Mg	mg/L			0.44		0.30	0.26	0.44	0.27	0.46						-	0.36	0.46	0.26	6	
20	NH_3	mg/L	12.80		20.50	2.84	7.97	8.08	18.96	8.26	5.42						2.0	10.60	20.50	2.84	8	8
21	F	mg/L	0.22			0.06		0.03		0.40	0.55						-	0.25	0.55	0.03	5	0
22	Cl^-	mg/L			88	382	91	38		53	62						20.0	119	382	38	6	6
23	Cl_2	mg/L							72	1.82	1.0						0.003	24.96	72.09	0.96	3	
24	NO_3	mg/L	0.29	0.26	0.10	2.79	0.08	0.18	0.58		0.11						-	0.55	2.79	0.08	8	0
25	NO_2	mg/L		0.36	0.01	0.42	0.06	0.01	0.03	0.01	0.01						-	0.11	0.42	0.01	8	0
	T-N	mg/L	13.09		20.61	6.05	8.11	8.27	19.56	8.27	5.53						1.0	11.19	20.61	5.53	8	8
26	PO_4	mg/L	1.93	0.36	3.50	0.25	2.85	1.73	2.30	1.02	1.65						0.50	1.73	3.50	0.25	9	7
27	SO_4	mg/L			33	54	103	5	49	29	27						50.0	43	103	5	7	2
28	H_2S	mg/L	13.702	3.851	10.11	0.98	15.82	0.08	5.28	0.40	0.20						0.002	5.60	15.82	0.08	9	9
29	Phenol	mg/L	0.020	0.01	0.02		0.01	0.02	0.02	0.01	0.02						<0	0.02	0.02	0.01	8	0
30	Oil and Grease	mg/L			0.09	0.25	0.10	0.57	0.47	0.30	0.60						1.0	0.34	0.60	0.09	7	0
31	Active Substance	mg/L		1.39	2.24	0.11	0.15	1.54	0.12	1.45	1.10						0.50	1.01	2.24	0.11	8	5
32	COD_{Mn}	mg/L	40	82	59	19	41	37	98	60	111						25.0	61	111	19	9	8
33	BOD	mg/L	24	61	41	19	37	23	74	50	87						20.0	46	87	19	9	8
34	COD_{Cr}	mg/L	67	103	63	29	85	67	138	95	158						30.0	89	158	29	9	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	1400	16000	3.3	14	1600000	2.4	35	13	49						0.02	179724	1600000	2.4	9	9
36	Fecal Coliforms	$\times 10^6$No./100mL	220	16000	0.049	6.3	280000	2.4	35	7.9	23						0.004	32921.6	280000	0.049	9	9

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (42/67)

Sampling Place 27 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.0	0.0		0.0	0.0				0.0		0.0	0.0	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	388	48,650	7,870	1,170	5,140	31,300	47,050	1,079	4,410	4,090	12,400	3,845	4,735	5,445	1,000	12,684	48,650	388	14	13
2	TDS	mg/L	1,897	27,500	4,380	508	2,550	3,180	17,290	729	1,561	1,835	4,870	977	2,450	1,949	200	5,120	27,500	508	14	14
3	TSS	mg/L	45	5	78	15	48	28	10	17	39	60	77	20	25	15	-	34	78	5	14	0
4	Turbidity	NTU	49	2	69	27	55	5	7	8	174	154	36	74	55	57	-	55	174	2	14	0
5	Temperature	℃	29	33	30	27	30	30	29	29	30	31	32	30	31	32	Normal Temp.	30	33	27	14	
6	Color	Pt-Co Scale								50	207						-	129	207	50	2	0
7	DO	mg/L	0.6	4.6	0.2	7.0		1.8	6.4	1.2	0.00	0.1		0			3.0	2.4	7.0	0.0	9	6
8	pH	-	7.1	7.9	7.4	7.5	7.9	6.9	7.9	7.1	7.8	7.5	8.1	7.3	8.1	7.3	6.0-8.5	7.6	8.1	6.9	14	0
9	Salinity										0.22						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L		0.7	0.3	0.2	0.2	0.2	0.1	0.1	0.2	0.3	0.2	0.3	0.9	0.4	-	0.3	0.9	0.1	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.04	0.20	0.01	0.08	0.03	3.80	0.11	0.01		0.01	0.03	0.01	1.0	0.39	3.80	0.01	11	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.52		0.34	0.06	0.10	0.29	0.47	0.43	0.40	0.44	0.39	0.95	-	0.40	0.95	0.06	11	
20	NH_3	mg/L	11.95		11.59	2.53	5.35	3.87	2.82		5.82	29.95	12.94	16.91	13.49	11.45	-	10.72	29.95	2.53	12	0
21	F	mg/L	0.75			0.28		1.13	1.27		0.22						-	0.73	1.27	0.22	5	0
22	Cl^-	mg/L			2,503	84	34	10,693			93,717	1,150	3,749	964	1,254	1,639	-	11,579	93,717	34	10	0
23	Cl_2	mg/L							90,113		0.9			0.01			-	########	90,112.50	0.01	3	
24	NO_3	mg/L	0.18		0.25	2.18	0.08	0.09	4.09		0.10	0.14	0.02	0		0.31	-	0.69	4.09	0.02	11	0
25	NO_2	mg/L		0.03	0.01	0.24	0.05	0.01	0.01		0.01	0.01	0.03	0.04	0.01	0.02	-	0.04	0.24	0.01	12	0
	T-N	mg/L	12.13		11.85	4.95	5.48	3.97	6.92		5.93	30.10	12.99	17.09	13.50	11.78	-	11.39	30.10	3.97	12	0
26	PO_4	mg/L	2.09	0.37	1.70	0.14	2.07	0.56	0.27	0.99	1.36	1.93	1.14	0.63	1.45	0.84	0.50	1.11	2.09	0.14	14	11
27	SO_4	mg/L			286	68	166	83	3,303	70	148	174	513	131	275	250	100	456	3,303	68	12	9
28	H_2S	mg/L	8.20	0.17	4.85	0.11	5.86	0.12	0.61		0.26	5.02	6.71	7.19	7.19	1.83	-	3.70	8.20	0.11	13	0
29	Phenol	mg/L	0.01	0.01	0.01	0.02	0.01	0.02	0.02		0.01	0.02	0.09	0.27	0	0.04	-	0.04	0.27	0.00	13	0
30	Oil and Grease	mg/L			0.16	0.21	0.34		0.04	0.16	0.87	0.54			0.00	0	<0	0.26	0.87	0.00	9	0
31	Active Substance	mg/L	0.56	0.17	2.45	0.66	0.43	0.24	0.05	1.46	1.15	0.04	1.70	0.14	1.37	1.87	0.50	0.88	2.45	0.04	14	8
32	COD_{Mn}	mg/L	91	61	87	12	48	32	66	48	57	154	80	89	50	52	25.0	66	154	12	14	13
33	BOD	mg/L	49	46	72	11	38	16	48	34	38	107	57	70	41	48	20.0	48	107	11	14	12
34	COD_{Cr}	mg/L	160	110	122	34	81	67	96	97	85	208	90	113	109	114	30.0	106	208	34	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	160	0.13	3.3	7.9	11	280	4.3	170	13	3.1	1.4	280	170	1.7	0.02	78.987857	280	0.13	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	90	0.13	3.3	2.4	2.8	140	0.11	140	13	2.3	0.94	140	170	1.1	0.004	50.434286	170	0.11	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (43/67)

Sampling Place 28 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2					0.5	2.2	0.3	0.4							0.7	2.2	0.2	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	930		800	309	965	534	929	667	1,030						1,000	770	1,030	309	8	1
2	TDS	mg/L	418		424	148	438	225	430	268	363						200	339	438	148	8	7
3	TSS	mg/L	186		294	65	209	35	99	35	331						-	157	331	35	8	0
4	Turbidity	NTU	123		109	77	136	15	63	13	444						-	122	444	13	8	0
5	Temperature	℃	26		27	26	27	26	27	27	27						Normal Temp.	26	27	26	8	
6	Color	Pt-Co Scale								115	339						-	227	339	115	2	0
7	DO	mg/L	0.2		1.0	7.4		0.8	5.9	1.2	1.9						3.0	2.6	7.4	0.2	7	5
8	pH	-	7.0		7.2	7.6	7.9	7.0	7.8	7.2	7.8						6.0-8.5	7.4	7.9	7.0	8	0
9	Salinity										0.04						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.6	0.3	0.6	0.1	0.2	0.8	0.6						-	0.4	0.8	0.1	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02	0.29	0.03	0.45	0.03	0.03	0.47						1.0	0.19	0.47	0.02	7	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.50	0.06	0.49		0.57	0.52	0.63						-	0.46	0.63	0.06	6	
20	NH_3	mg/L	19.28		10.15	2.94	2.18	9.10	11.29		4.08						-	8.43	19.28	2.18	7	0
21	F	mg/L	0.91		0.70												-	0.80	0.91	0.70	2	0
22	Cl^-	mg/L			75	89	64	41			82						-	70	89	41	5	0
23	Cl_2	mg/L							67		2.4						-	34.85	67.28	2.41	2	
24	NO_3	mg/L	0.29		0.48	0.32	0.35	0.14	0.28		0.21						-	0.30	0.48	0.14	7	0
25	NO_2	mg/L			0.01	0.02	0.07	0.03	0.04		0.04						-	0.04	0.07	0.01	6	0
	T-N	mg/L	19.57		10.64	3.28	2.60	9.27	11.61		4.32						-	8.76	19.57	2.60	7	0
26	PO_4	mg/L	2.29		4.85	0.31	4.17	1.31	3.60	4.82	2.33						0.50	2.96	4.85	0.31	8	7
27	SO_4	mg/L			14	11	18	27	36	34	27						100	24	36	11	7	0
28	H_2S	mg/L	10.72		15.36	0.41	2.57	0.21	1.26		6.10						-	5.23	15.36	0.21	7	0
29	Phenol	mg/L	0.01		0.01	0.01	0.01	0.01	0.11		0.01						-	0.02	0.11	0.01	7	0
30	Oil and Grease	mg/L			0.35	0.43	1.84	0.21	0.49	0.10	1.45						<0	0.70	1.84	0.10	7	0
31	Active Substance	mg/L			0.61	0.53	0.06	1.46	0.19	1.14	1.43						0.50	0.77	1.46	0.06	7	5
32	COD_{Mn}	mg/L	118		119	56	154	64	121	55	220						25.0	113	220	55	8	8
33	BOD	mg/L	82		108	48	138	38	97	44	203						20.0	95	203	38	8	8
34	COD_{Cr}	mg/L	136		346	106	200	96	168	73	416						30.0	193	416	73	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	80		3500	35	17	3500	2200	1700	2200						0.02	1654	3500	17	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	80		1400	22	11	1300	700	280	220						0.004	501.625	1400	11	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (44/67)

Sampling Place 29 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	1.6	2.0				1.7	1.9	3.1	1.3	0.0				0.4		1.5	3.1	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	341	313	386	370	489	285	283	261	557	242	685	412	385	475	1,000	392	685	242	14	0
2	TDS	mg/L	161	199	267	175	210	185	116	155	182	147	263	123	191	148	200	180	267	116	14	3
3	TSS	mg/L	32	14	55	18	20	25	11	40	15	20	27	15	42	25	-	26	55	11	14	0
4	Turbidity	NTU	1	15	167	20	7	12	3	14	26	62	28	12	25	81	-	34	167	1	14	0
5	Temperature	℃	28	29	29	28	31	27	28	28	29	25	29	28	27	28	Normal Temp.	28	31	25	14	
6	Color	Pt-Co Scale								148	83						-	116	148	83	2	0
7	DO	mg/L	1.5	6.0	0.6	0.8	0.6	6.7	0.3	6.3	6.2	1.5	0.5	1.0	1.4	0.4	3.0	2.4	6.7	0.3	14	10
8	pH	-	7.2	7.2	6.9	6.9	7.6	7.4	7.1	7.3	8.0	7.2	7.9	6.8	6.2	6.1	6.0-8.5	7.1	8.0	6.1	14	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.00			0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L		4.1	0.8	0.1	0.7	0.9	0.9	0.7	0.7	0.8	0.7	0.8	0.9	1.4	-	1.0	4.1	0.1	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.07	0.02	0.05	0.04	0.22	0.06	0.07		0.05	0.09	0.06	0	1.0	0.07	0.22	0.00	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.33	0.01	0.25	0.24	0.29	0.25	0.39	0.32	0.41	0.35	0.37	0.41	-	0.30	0.41	0.01	12	
20	NH_3	mg/L	3.02		9.77	8.64	97.53	2.18	3.93		4.47	0.66	10.23	10.89	6.53	9.32	-	13.93	97.53	0.66	12	0
21	F	mg/L				0.57	0.63	0.52	0.09		0.09	0.15					-	0.34	0.63	0.09	6	0
22	Cl^-	mg/L			49	111	72	62			67	19	46	39	34	43	-	54	111	19	10	0
23	Cl_2	mg/L							34		0.1						-	16.89	33.64	0.15	2	
24	NO_3	mg/L	0.18	0.08	0.11	0.36	0.07	0.75	0.64		0.14	0.69		0	0	0.08	-	0.27	0.75	0.04	12	0
25	NO_2	mg/L		0.02	0.01	0.34	0.01	0.16	0.19		0.01	0.33	0.01	0.01	0.04	0.02	-	0.10	0.34	0.01	12	0
	T-N	mg/L	3.20		9.89	9.34	97.61	3.09	4.77		4.62	1.68	10.24	10.96	6.61	9.42	-	14.29	97.61	1.68	12	0
26	PO_4	mg/L	0.34	0.62	1.53	0.29	0.60	0.16	0.26	0.25	0.73	0.30	0.98	0.68	0.47	0.64	0.50	0.56	1.53	0.16	14	7
27	SO_4	mg/L			72	41	31	28	26	17	34	17	179	37	37	45	100	47	179	17	12	1
28	H_2S	mg/L	0.23	0.19	0.73	0.19	0.35	0.20	0.15		3.26	0.23	0.35	0.31	0.32	0.33	-	0.53	3.26	0.15	13	0
29	Phenol	mg/L	0.01	0.01	0.01	0.02	0.01	0.01	0.03		0.01	0.02	0.15	0.02	0.02	0.05	-	0.03	0.15	0.01	13	0
30	Oil and Grease	mg/L			0.10	0.09	0.17		0.02	0.03	0.11	0.11		0.13		0	<0	0.08	0.17	0.00	9	0
31	Active Substance	mg/L		0.37	1.29	0.92	0.19	0.16	0.23	0.54	0.35	0.03	1.30	0.10	0.14	1.86	0.50	0.57	1.86	0.03	13	5
32	COD_{Mn}	mg/L	42	38	44	22	33	19	22	28	57	28	31	33	28	30	25.0	32	57	19	14	11
33	BOD	mg/L	39	21	31	21	27	11	12	13	40	20	29	21	21	23	20.0	23	40	11	14	11
34	COD_{Cr}	mg/L	74	49	72	49	48	31	74	31	71	56	64	39	66	80	30.0	57	80	31	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	28	280	24	28	5.4	4.6	0.28	7.9	92	0.22	920	350	0.14	110000	0.02	7981.47	110000	0.14	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	2.8	280	13	17	1.7	1.7	0.14	2.2	54	0.14	170	3.5	2.8	2800	0.004	239.213	2800	0.14	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (45/67)

Sampling Place 29A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.6					4.7	2.4	1.9	0.7							2.1	4.7	0.6	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	338		368	320	458	287	263	294	659						1,000	373	659	263	8	0
2	TDS	mg/L	157		253	151	220	190	108	116	218						200	177	253	108	8	3
3	TSS	mg/L	20		10	20	25	31	13	15	16						-	19	31	10	8	0
4	Turbidity	NTU	91		113	24	5	21	2	10	28						-	37	113	2	8	0
5	Temperature	℃	27		29	27	30	26	28	27	28						Normal Temp.	28	30	26	8	
6	Color	Pt-Co Scale								45	100						-	73	100	45	2	0
7	DO	mg/L	1.5		1.0	1.4	1.1	7.0	1.5	6.5	6.2						3.0	3.3	7.0	1.0	8	5
8	pH	-	7.0		6.9	7.1	7.7	7.4	6.9	7.1	8.0						6.0-8.5	7.3	8.0	6.9	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.6	0.3	0.7	1.2	0.8	0.1							-	0.6	1.2	0.1	6	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.05		0.05	0.71	0.03	0.08							1.0	0.18	0.71	0.03	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.28	6.88	0.25	0.19	0.25	0.28	0.02						-	1.16	6.88	0.02	7	
20	NH_3	mg/L	2.63		4.00	2.78	3.95	2.42	3.16		3.90						-	3.26	4.00	2.42	7	0
21	F	mg/L	0.18		0.37		0.40	0.75	0.04		0.02						-	0.29	0.75	0.02	6	0
22	Cl^-	mg/L			54	51	53	24			62						-	49	62	24	5	0
23	Cl_2	mg/L							38		0.5						-	19.46	38.45	0.48	2	
24	NO_3	mg/L	0.13		0.14	1.80	0.21	0.38	0.36		0.14						-	0.45	1.80	0.13	7	0
25	NO_2	mg/L				0.11	0.02	0.12	0.08		0.01						-	0.07	0.12	0.01	5	0
	T-N	mg/L	2.76		4.14	4.69	4.18	2.92	3.60		4.04						-	3.76	4.69	2.76	7	0
26	PO_4	mg/L	0.30		1.53	0.11	0.64	0.27	0.15	0.27	0.80						0.50	0.51	1.53	0.11	8	3
27	SO_4	mg/L			22	42	28	32	24	17	34						100	28	42	17	7	0
28	H_2S	mg/L	0.11		0.28	0.08	0.21	0.16	0.23		2.76						-	0.55	2.76	0.08	7	0
29	Phenol	mg/L	0.01		0.01	0.02	0.01	0.02	0.02		0.01						-	0.02	0.02	0.01	7	0
30	Oil and Grease	mg/L			0.03	0.07	0.12		0.02	0.01	0.04						<0	0.05	0.12	0.01	6	0
31	Active Substance	mg/L			1.97	0.92	0.13	0.11	0.11	0.53	0.50						0.50	0.61	1.97	0.11	7	4
32	COD_{Mn}	mg/L	26		32	19	24	25	26	25	45						25.0	28	45	19	8	4
33	BOD	mg/L	14		18	17	14	13	12	15	25						20.0	16	25	12	8	1
34	COD_{Cr}	mg/L	59		52	20	37	37	43	38	51						30.0	42	59	20	8	7
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	11		540	7.9	1.7	17	0.022	0.33	33						0.02	76.369	540	0.022	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	1.1		540	4.9	0.46	2.2	0.017	0.028	23						0.004	71.4631	540	0.017	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (46/67)

Sampling Place 30 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.0	0.0	0.0	0.0	0.0				0.0		0.0	0.0	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	1,125	622	2,950	414	4,820	2,560	2,280	2,370	2,185	950	2,330	2,240	1,305	752	1,000	1,922	4,820	414	14	10
2	TDS	mg/L	685	276	1,469	193	2,380	1,040	897	983	716	425	1,022	566	702	376	200	838	2,380	193	14	13
3	TSS	mg/L	32	26	46	25	35	46	21	20	70	16	34	13	15	21	-	30	70	13	14	0
4	Turbidity	NTU	9	115	13	8	46	29	115	264	94	57	15	44	21	46	-	62	264	8	14	0
5	Temperature	℃	31	29	29	28	30	30	29	31	30	31	30	29	30	28	Normal Temp.	30	31	28	14	
6	Color	Pt-Co Scale								97	253						-	175	253	97	2	0
7	DO	mg/L	2.3	0.8	0.1	0.9	0.2	0.9	0.1	0.00	0.1	0.4	0	0			3.0	0.5	2.3	0.0	11	11
8	pH	-	6.8	7.1	7.2	7.5	7.9	7.5	7.3	7.3	7.6	7.5	8.1	7.2	8.3	7.0	6.0-8.5	7.5	8.3	6.8	14	0
9	Salinity										0.10						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L		7.9	0.3	0.1	0.1	0.2	0.5	0.3	0.4	0.5	0.2	0.2	0.3	0.6	-	0.9	7.9	0.1	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.05	0.01	0.01	0.10	0.04	0.03	0.50	0.02		0	0.04	0.01	1.0	0.07	0.50	0.00	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.38		0.79	0.20	0.34	0.28	0.54	0.33	0.31	0.31	0.25	0.32	-	0.37	0.79	0.20	11	
20	NH_3	mg/L	14.53		7.66	3.06	11.90	11.78	14.25		13.68	8.10	8.67	14.87	12.59	13.80	-	11.24	14.87	3.06	12	0
21	F	mg/L	0.57		0.90	0.38	0.07	1.34	0.44								-	0.62	1.34	0.07	6	0
22	Cl^-	mg/L			68	106	817	320			332	139	529	458	193	121	-	308	817	68	10	0
23	Cl_2	mg/L							577		1.7						-	289.22	576.72	1.72	2	
24	NO_3	mg/L	0.14	0.01	0.42	1.34	0.18	0.16	0.11		0.08	0.15		0	-	0.11	-	0.23	1.34	0.00	12	0
25	NO_2	mg/L		0.02	0.01	0.28	0.02	0.01			0.03	0.01	0.01	0.03	0.03	0.04	-	0.04	0.28	0.01	11	0
	T-N	mg/L	14.66		8.09	4.68	12.10	11.95	14.36		13.78	8.26	8.68	15.02	12.62	13.95	-	11.51	15.02	4.68	12	0
26	PO_4	mg/L	1.99	1.42	4.74	0.24	2.63	2.10	1.20	1.63	1.60	1.24	0.97	1.53	1.46	0.60	0.50	1.67	4.74	0.24	14	13
27	SO_4	mg/L			221	27	517	185	122	72	85	43	109	48	60	58	100	129	517	27	12	5
28	H_2S	mg/L	11.49	1.48	63.75	0.14	0.92	0.33	5.96		0.48	4.92	7.64	8.94	8.32	7.65	-	9.39	63.75	0.14	13	0
29	Phenol	mg/L	0.01	0.01	0.01	0.02	0.01	0.02	0.03		0.01	0.02		0	0.03	0.05	-	0.02	0.05	0.00	12	0
30	Oil and Grease	mg/L			0.09	0.16	0.86	0.89	0.04	0.17	0.72	0.28			0.18	0	<0	0.34	0.89	0.00	10	0
31	Active Substance	mg/L		1.27	2.09	0.15	0.38	1.64	0.15	1.70	1.11	0.05	1.23	0.10	0.05	1.19	0.50	0.85	2.09	0.05	13	7
32	COD_{Mn}	mg/L	37	28	82	19	64	96	44	70	41	54	68	60	65	29	25.0	54	96	19	14	13
33	BOD	mg/L	21	14	58	17	45	87	35	55	35	43	56	49	41	21	20.0	41	87	14	14	12
34	COD_{Cr}	mg/L	100	38	110	48	99	127	89	93	90	90	96	91	106	66	30.0	89	127	38	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	35	22	2.4	46	9.2	13	1300	11	28	1.4	7.9	280	0.5	80	0.02	131.171	1300	0.5	14	14
36	Fecal Coliforms	$\times 10^6$No./100mL	35	22	0.33	13	9.2	1.7	490	2.8	14	1.1	4.9	3.5	0.3	80	0.004	48.4164	490	0.3	14	14

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (47/67)

Sampling Place 31 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	6.8					12.6	0.0	0.0	0.0							3.9	12.6	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	6,305		2,995	900		2,110	5,990	1,610	5,590						1,000	3,643	6,305	900	7	6
2	TDS	mg/L	770		1,526	389		416	2,470	657	1,939						200	1,167	2,470	389	7	7
3	TSS	mg/L	25		40	75		21	17	25	26						-	33	75	17	7	0
4	Turbidity	NTU	7		8	15		25	104	126	100						-	55	126	7	7	0
5	Temperature	℃	28		29	28		28	29	29	29						Normal Temp.	28	29	28	7	
6	Color	Pt-Co Scale								119	120						-	120	120	119	2	0
7	DO	mg/L	2.1		0.1	1.00		0.3	0.31	0.00	0.0						3.0	0.6	2.1	0.0	6	6
8	pH	-	6.9		7.0	7.4		7.7	7.1	7.1	7.4						6.0-8.5	7.2	7.7	6.9	7	0
9	Salinity										0.29						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.3	0.5		0.6	0.5	0.5	0.0						-	0.4	0.6	0.0	6	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02			0.28	0.60	0.03	0.07						1.0	0.20	0.60	0.02	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.43	0.13		0.22	0.35	0.28	0.39						-	0.30	0.43	0.13	6	
20	NH_3	mg/L	10.98		13.99	2.81		6.45	12.82		5.18						-	8.70	13.99	2.81	6	0
21	F	mg/L	0.13					1.47	0.63								-	0.74	1.47	0.13	3	0
22	Cl^-	mg/L			807	132		500			2,787						-	1,056	2,787	132	4	0
23	Cl_2	mg/L							1,826		1.4						-	913.83	#######	1.38	2	
24	NO_3	mg/L	0.16		0.16	1.12		0.08	3.33		0.07						-	0.82	3.33	0.07	6	0
25	NO_2	mg/L			0.01	0.92		0.01	0.10		0.01						-	0.21	0.92	0.01	5	0
	T-N	mg/L	11.14		14.16	4.85		6.54	16.25		5.26						-	9.70	16.25	4.85	6	0
26	PO_4	mg/L	1.58		3.05	0.14		0.80	1.21	1.39	1.47						0.50	1.38	3.05	0.14	7	6
27	SO_4	mg/L			134	58		160	356	42	178						100	155	356	42	6	4
28	H_2S	mg/L	16.84		14.64	0.19		0.23	0.82		3.47						-	6.03	16.84	0.19	6	0
29	Phenol	mg/L	0.01		0.01	0.02		0.02	0.02		0.01						-	0.01	0.02	0.01	6	0
30	Oil and Grease	mg/L			0.14	0.55		0.12	0.16	0.08	1.11						<0	0.36	1.11	0.08	6	0
31	Active Substance	mg/L	0.09		1.62	1.02		0.78	0.10	2.20	1.64						0.50	1.06	2.20	0.09	7	5
32	COD_{Mn}	mg/L	37		64	51		36	65	51	84						25.0	55	84	36	7	7
33	BOD	mg/L	25		52	27		17	48	43	70						20.0	40	70	17	7	6
34	COD_{Cr}	mg/L	99		79	95		65	92	91	99						30.0	89	99	65	7	7
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	220		35	70		0.00092	16	4.9	33						0.02	54.1287	220	0.00092	7	6
36	Fecal Coliforms	$\times 10^6$No./100mL	28		28	17		0.00092	9.2	3.3	33						0.004	16.9287	33	0.00092	7	6

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (48/67)

Sampling Place 32 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0					5.0	0.0	0.0	0.0	0.0				0.0		0.7	5.0	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	27,500		9,200	140	3,870		6,210	3,490	7,550	39,900	41,400	3,110		43,250	1,000	16,875	43,250	140	11	10
2	TDS	mg/L	18,360		4,820	69	1,901		2,500	1,452	2,670	18,910	1,901	784		21,625	200	6,817	21,625	69	11	10
3	TSS	mg/L	31		78	380	25		10	23	16	19	5	10		5	-	55	380	5	11	0
4	Turbidity	NTU	7		16	463	21		109	229	125	63	27	187		22	-	115	463	7	11	0
5	Temperature	℃	31		30	26	29		30	31	31	32	33	32		30	Normal Temp.	30	33	26	11	
6	Color	Pt-Co Scale								121	97						-	109	121	97	2	0
7	DO	mg/L	4.8		0.00	4.50	0.1		0.09	0.00	0.0	0.5	0.6	0		3.8	3.0	1.6	4.8	0.0	9	6
8	pH	-	7.4		7.5	7.4	7.7		7.2	7.4	7.6	7.6	8.2	7.7		6.6	6.0-8.5	7.5	8.2	6.6	11	0
9	Salinity										0.41						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001			0		0	0.005	0.000	0.001	0.000	3	1
11	Fe	mg/L			0.2	0.6	0.2		0.4	0.3	0.1		0.1	0.2		0.1	-	0.2	0.6	0.1	9	0
12	Cd	mg/L												0		0	0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L												0		0	-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0		0	0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L			0.03	0.01	0.03		0.29	0.01	0.05	0.02	0.01	0		0.02	1.0	0.05	0.29	0.00	10	0
17	Cu	mg/L												0		0	0.10	0.000	0.000	0.000	2	0
18	Pb	mg/L												0		0	0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.42		0.30		0.33	0.30	0.36	0.18	0.16	0.36		0.18	-	0.29	0.42	0.16	9	
20	NH_3	mg/L	8.78		10.48	0.65	14.68		12.74		5.21	2.44	3.03	19.21		2.11	-	7.93	19.21	0.65	10	0
21	F	mg/L	0.57		0.09						0.30	1.44	0.89			0.73	-	0.67	1.44	0.09	6	0
22	Cl^-	mg/L			3,604	64	716				2,211	13,937	16,340	1,205		16,754	-	6,854	16,754	64	8	0
23	Cl_2	mg/L							2,019		0.6			0.01			-	673.05	#######	0.01	3	
24	NO_3	mg/L	0.22		0.19	2.68	0.10		0.26		0.15	0.18		0		0.45	-	0.50	2.68	0.10	9	0
25	NO_2	mg/L			0.01	0.09	0.03		0.02		0.01	0.06	0.14	0.03		0.11	-	0.05	0.14	0.01	9	0
	T-N	mg/L	8.99		10.68	3.42	14.81		13.01		5.37	2.68	3.17	19.48		2.67	-	8.43	19.48	2.67	10	0
26	PO_4	mg/L	0.73		1.32	0.05	2.26		1.03	1.10	1.94	0.37	0.42	0.79		0.20	0.50	0.93	2.26	0.05	11	7
27	SO_4	mg/L			341	27	311		330	160	287	994	1,895	130		2,394	100	687	2,394	27	10	9
28	H_2S	mg/L	0.25		1.21	1.15	3.43		2.75		6.64	0.18	0.22	0.83		0.11	-	1.68	6.64	0.11	10	0
29	Phenol	mg/L	0.01		0.01	0.02	0.01		0.02			0.02	0.06	0.11		0.16	-	0.05	0.16	0.01	9	0
30	Oil and Grease	mg/L			0.18	0.82	0.46		0.39	0.08	0.80	0.09	0.36	3.11		0	<0	0.63	3.11	0.00	10	0
31	Active Substance	mg/L			1.84	0.11	0.36		0.26	1.14	1.53	0.02	0.13	0.08		0.15	0.50	0.56	1.84	0.02	10	3
32	COD_{Mn}	mg/L	94		78	28	35		49	64	71	107	105	66		28	25.0	66	107	28	11	11
33	BOD	mg/L	32		30	18	23		26	45	61	67	79	41		17	20.0	40	79	17	11	9
34	COD_{Cr}	mg/L	97		102	53	81		84	76	93	128	150	103		89	30.0	96	150	53	11	11
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.07		3.5	1.3	24		14	1.1	0.94	0.033	14	0.8		0.3	0.02	5.45845	24	0.033	11	11
36	Fecal Coliforms	$\times 10^6$No./100mL	0.05		2.8	0.49	24		0.094	0.7	0.94	0.007	14	0.17		0.07	0.004	3.93827	24	0.007	11	11

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (49/67)

Sampling Place 33 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2	1.3				2.3	6.9	7.9	0.9	9.6				5.6		4.3	9.6	0.2	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	483	239	478	181	487	184	189	170	480	423	374	252		176	1,000	316	487	170	13	0
2	TDS	mg/L	309	117	258	89	205	121	83	73	155	241	231	70		92	200	157	309	70	13	5
3	TSS	mg/L	37	41	46	412	15	157	20	28	25	25	10	24		54	-	69	412	10	13	0
4	Turbidity	NTU	31	20	26	395	123	195	26	9	11	84	81	4		43	-	80	395	4	13	0
5	Temperature	℃	28	28	29	27	29	26	28	29	29	29	30	30		28	Normal Temp.	28	30	26	13	
6	Color	Pt-Co Scale								71	60						-	66	71	60	2	0
7	DO	mg/L	0.1	1.6	1.0	2.40	1.5	4.1	3.16	3.95	1.8	6.4	5.5	5.0		6.5	3.0	3.3	6.5	0.1	13	6
8	pH	-	6.2	7.8	7.0	7.3	7.9	7.4	6.2	6.9	7.6	7.2	6.4	7.5		7.5	6.0-8.5	7.1	7.9	6.2	13	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L											0.00	0		0	0.005	0.001	0.002	0.000	3	1
11	Fe	mg/L		3.3	1.5	0.4	0.9	0.1	0.6	0.5	0.8	0.7	0.6	0.7		0.7	-	0.9	3.3	0.1	12	0
12	Cd	mg/L												0		0	0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L												0		0	-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L											0.05	0		0	0.10	0.017	0.050	0.000	3	0
16	Zn	mg/L			0.04		0.15	8.22	0.33	0.04	0.62	0.15	0.15	0		1.49	1.0	1.12	8.22	0.00	10	2
17	Cu	mg/L												0		0	0.10	0.000	0.000	0.000	2	0
18	Pb	mg/L												0		0	0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.86		0.48	0.01	0.16	0.13	0.70	0.29	0.24	0.30		0.21	-	0.34	0.86	0.01	10	
20	NH_3	mg/L	3.30		6.48	1.53	3.12	1.12	0.96		4.67	1.68	2.44	2.50		1.14	-	2.63	6.48	0.96	11	0
21	F	mg/L	0.07				0.23	1.05	0.13				0.06			0.73	-	0.38	1.05	0.06	6	0
22	Cl^-	mg/L			55	115	43	10			10	24	60	29		19	-	41	115	10	9	0
23	Cl_2	mg/L							29		0.5						-	14.65	28.84	0.46	2	
24	NO_3	mg/L	0.23	0.27	0.10	1.64	1.13	1.44	1.79		1.88	1.76	0.23	1		1.77	-	1.11	1.88	0.10	12	0
25	NO_2	mg/L		0.20	0.04	0.11	0.31	0.08	0.74		0.16	0.17	0.29	0.20		0.17	-	0.22	0.74	0.04	11	0
	T-N	mg/L	3.53		6.62	3.28	4.56	2.64	3.48		6.71	3.61	2.96	3.83		3.08	-	4.03	6.71	2.64	11	0
26	PO_4	mg/L	0.18	0.05	0.22	0.05	0.36	0.08	0.01	0.04	0.18	0.09	0.11	0.11		0.05	0.50	0.12	0.36	0.01	13	0
27	SO_4	mg/L			33	33	22	24	20	11	32	13	25	15		16	100	22	33	11	11	0
28	H_2S	mg/L	1.22	0.15	0.75	0.56	0.20	0.03	0.21		4.50	0.10	0.09	0.15		0.18	-	0.68	4.50	0.03	12	0
29	Phenol	mg/L	0.01	0.01	0.01	0.01	0.01	0.02	0.02			0.02	0.08	0.02		0.05	-	0.02	0.08	0.01	11	0
30	Oil and Grease	mg/L			0.05	0.18	0.06		0.05	0.11	0.22	0.24	0.24	0.33		0	<0	0.15	0.33	0.00	10	0
31	Active Substance	mg/L		0.33	0.73	0.20	0.25	0.09	0.07	0.09	0.72	0.03	0.03	0.08		0.12	0.50	0.23	0.73	0.03	12	2
32	COD_{Mn}	mg/L	37	20	41	40	32	40	10	12	24	23	22	11		22	25.0	26	41	10	13	5
33	BOD	mg/L	28	17	31	15	21	25	8	8	12	15	17	7		17	20.0	17	31	7	13	4
34	COD_{Cr}	mg/L	73	33	68	68	61	72	26	17	45	55	43	20		57	30.0	49	73	17	13	10
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	2.4	1.6	17	4.9	16	2.4	1.1	0.84	0.0094	0.14	0.35	3.5		0.3	0.02	3.88765	17	0.0094	13	12
36	Fecal Coliforms	$\times 10^6$No./100mL	0.28	0.17	1.7	1.4	0.7	2.4	0.28	0.63	0.0094	0.049	0.028	0.7		0.11	0.004	0.65049	2.4	0.0094	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (50/67)

Sampling Place 33A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2					0.0	0.9	3.4	1.2							1.1	3.4	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	516		542	1,160	865	257	346	197	608						1,000	561	1,160	197	8	1
2	TDS	mg/L	245		291	500	350	184	142	79	159						200	244	500	79	8	4
3	TSS	mg/L	51		55	31	57	101	15	80	35						-	53	101	15	8	0
4	Turbidity	NTU	32		51	11	299	122	20	20	22						-	72	299	11	8	0
5	Temperature	℃	29		29	28	31	27	29	30	30						Normal Temp.	29	31	27	8	
6	Color	Pt-Co Scale								55	65						-	60	65	55	2	0
7	DO	mg/L	0.4		0.0	1.00	0.3	1.0	0.42	0.97	0.2						3.0	0.5	1.0	0.0	8	8
8	pH	-	6.9		6.9	7.6	8.2	7.3	6.1	7.2	7.6						6.0-8.5	7.2	8.2	6.1	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.6		0.3	0.8	1.2	0.5	1.0						-	0.7	1.2	0.3	6	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.01	0.01	0.11	0.49	0.12	0.05	0.95						1.0	0.25	0.95	0.01	7	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.47	0.01	0.27	0.15	0.33	0.09	0.56						-	0.27	0.56	0.01	7	
20	NH_3	mg/L	11.28		9.26	4.50	0.81	2.19	0.86		5.13						-	4.86	11.28	0.81	7	0
21	F	mg/L	0.17			0.58		0.56									-	0.44	0.58	0.17	3	0
22	Cl^-	mg/L			57	55	72	17			43						-	49	72	17	5	0
23	Cl_2	mg/L							34		0.1						-	16.88	33.64	0.12	2	
24	NO_3	mg/L	0.12		0.10	0.14	0.16	1.07	0.20		2.21						-	0.57	2.21	0.10	7	0
25	NO_2	mg/L			0.01	0.16	0.07	0.16	0.01		0.04						-	0.08	0.16	0.01	6	0
	T-N	mg/L	11.40		9.37	4.80	1.04	3.42	1.07		7.38						-	5.50	11.40	1.04	7	0
26	PO_4	mg/L	1.14		2.75	0.45	3.02	0.13	0.06	0.09	0.58						0.50	1.03	3.02	0.06	8	4
27	SO_4	mg/L			17	73	39	32	31	12	23						100	32	73	12	7	0
28	H_2S	mg/L	8.73		7.02	0.36	2.96	0.13	0.28		6.88						-	3.77	8.73	0.13	7	0
29	Phenol	mg/L	0.01		0.01			0.02	0.02								-	0.01	0.02	0.01	4	0
30	Oil and Grease	mg/L			0.08	0.18	0.61	0.09	0.20	0.17	0.09						<0	0.20	0.61	0.08	7	0
31	Active Substance	mg/L			1.75	1.13	0.12	0.15	0.23	0.08	0.10						0.50	0.51	1.75	0.08	7	2
32	COD_{Mn}	mg/L	94		53	28	69	57	41	34	44						25.0	53	94	28	8	8
33	BOD	mg/L	74		32	17	58	26	27	10	29						20.0	34	74	10	8	6
34	COD_{Cr}	mg/L	112		92	42	113	81	60	51	92						30.0	81	113	42	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	22		920	79	92	7	3.5	0.79	54						0.02	147.286	920	0.79	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	11		28	11	54	1.1	1.7	0.79	54						0.004	20.1988	54	0.79	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (51/67)

Sampling Place 34 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				9.1	0.0	0.0	0.0	0.0				3.7		1.6	9.1	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	1,420	1,490	2,100	1,645	1,765	1,750	2,920	2,600	4,830	1,970	3,140	2,200			1,000	2,319	4,830	1,420	12	12
2	TDS	mg/L	815	656	1,030	678	825	860	1,167	1,087	1,657	935	1,389	544			200	970	1,657	544	12	12
3	TSS	mg/L	91	69	16	56	36	22	59	53	25	82	90	17			-	51	91	16	12	0
4	Turbidity	NTU	24	226	8	17	39	51	170	206	174	191	35	70			-	101	226	8	12	0
5	Temperature	℃	30	30	29	29	31	30	29	31	31	29	30	28			Normal Temp.	30	31	28	12	
6	Color	Pt-Co Scale								265	134						-	200	265	134	2	0
7	DO	mg/L	2.0	0.4	0.1	1.60	0.2	1.1	0.10	0.00	0.0	0.1		0			3.0	0.6	2.0	0.0	10	10
8	pH	-	7.1	7.2	7.1	7.5	7.8	7.8	7.2	7.3	7.5	7.6	8.1	7.3			6.0-8.5	7.5	8.1	7.1	12	0
9	Salinity										0.25						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0			0.005	0.000	-	0.000	1	0
11	Fe	mg/L		13.8	0.3	0.6	0.1	0.6	0.1	0.2	0.1	0.1	0.1	0.1			-	1.5	13.8	0.1	11	0
12	Cd	mg/L												0			0.010	0.000	0.000	0.000	1	0
13	Cr	mg/L												0			-	0.000	0.000	0.000	1	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0			0.10	0.000	0.000	0.000	1	0
16	Zn	mg/L			0.03	0.02	0.03	0.11	0.01	0.02	0.02	0.01		0.01			1.0	0.03	0.11	0.01	9	0
17	Cu	mg/L												0			0.10	0.000	0.000	0.000	1	0
18	Pb	mg/L												0			0.10	0.000	0.000	0.000	1	0
19	Mg	mg/L			0.52	1.08	0.21	0.17	0.63	0.46	0.91	0.59	1.71	0.32			-	0.66	1.71	0.17	10	
20	NH_3	mg/L	18.10		9.49	16.33	31.59	6.82	8.70		4.53	21.36	17.12	24.95			-	15.90	31.59	4.53	10	0
21	F	mg/L	0.63		0.94				0.28		0.35						-	0.55	0.94	0.28	4	0
22	Cl^-	mg/L			490	157	149	634			1,836	351	673	415			-	588	1,836	149	8	0
23	Cl_2	mg/L							610		0.7						-	305.52	610.36	0.68	2	
24	NO_3	mg/L	0.36	0.51	0.16	0.18	0.10	0.25	0.19		0.19	0.16	0.12	0			-	0.24	0.51	0.10	11	0
25	NO_2	mg/L		0.04	0.01	0.04	0.04	0.01	0.01		0.01	0.02	0.05	0.05			-	0.03	0.05	0.01	10	0
	T-N	mg/L	18.46		9.66	16.55	31.73	7.08	8.90		4.73	21.54	17.29	25.38			-	16.13	31.73	4.73	10	0
26	PO_4	mg/L	2.05	3.53	2.80	2.12	2.22	0.67	1.93	1.83	1.72	2.34	1.72	1.45			0.50	2.03	3.53	0.67	12	12
27	SO_4	mg/L			103	44	172	176	374	92	261	137	216	145			100	172	374	44	10	8
28	H_2S	mg/L	1.12	34.12	0.68	1.04	0.32	0.22	6.22		1.36	7.04	1.53	13.95			-	6.15	34.12	0.22	11	0
29	Phenol	mg/L		0.02	0.01		0.01	0.02	0.03			0.01	0.12	0.06			-	0.03	0.12	0.01	8	0
30	Oil and Grease	mg/L			0.07	0.21	0.39		0.48	0.19	1.77	0.20	0.43	0.13			<0	0.43	1.77	0.07	9	0
31	Active Substance	mg/L	1.34	2.66	2.31	2.29	0.47	0.23	0.46	2.89	1.94	0.06	1.36	0.08			0.50	1.34	2.89	0.06	12	7
32	COD_{Mn}	mg/L	97	87	52	48	35	29	96	76	60	162	76	104			25.0	77	162	29	12	12
33	BOD	mg/L	49	62	34	41	21	23	76	36	35	122	68	88			20.0	54	122	21	12	12
34	COD_{Cr}	mg/L	140	120	92	91	70	51	149	96	99	261	134	159			30.0	122	261	51	12	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	3	70	2.8	63	5.4	12	3.5	3.3	22	3.1	7	35			0.02	19.175	70	2.8	12	12
36	Fecal Coliforms	$\times 10^6$No./100mL	0.05	50	2.8	1.7	3.5	6.3	1.7	3.3	22	1.3	1.7	170			0.004	22.0292	170	0.05	12	12

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (52/67)

Sampling Place 35 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.6					0.3	0.7	0.5	1.0	0.1				0.6		0.5	1.0	0.1	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	661		732	681	990	483	492	577	1,105	985	1,360	1,485			1,000	868	1,485	483	11	3
2	TDS	mg/L	315		381	305	456	363	195	368	292	435	443	259			200	347	456	195	11	10
3	TSS	mg/L	50		27	27	73	45	20	30	40	89	100	15			-	47	100	15	11	0
4	Turbidity	NTU	20		64	10	2	38	39	38	201	15	17	52			-	45	201	2	11	0
5	Temperature	℃	29		30	27	27	27	29	30	31	31	32	30			Normal Temp.	30	32	27	11	
6	Color	Pt-Co Scale								150	250						-	200	250	150	2	0
7	DO	mg/L	5.6		0.00	0.50	0.3	6.5	6.20	1.61		0.1		0			3.0	2.6	6.5	0.0	8	5
8	pH	-	7.1		7.2	7.2	8.5	7.6	7.7	6.7	8.1	7.3	8.3	7.9			6.0-8.5	7.6	8.5	6.7	11	0
9	Salinity										0.04						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0			0.005	0.000	-	0.000	1	0
11	Fe	mg/L			0.9	0.5	0.6	1.6	1.1	0.9	0.5	0.6	0.6	0.6			-	0.8	1.6	0.5	10	0
12	Cd	mg/L												0			0.010	0.000	0.000	0.000	1	0
13	Cr	mg/L												0			-	0.000	0.000	0.000	1	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0			0.10	0.000	0.000	0.000	1	0
16	Zn	mg/L			0.03		0.07	0.37	0.34	0.04	0.21	0.01	0.03	0.20			1.0	0.14	0.37	0.01	9	0
17	Cu	mg/L												0			0.10	0.000	0.000	0.000	1	0
18	Pb	mg/L												0			0.10	0.000	0.000	0.000	1	0
19	Mg	mg/L			0.99	0.70	0.59	0.46	0.62	0.68	0.82	1.33	1.12	1.30			-	0.86	1.33	0.46	10	
20	NH_3	mg/L	14.00		0.90	16.70	14.98	5.26	7.50		5.03	28.27	13.64	19.24			-	12.55	28.27	0.90	10	0
21	F	mg/L	0.37		1.36	0.59	1.25	0.54	0.21		0.40	1.33					-	0.76	1.36	0.21	8	0
22	Cl^-	mg/L			90	140	67	36			77	14	101	92			-	77	140	14	8	0
23	Cl_2	mg/L							34		0.9						-	17.26	33.64	0.88	2	
24	NO_3	mg/L	0.24		0.11	0.11	0.25	0.56	0.19		0.18	0.21		0			-	0.23	0.56	0.11	9	0
25	NO_2	mg/L			0.01	0.01	0.01	0.33	0.02		0.01	0.01	0.03	0.06			-	0.05	0.33	0.01	9	0
	T-N	mg/L	14.24		1.02	16.82	15.24	6.15	7.71		5.22	28.49	13.67	19.51			-	12.81	28.49	1.02	10	0
26	PO_4	mg/L	1.63		2.73	1.95	1.49	0.51	0.80	0.80	1.64	2.43	1.77	1.78			0.50	1.59	2.73	0.51	11	11
27	SO_4	mg/L			22	3	157	68	28	20	29	32	77	24			100	46	157	3	10	1
28	H_2S	mg/L	0.93		0.59	0.71	2.64	0.39	0.64		1.07	2.00	3.03	2.44			-	1.44	3.03	0.39	10	0
29	Phenol	mg/L			0.01	0.01	0.01	0.02	0.02			0.02	0.04	0.07			-	0.03	0.07	0.01	8	0
30	Oil and Grease	mg/L			0.16	0.24	0.72	0.23	0.08	0.08	0.65	0.11		0.36			<0	0.29	0.72	0.08	9	0
31	Active Substance	mg/L	1.45		1.28	3.78	0.30	1.07	0.16	1.29	1.73	0.01	0.71	0.07			0.50	1.08	3.78	0.01	11	7
32	COD_{Mn}	mg/L	40		70	44	52	42	42	43	52	96	96	94			25.0	61	96	40	11	11
33	BOD	mg/L	22		46	36	25	31	25	28	45	83	88	65			20.0	45	88	22	11	11
34	COD_{Cr}	mg/L	82		80	88	84	78	51	63	95	166	171	154			30.0	101	171	51	11	11
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	16000		350	110	1600	4.6	17	130	17	4.9	17	3.5			0.02	1659.45	16000	3.5	11	11
36	Fecal Coliforms	$\times 10^6$No./100mL	280		7.9	110	350	3.3	4.9	17	17	0.013	7.9	70			0.004	78.9103	350	0.013	11	11

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (53/67)

Sampling Place 36 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.1					0.4	0.2	0.5	0.2							0.3	0.5	0.1	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	582		428	444	698	490	560	548	755						1,000	563	755	428	8	0
2	TDS	mg/L	256		301	202	332	382	225	215	240						200	269	382	202	8	8
3	TSS	mg/L	25		38	800	15	23	170	15	20						-	138	800	15	8	0
4	Turbidity	NTU	146		207	376	41	34	159	5	25						-	124	376	5	8	0
5	Temperature	℃	26		28	28	27	27	27	27	27						Normal Temp.	27	28	26	8	
6	Color	Pt-Co Scale								73	70						-	72	73	70	2	0
7	DO	mg/L	0.0		0.7	2.30	0.0	1.7	0.55	0.00	0.0						3.0	0.7	2.3	0.0	7	7
8	pH	-	7.3		6.5	7.5	8.0	7.6	6.1	7.4	7.5						6.0-8.5	7.2	8.0	6.1	8	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L															0.005	-	-	0.000	0	0
11	Fe	mg/L			0.8	0.0	1.0	0.3	1.1	0.9	0.9						-	0.7	1.1	0.0	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L					0.06	0.03	0.47	0.02	0.03						1.0	0.12	0.47	0.02	5	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.71	0.03	0.64	0.44	0.72	0.86	0.71						-	0.59	0.86	0.03	7	
20	NH_3	mg/L	10.73		9.18	6.62	16.07	22.32	4.08		4.76						-	10.54	22.32	4.08	7	0
21	F	mg/L	0.47		0.59			0.48	0.56		0.18						-	0.46	0.59	0.18	5	0
22	Cl^-	mg/L			55	277	58	34			58						-	96	277	34	5	0
23	Cl_2	mg/L							43		0.9						-	22.08	43.25	0.92	2	
24	NO_3	mg/L	0.26		0.19	0.86	0.15	0.44	2.17		0.90						-	0.71	2.17	0.15	7	0
25	NO_2	mg/L			0.01	0.09	0.04	0.06	0.02		0.01						-	0.04	0.09	0.01	6	0
	T-N	mg/L	10.99		9.38	7.57	16.26	22.82	6.27		5.67						-	11.28	22.82	5.67	7	0
26	PO_4	mg/L	1.44		3.03	0.24	1.20	0.57	0.67	0.86	1.76						0.50	1.22	3.03	0.24	8	7
27	SO_4	mg/L			19	43	8	60	49	16	15						100	30	60	8	7	0
28	H_2S	mg/L	0.19		0.47	0.24	0.49	0.20	0.52		3.93						-	0.86	3.93	0.19	7	0
29	Phenol	mg/L			0.01		0.01	0.02	0.02								-	0.02	0.02	0.01	4	0
30	Oil and Grease	mg/L			0.65	0.16	0.26	0.16	0.34	0.09	0.35						<0	0.29	0.65	0.09	7	0
31	Active Substance	mg/L			3.89	0.13	0.28	1.03	0.21	1.94	0.24						0.50	1.10	3.89	0.13	7	3
32	COD_{Mn}	mg/L	47		60	45	42	32	87	25	45						25.0	48	87	25	8	8
33	BOD	mg/L	20		39	26	23	16	63	20	37						20.0	31	63	16	8	6
34	COD_{Cr}	mg/L	72		80	74	73	66	117	34	85						30.0	75	117	34	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	140		140	220	35	11	2100	11	1300						0.02	494.625	2100	11	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	110		49	3.3	11	0.35	140	2.8	94						0.004	51.3063	140	0.35	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (54/67)

Sampling Place 36A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.2					9.6	1.5	1.3	0.7	17.6				0.9		4.5	17.6	0.2	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	452		372	980	681	519	380	420	568	542	638	602	466		1,000	552	980	372	12	0
2	TDS	mg/L	253		261	422	320	484	159	168	184	411	296	171	238		200	281	484	159	12	8
3	TSS	mg/L	22		480	70	159	42	790	18	33	209	35	8	16		-	157	790	8	12	0
4	Turbidity	NTU	1,000		999	180	463	44	450	5	34	352	11	71	27		-	303	1,000	5	12	0
5	Temperature	℃	27		29	28	27	27	27	28	28	31	30	28	28		Normal Temp.	28	31	27	12	
6	Color	Pt-Co Scale								25	42						-	34	42	25	2	0
7	DO	mg/L	0.0		1.0	0.50	0.2	2.6	4.60	1.08	1.1	0.9	0.6	0	1.7		3.0	1.2	4.6	0.0	12	11
8	pH	-	7.0		6.8	7.0	8.1	8.0	7.0	7.3	7.7	7.7	7.1	7.4	7.2		6.0-8.5	7.4	8.1	6.8	12	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0		0.005	0.000	-	0.000	2	0
11	Fe	mg/L			0.2	0.2	0.2	0.1	0.5	0.8	0.4	1.2	0.8	0.6	0.9		-	0.5	1.2	0.1	11	0
12	Cd	mg/L												0	0		0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L												0	0		-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L			0.02	0.01	37.90	0.03	0.81	0.01	0.05	0.02	0.04	0.01	0.02		1.0	3.54	37.90	0.01	11	1
17	Cu	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
18	Pb	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.27	0.50	0.89	0.28	0.08	0.80	0.54	0.63	0.73	0.66	0.66		-	0.55	0.89	0.08	11	
20	NH_3	mg/L	3.82		6.39	13.35	18.36	4.44	3.20		5.69	4.51	11.84	17.17	7.85		-	8.78	18.36	3.20	11	0
21	F	mg/L	0.20			0.68		0.10				0.42					-	0.35	0.68	0.10	4	0
22	Cl^-	mg/L			58	259	67	43			29	53	48	53	36		-	72	259	29	9	0
23	Cl_2	mg/L							24		0.1						-	12.05	24.03	0.06	2	
24	NO_3	mg/L	0.22		0.17	0.11	0.18	1.02	3.09		1.35	0.24	0.21	0			-	0.68	3.09	0.11	10	0
25	NO_2	mg/L				0.06	0.04	0.29	0.03		0.11	0.01	0.01	0.03	0.01		-	0.06	0.29	0.01	9	0
	T-N	mg/L	4.04		6.56	13.52	18.58	5.75	6.32		7.15	4.76	12.06	17.38	7.86		-	9.45	18.58	4.04	11	0
26	PO_4	mg/L	0.32		0.69	0.98	1.13	0.18	0.18	0.33	0.59	0.98	1.54	0.63	0.64		0.50	0.68	1.54	0.18	12	8
27	SO_4	mg/L			47	61	35	84	59	24	53	26	17	12	23		100	40	84	12	11	0
28	H_2S	mg/L	0.52		0.75	0.47	0.15	0.10	0.37		1.73	0.70	0.56	0.39	0.40		-	0.56	1.73	0.10	11	0
29	Phenol	mg/L	0.01		0.01		0.02	0.02	0.02			0.02	0.09	0	0.04		-	0.03	0.09	0.00	9	0
30	Oil and Grease	mg/L			0.26	0.11	0.19	0.11	0.12	0.08	0.22	0.03		0.19			<0	0.15	0.26	0.03	9	0
31	Active Substance	mg/L			0.20	2.57	0.13	0.50	0.20	0.15	2.89	0.06	2.45	0.10	0.15		0.50	0.86	2.89	0.06	11	4
32	COD_{Mn}	mg/L	70		69	41	86	26	62	24	27	46	43	93	39		25.0	52	93	24	12	11
33	BOD	mg/L	32		32	33	54	17	48	20	18	43	40	72	34		20.0	37	72	17	12	9
34	COD_{Cr}	mg/L	82		76	54	121	51	91	27	50	72	57	125	45		30.0	71	125	27	12	11
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	170		33	1600	7.9	170	17	22	35	160	280	3.5	170		0.02	222.367	1600	3.5	12	12
36	Fecal Coliforms	$\times 10^6$No./100mL	110		7	17	4.9	33	1.4	1.7	35	5.8	2.2	1.1	1.7		0.004	18.4	110	1.1	12	12

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (55/67)

Sampling Place 37 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	7.3	0.0				2.5	2.6	2.1	2.3	6.7				0.7		3.0	7.3	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	680	778	727	5,630	1,060	580	649	629	905	420	519	985	474		1,000	1,080	5,630	420	13	2
2	TDS	mg/L	325	348	373	2,600	493	435	235	256	305	175	237	226	238		200	480	2,600	175	13	12
3	TSS	mg/L	100	46	104	25	40	35	27	20	130	25	39	17	18		-	48	130	17	13	0
4	Turbidity	NTU	8	209	181	10	244	35	29	32	4	8	8	28	33		-	63	244	4	13	0
5	Temperature	℃	26	29	27	30	27	27	27	27	27	29	30	28	28		Normal Temp.	28	30	26	13	
6	Color	Pt-Co Scale								70	130						-	100	130	70	2	0
7	DO	mg/L	6.5	0.4	0.00	0.10	0.3	6.2	4.16	0.00	0.0	0.2		0	1.4		3.0	1.9	6.5	0.0	10	7
8	pH	-	7.0	7.1	7.1	7.6	8.2	7.6	7.1	6.5	7.8	7.6	6.6	7.6	7.4		6.0-8.5	7.3	8.2	6.5	13	0
9	Salinity										0.04						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0		0.005	0.000	-	0.000	2	0
11	Fe	mg/L		8.9	0.6	0.1	0.2	1.2	1.2	0.8	0.2	1.3	1.0	0.7	0.8		-	1.4	8.9	0.1	12	0
12	Cd	mg/L												0	0		0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L												0	0		-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L			0.02		0.13	0.06	0.10	0.02	0.02	0.01	0.04	0.12	0.01		1.0	0.05	0.13	0.01	10	0
17	Cu	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
18	Pb	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.67	0.57	0.22	0.39	0.51	0.69	0.14	0.82	0.75	0.59	0.61		-	0.54	0.82	0.14	11	
20	NH_3	mg/L	14.03		14.78	10.89	28.29	7.62	7.04		5.09	6.53	15.35	15.04	5.84		-	11.86	28.29	5.09	11	0
21	F	mg/L	0.31			0.31			0.21			0.14					-	0.24	0.31	0.14	4	0
22	Cl^-	mg/L			77	1,255	87	48			48	34	43	92	46		-	192	1,255	34	9	0
23	Cl_2	mg/L							48		1.1			0.01			-	16.38	48.06	0.01	3	
24	NO_3	mg/L	0.66	0.08	0.18	0.08	0.17	0.58	0.19		0.31	0.20		0			-	0.26	0.66	0.08	10	0
25	NO_2	mg/L		0.03	0.05		0.04	0.34			0.01	0.02	0.02	0.04	0.01		-	0.06	0.34	0.01	9	0
	T-N	mg/L	14.69		15.01	10.97	28.50	8.54	7.23		5.40	6.75	15.37	15.25	5.85		-	12.14	28.50	5.40	11	0
26	PO_4	mg/L	1.23	1.85	1.90	0.90	2.88	0.45	0.66	0.80	0.88	0.32	0.54	0.94	0.46		0.50	1.06	2.88	0.32	13	10
27	SO_4	mg/L			49	472	193	56	62	36	75	44	40	88	37		100	105	472	36	11	2
28	H_2S	mg/L	0.39	4.44	4.77	0.45	0.19	0.27	0.34		0.48	0.29	0.68	6.14	0.70		-	1.60	6.14	0.19	12	0
29	Phenol	mg/L	0.01	0.02	0.01		0.01	0.02	0.02			0.02	0.08	0.13	0.04		-	0.04	0.13	0.01	10	0
30	Oil and Grease	mg/L			0.72	0.09	1.68	0.25	0.28	0.04	1.21	0.84	0.02	0.69	0.03		<0	0.53	1.68	0.02	11	0
31	Active Substance	mg/L		2.40	1.87	2.43	0.50	0.68	0.32	1.67	0.79	0.01	1.02	0.12	0.19		0.50	1.00	2.43	0.01	12	8
32	COD_{Mn}	mg/L	52	80	100	43	72	39	45	44	83	36	39	102	24		25.0	58	102	24	13	12
33	BOD	mg/L	25	66	89	42	51	32	30	34	63	29	31	93	19		20.0	46	93	19	13	12
34	COD_{Cr}	mg/L	89	109	154	114	117	49	72	61	141	38	45	125	59		30.0	90	154	38	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	3000	1700	220	3.5	12	1.7	70	220	540	0.7	17	280	280		0.02	488.069	3000	0.7	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	1700	300	22	3.5	9.4	0.7	7	7	170	4.6	7.9	2.2	70		0.004	177.254	1700	0.7	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (56/67)

Sampling Place 38 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.0	10.4	1.4	0.0	21.4				0.0		4.2	21.4	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	2,550	2,820	6,090	46,700	17,500	1,900	2,310	4,545	11,400	811	4,070	7,415	1,130		1,000	8,403	46,700	811	13	12
2	TDS	mg/L	1,205	1,265	3,140	24,600	8,350	1,799	840	1,933	3,940	332	1,861	1,975	743		200	3,999	24,600	332	13	13
3	TSS	mg/L	43	42	45	15	20	115	28	15	25	32	63	28	20		-	38	115	15	13	0
4	Turbidity	NTU	30	178	36	22	120	124	129	29	121	10	6	24	40		-	67	178	6	13	0
5	Temperature	℃	31	30	31	30	29	27	29	30	29	30	32	31	30		Normal Temp.	30	32	27	13	
6	Color	Pt-Co Scale								55	163						-	109	163	55	2	0
7	DO	mg/L	5.4	0.5	0.3	2.90	0.7	6.9	4.44	0.00		0.1		0			3.0	2.4	6.9	0.0	9	6
8	pH	-	7.0	7.5	7.2	7.9	8.1	8.3	7.7	6.6	7.6	7.9	7.1	7.3	6.9		6.0-8.5	7.5	8.3	6.6	13	0
9	Salinity										0.65						-	1	1	1	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0		0.005	0.000	-	0.000	2	0
11	Fe	mg/L		7.3	0.6		0.3	1.3	1.2	0.7	0.3	1.5	0.8	0.5	1.3		-	1.4	7.3	0.3	11	0
12	Cd	mg/L												0	0		0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L												0	0		-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L			0.02		0.07	0.17	0.13	0.03	0.11	0.03	0.05	0.09	0.09		1.0	0.08	0.17	0.02	10	0
17	Cu	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
18	Pb	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.71	0.03	0.46	0.31	0.52	0.57	0.58	0.68	0.91	0.65	0.63		-	0.55	0.91	0.03	11	
20	NH_3	mg/L	9.38		7.48	0.52	0.73	5.85	4.09		5.66	3.33	6.52	14.04	5.85		-	5.77	14.04	0.52	11	0
21	F	mg/L	0.55		0.98	1.36	0.32		0.51		0.14	0.08					-	0.56	1.36	0.08	7	0
22	Cl^-	mg/L			1,739	13,400	356	399			1,250	139	1,105	1,495	193		-	2,231	13,400	139	9	0
23	Cl_2	mg/L							961		0.6						-	480.90	961.20	0.60	2	
24	NO_3	mg/L	0.39	0.10	0.10	0.23	0.03	0.23	0.13		0.24	0.20		0			-	0.18	0.39	0.03	10	0
25	NO_2	mg/L		0.02	0.05	0.02	0.01				0.01	0.01	0.01	0.03	0.01		-	0.02	0.05	0.01	9	0
	T-N	mg/L	9.76		7.63	0.77	0.77	6.08	4.22		5.91	3.54	6.53	14.24	5.86		-	5.94	14.24	0.77	11	0
26	PO_4	mg/L	1.86	1.63	2.78	0.08	1.40	0.46	0.55	0.99	0.79	0.29	0.61	1.47	0.59		0.50	1.04	2.78	0.08	13	10
27	SO_4	mg/L			312	1,929	79	124	154	91	433	42	193	394	13		100	342	1,929	13	11	7
28	H_2S	mg/L	11.22	1.23	0.71	0.06	6.41	0.24	0.72		0.28	0.74	5.34	44.20	1.42		-	6.05	44.20	0.06	12	0
29	Phenol	mg/L	0.02	0.02	0.01				0.02			0.01	0.17	0.05	0		-	0.04	0.17	0.00	8	0
30	Oil and Grease	mg/L			0.17	0.13	1.25	0.19	0.25	0.05	0.87	0.35		0.33			<0	0.40	1.25	0.05	9	0
31	Active Substance	mg/L	1.29	2.43	2.78	0.09	0.32	0.92	0.54	0.97	0.11	0.03	1.10	0.08	1.48		0.50	0.93	2.78	0.03	13	8
32	COD_{Mn}	mg/L	97	36	61	31	41	38	35	60	72	39	57	94	35		25.0	54	97	31	13	13
33	BOD	mg/L	75	21	55	27	29	27	30	26	66	35	51	78	26		20.0	42	78	21	13	13
34	COD_{Cr}	mg/L	110	79	137	85	83	70	57	88	81	78	82	151	51		30.0	89	151	51	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	160	22	280	0.094	0.46	9.2	16	13	1.4	1.7	140	220	2800		0.02	281.835	2800	0.094	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	22	17	170	0.024	0.46	1.4	2.2	1.7	1.4	3.3	9.4	90	3500		0.004	293.76	3500	0.024	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (57/67)

Sampling Place 38A Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.4	0.0	0.0	0.0							0.1	0.4	0.0	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	12,250	49,450	37,100	750	53,050	52,200	48,800	15,500	39,250						1,000	34,261	53,050	750	9	8
2	TDS	mg/L	6,490	27,000	16,200	410	29,000	9,500	11,600	5,650	993						200	11,871	29,000	410	9	9
3	TSS	mg/L	25	12	15	477	21	18	20	35	20						-	71	477	12	9	0
4	Turbidity	NTU	40	39	22	378	74	8	5	37	82						-	76	378	5	9	0
5	Temperature	℃	29	32	30	28	29	30	29	30	30						Normal Temp.	30	32	28	9	
6	Color	Pt-Co Scale								51	40						-	46	51	40	2	0
7	DO	mg/L	6.0	2.5	2.4	0.50	1.6	6.3	4.76	0.04	0.6						3.0	2.7	6.3	0.0	9	6
8	pH	-	6.9	6.9	7.2	7.3	8.0	8.0	7.0	5.9	8.0						6.0-8.5	7.2	8.0	5.9	9	0
9	Salinity										2.52						-	3	3	3	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001						0.005	0.001	0.001	0.001	1	1
11	Fe	mg/L		0.4	0.1	0.1	0.1	0.2	0.2	0.5	0.2						-	0.2	0.5	0.1	8	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	#DIV/0!	0.000	0.000	0	0
16	Zn	mg/L			0.04	0.01	0.05	0.08	0.46	0.02	0.03						1.0	0.10	0.46	0.01	7	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.12	0.40	0.03	0.01	0.11	0.50	0.47						-	0.23	0.50	0.01	7	
20	NH_3	mg/L	1.93		1.55	12.23	15.20	0.48	0.85		1.43						-	4.81	15.20	0.48	7	0
21	F	mg/L	0.51		0.63		1.53	2.16	1.45		0.57						-	1.14	2.16	0.51	6	0
22	Cl^-	mg/L			3,846	60	375	18,864			6,536						-	5,936	18,864	60	5	0
23	Cl_2	mg/L							87,710								-	########	########	########	1	
24	NO_3	mg/L	0.26		0.08	0.39	0.06	0.08	0.25		0.11						-	0.18	0.39	0.06	7	0
25	NO_2	mg/L		0.03	0.01	0.05	0.01	0.03	0.08		0.01						-	0.03	0.08	0.01	7	0
	T-N	mg/L	2.19		1.64	12.67	15.27	0.59	1.18		1.55						-	5.01	15.27	0.59	7	0
26	PO_4	mg/L	0.61	0.57	0.09	1.11	0.11	0.09	0.17	0.16	0.18						0.50	0.34	1.11	0.09	9	3
27	SO_4	mg/L			1,395	37	15	77	3,034	557	525						100	806	3,034	15	7	4
28	H_2S	mg/L	0.09	0.06	0.11	0.99	3.08	0.06	0.09		1.70						-	0.77	3.08	0.06	8	0
29	Phenol	mg/L	0.01	0.02	0.01	0.02		0.02	0.02								-	0.02	0.02	0.01	6	0
30	Oil and Grease	mg/L			0.09	0.12	0.08	0.12	0.04	0.08	0.16						<0	0.10	0.16	0.04	7	0
31	Active Substance	mg/L	1.48	0.16	0.11	1.76	0.05	0.07	0.30	0.14	1.61						0.50	0.63	1.76	0.05	9	3
32	COD_{Mn}	mg/L	29	84	59	282	81	15	62	54	49						25.0	79	282	15	9	8
33	BOD	mg/L	22	58	37	120	34	5	14	11	22						20.0	36	120	5	9	6
34	COD_{Cr}	mg/L	49	107	68	479	116	48	74	67	51						30.0	118	479	48	9	9
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.24	0.0024	0.0049	24	0.013	0.0022	0.046	1.4	0.0013						0.02	2.8566444	24	0.0013	9	4
36	Fecal Coliforms	$\times 10^6$No./100mL	0.05	0.0024	0.0033	13	0.00035	0.00094	0.046	0.11	0.00023						0.004	1.4681356	13	0.00023	9	4

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (58/67)

Sampling Place 39 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.4					1.0	0.6	0.6	0.5	0.5				0.4		0.6	1.0	0.4	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	723		462	1,355	874	731	660	711	277	687	930	789	707		1,000	742	1,355	277	12	1
2	TDS	mg/L	352		318	612	435	531	272	309	240	364	415	238	345		200	369	612	238	12	12
3	TSS	mg/L	56		50	155	45	66	15	40	37	57	66	9	48		-	54	155	9	12	0
4	Turbidity	NTU	272		257	106	76	87	49	17	38	165	56	43	35		-	100	272	17	12	0
5	Temperature	℃	29		30	29	31	30	30	31	29	25	31	29	30		Normal Temp.	30	31	25	12	
6	Color	Pt-Co Scale								138	280						-	209	280	138	2	0
7	DO	mg/L	0.0		1.0	0.40	0.1	0.5	0.05	0.00	0.6	0		0			3.0	0.3	1.0	0.0	9	9
8	pH	-	7.4		6.9	8.4	7.8	7.8	6.3	7.4	7.5	7.2	7.9	7.2	6.8		6.0-8.5	7.4	8.4	6.3	12	0
9	Salinity										0.01						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001			0	0		0.005	0.000	0.001	0.000	3	1
11	Fe	mg/L			0.3	0.5	0.3	0.1	0.8	0.5	0.1	0.4	0.3	0.4	0.4		-	0.4	0.8	0.1	11	0
12	Cd	mg/L												0	0.03		0.010	0.015	0.030	0.000	2	1
13	Cr	mg/L												0	0		-	0.000	0.000	0.000	2	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L				0.06	0.04	0.02	0.92	0.04	0.05	0.01	0.04	0.08	0.02		1.0	0.13	0.92	0.01	10	0
17	Cu	mg/L												0	0.03		0.10	0.015	0.030	0.000	2	0
18	Pb	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			0.38	0.38	0.47	0.37	0.55	0.56	0.55	0.58	0.55	0.55	0.60		-	0.50	0.60	0.37	11	
20	NH_3	mg/L	11.58		11.75	12.79	19.55	12.48	0.29		5.27	9.99	17.55	21.46	16.59		-	12.66	21.46	0.29	11	0
21	F	mg/L	0.58								0.29	1.06					-	0.64	1.06	0.29	3	0
22	Cl^-	mg/L			57	306	67	58			183	62	77	82	68		-	107	306	57	9	0
23	Cl_2	mg/L							77		0.9			0.01			-	25.93	76.89	0.01	3	
24	NO_3	mg/L	0.14		0.18	0.22	0.15	0.17	3.90		0.11	0.21		0			-	0.60	3.90	0.11	9	0
25	NO_2	mg/L			0.01	0.03	0.05	0.05	0.01			0.01	0.04	0.05	0.01		-	0.03	0.05	0.01	9	0
	T-N	mg/L	11.72		11.94	13.04	19.75	12.70	4.20		5.38	10.21	17.59	21.79	16.60		-	13.17	21.79	4.20	11	0
26	PO_4	mg/L	1.71		0.94	0.97	2.25	2.06	1.73	1.28	1.62	2.31	2.15	1.39	1.70		0.50	1.68	2.31	0.94	12	12
27	SO_4	mg/L			54	48	199	91	62	36	41	44	50	24	42		100	63	199	24	11	1
28	H_2S	mg/L	17.49		2.57	3.76	5.29	0.32	0.40		7.37	0.84	1.07	1.76	1.19		-	3.82	17.49	0.32	11	0
29	Phenol	mg/L	0.02		0.01	0.01	0.01	0.02				0.02	0.06	0.01	0.04		-	0.02	0.06	0.01	9	0
30	Oil and Grease	mg/L			0.37	0.09	0.88	0.51	0.48	0.23	1.09	0.16	0.51	0.39	0.01		<0	0.43	1.09	0.01	11	0
31	Active Substance	mg/L	1.67		3.41	1.89	0.48	1.82	0.04	2.86	0.23	0.05	2.06	0.09	0.17		0.50	1.23	3.41	0.04	12	6
32	COD_{Mn}	mg/L	82		60	72	85	74	71	73	61	82	165	99	64		25.0	82	165	60	12	12
33	BOD	mg/L	40		36	157	70	57	52	30	26	81	142	68	55		20.0	68	157	26	12	12
34	COD_{Cr}	mg/L	122		98	446	112	107	138	85	87	161	178	176	102		30.0	151	446	85	12	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	360		16000	280	540	7	46	140	280	2.4	2800	35	28000		0.02	4040.87	28000	2.4	12	12
36	Fecal Coliforms	$\times 10^6$No./100mL	360		1200	17	76	0.7	46	3.5	280	2.4	140	7	22000		0.004	2011.05	22000	0.7	12	12

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (59/67)

Sampling Place 40 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.7					0.7	1.3	1.2	1.2	0.8				0.3		0.9	1.3	0.3	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	910		665	1,355	1,610	1,160	820	1,715	1,670	1,380	1,265	1,460	1,330	1,330	1,000	1,282	1,715	665	13	10
2	TDS	mg/L	408		454	612	769	816	326	706	328	614	564	363	695	731	200	568	816	326	13	13
3	TSS	mg/L	47		55	155	76	35	388	160	83	76	209	34	51	69	-	111	388	34	13	0
4	Turbidity	NTU	289		225	106	57	48	160	24	40	166	42	52	82	201	-	115	289	24	13	0
5	Temperature	℃	29		30	29	32	29	30	31	31	29	30	28	27	29	Normal Temp.	29	32	27	13	
6	Color	Pt-Co Scale								340	290						-	315	340	290	2	0
7	DO	mg/L	2.0		0.9	0.40	0.2	0.3		0.00	0.3	0.6		0.2			3.0	0.6	2.0	0.2	8	8
8	pH	-	8.1		6.4	8.4	7.4	8.1	6.2	7.3	8.4	6.5	7.5	7.4	8.8	7.9	6.0-8.5	7.6	8.8	6.2	13	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001			0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L			0.5	0.5	1.0	0.4	0.1	1.1	1.7	0.6	0.4	0.6	1.7	1.6	-	0.9	1.7	0.1	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L											0.04	0	0	0	-	0.010	0.040	0.000	4	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L										0.01		0.12	0	0.06	0.10	0.048	0.120	0.000	4	1
16	Zn	mg/L			0.09	0.06	0.04	0.04	3.18	0.06	0.11	0.04	0.04	0.03	0.11	0.06	1.0	0.32	3.18	0.03	12	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.41	0.38	0.40		0.40	0.54	0.52	0.51	0.31	0.38	0.66	0.48	-	0.45	0.66	0.31	11	
20	NH_3	mg/L	11.08		11.00	12.79	18.93	5.29	7.78		5.52	13.63	10.99	15.20	10.27	12.61	-	11.26	18.93	5.29	12	0
21	F	mg/L	0.93		0.97				0.42		1.91		0.47			0.37	-	0.84	1.91	0.37	6	0
22	Cl^-	mg/L			47	306	34	137			111	135	125	260	116	207	-	148	306	34	10	0
23	Cl_2	mg/L							96		1.0					0.01	-	32.36	96.12	0.01	3	
24	NO_3	mg/L	0.26		0.24	0.22	0.21	0.16	0.24		0.15	0.24	0.21	0			-	0.20	0.26	0.08	10	0
25	NO_2	mg/L			0.01	0.03	0.03	0.04	0.01		0.01	0.01	0.01	0.02	0.01	0.03	-	0.02	0.04	0.01	11	0
	T-N	mg/L	11.34		11.25	13.04	19.17	5.49	8.03		5.68	13.88	11.21	15.30	10.28	12.64	-	11.44	19.17	5.49	12	0
26	PO_4	mg/L	1.92		1.56	0.97	0.80	1.17	0.75	0.23	4.14	0.12	0.80	0.83	1.48	0.70	0.50	1.19	4.14	0.12	13	11
27	SO_4	mg/L			73	48	364	195	116	51	224	168	133	186	224	280	100	172	364	48	12	9
28	H_2S	mg/L	7.10		0.72	3.76	2.39	0.32	0.46		0.56	1.60	3.16	2.96	1.64	3.24	-	2.33	7.10	0.32	12	0
29	Phenol	mg/L	0.01		0.01	0.01	0.01	0.02	0.02			0.02	0.15	0.03	0.06	0.25	-	0.05	0.25	0.01	11	0
30	Oil and Grease	mg/L			0.56	0.09	1.87	0.52	1.42	0.25	0.41	0.21	0.86	0.11		0	<0	0.58	1.87	0.04	11	0
31	Active Substance	mg/L	2.39		1.66	1.89	0.40	1.14	0.19	0.98	0.35	0.10	1.38	0.32	0.18	1.45	0.50	0.96	2.39	0.10	13	7
32	COD_{Mn}	mg/L	128		64	72	64	55	91	257	99	70	90	106	65	52	25.0	93	257	52	13	13
33	BOD	mg/L	114		51	157	51	39	72	137	79	64	83	95	51	47	20.0	80	157	39	13	13
34	COD_{Cr}	mg/L	140		78	446	94	69	158	673	133	128	151	117	109	114	30.0	186	673	69	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	2.4		160	280	28	23	920	13	140	0.33	2.2	350	28	140	0.02	160.533	920	0.33	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	2.4		28	17	1.7	2.8	63	3.3	14	0.11	0.7	350	14	2.2	0.004	38.4008	350	0.11	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (60/67)

Sampling Place 41 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.3	0.6				0.0	0.1	0.7	0.7	0.4				0.4		0.4	0.7	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	154	115	178	170	222	167	167	189	227	183	202	162	240	168	1,000	182	240	115	14	0
2	TDS	mg/L	84	163	76	78	101	114	62	74	80	85	103	48	129	84	200	91	163	48	14	0
3	TSS	mg/L	38	49	38	36	28	39	120	50	18	49	33	34	21	20	-	41	120	18	14	0
4	Turbidity	NTU	49	29	8	25	9	32	57	24	76	23	56	244	30	7	-	48	244	7	14	0
5	Temperature	℃	30	30	31	29	30	29	28	30	30	31	30	29	28	29	Normal Temp.	29	31	28	14	
6	Color	Pt-Co Scale								35	30						-	33	35	30	2	0
7	DO	mg/L	2.2	1.1	2.4	3.50	3.7	1.2	1.44	1.50	0.5	1.4	2.4	1.5	2.8	1.9	3.0	2.0	3.7	0.5	14	12
8	pH	-	8.1	5.9	6.6	6.7	6.8	7.1	6.6	6.1	7.3	7.5	6.4	6.6	8.1	7.4	6.0-8.5	6.9	8.1	5.9	14	0
9	Salinity										0.00						-	-	-	-	0	1
II	**Chemical**																					
10	Hg	mg/L									0.001			0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L		11.2	0.3	0.5	0.6	0.8	0.5	0.7	0.9	0.7	0.7	0.7	1.2	1.0	-	1.5	11.2	0.3	13	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.02	0.01	0.04	0.08	0.08	0.02	0.33	0.02	0.04	0.07	0.15	0.04	1.0	0.08	0.33	0.01	12	0
17	Cu	mg/L				0.57								0	0.04	0	0.10	0.153	0.570	0.000	4	1
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.17	7.20	0.16	0.11		0.16	0.31	0.16	0.31	0.25	0.24	0.20	-	0.84	7.20	0.11	11	
20	NH_3	mg/L	0.34		0.74	1.17	0.83	1.00	0.92		1.34	1.44	2.77	1.25	1.59	1.37	-	1.23	2.77	0.34	12	0
21	F	mg/L	0.07					0.42					0.06			0.98	-	0.38	0.98	0.06	4	0
22	Cl^-	mg/L			19	60	19	38			38	10	19	14	10	87	-	31	87	10	10	0
23	Cl_2	mg/L							14		0.4						-	7.39	14.42	0.35	2	
24	NO_3	mg/L	0.33	1.15	0.84	0.96	0.84	0.92	2.30		0.20	0.88	0.08	1	1	0.67	-	0.81	2.30	0.08	13	0
25	NO_2	mg/L		0.12	0.06	0.06	0.03		0.18		0.01	0.09	0.06	0.02	0.05	0.05	-	0.07	0.18	0.01	11	0
	T-N	mg/L	0.66		1.64	2.19	1.70	1.92	3.40		1.55	2.41	2.91	1.90	2.33	2.09	-	2.06	3.40	0.66	12	0
26	PO_4	mg/L	0.10	0.32	0.04	0.04	0.15	0.07	0.04	0.11	0.11	0.10	0.06	0.06	0.17	0.08	0.50	0.10	0.32	0.04	14	0
27	SO_4	mg/L			29	39	116	12	32	23	32	18	79	31	25	24	100	38	116	12	12	1
28	H_2S	mg/L	0.26	0.22	0.15	0.22	0.17	0.13	0.28		2.26	0.34	0.32	0.48	0.31	0.10	-	0.40	2.26	0.10	13	0
29	Phenol	mg/L	0.01	0.02	0.01		0.01	0.02	0.03			0.02	0.03	0	0.04	0.08	-	0.02	0.08	0.00	11	0
30	Oil and Grease	mg/L			0.05	0.13	0.16	0.19	0.02	0.05	0.11	0.21	0.06		0.03	0	<0	0.10	0.21	0.02	11	0
31	Active Substance	mg/L		0.41	0.07	2.26	0.09	0.25	0.04	0.12	0.23	0.03	0.12	0.10	0.10	0.05	0.50	0.30	2.26	0.03	13	1
32	COD_{Mn}	mg/L	19	11	17	14	16	13	28	21	18	22	22	31	22	21	25.0	20	31	11	14	2
33	BOD	mg/L	11	5	15	4	7	7	17	13	12	15	14	20	13	19	20.0	12	20	4	14	1
34	COD_{Cr}	mg/L	31	20	32	19	33	23	45	27	28	56	32	77	34	39	30.0	35	77	19	14	9
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.00022	0.7	0.7		0.04	0.46	0.13	3.1	0.023	1.7	2.2	2.2	280	0.7	0.02	22.4579	280	0.00022	13	12
36	Fecal Coliforms	$\times 10^6$No./100mL	0.00017	0.17	0.7		0.04	0.079	0.033	2.3	0.023	1.4	0.23	2.2	110	0.5	0.004	9.05194	110	0.00017	13	12

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (61/67)

Sampling Place 42 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0	0.0				0.1	0.0	1.8	0.0	0.0				70.0		9.0	70.0	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	2,050	1,790	2,270	1,710	2,470	2,260	1,410	1,470	1,860	2,140	2,340	1,560	1,420		1,000	1,904	2,470	1,410	13	13
2	TDS	mg/L	84	768	1,157	752	1,228	1,567	535	600	350	953	1,265	511	745		200	809	1,567	84	13	12
3	TSS	mg/L	38	50	24	31	25	43	47	35	35	104	63	26	47		-	44	104	24	13	0
4	Turbidity	NTU	46	26	11	34	52	25	44	31	152	11	67	165	73		-	57	165	11	13	0
5	Temperature	℃	30	30	31	28	30	29	28	31	30	32	32	30	30		Normal Temp.	30	32	28	13	
6	Color	Pt-Co Scale								115	168						-	142	168	115	2	0
7	DO	mg/L	0.0	0.0	0.1	0.60	0.1	0.1	0.47	0.00	0.0	0		0			3.0	0.2	0.6	0.0	10	10
8	pH	-	6.9	6.7	7.0	7.6	7.7	7.6	7.0	6.8	7.5	7.3	7.7	7.3	8.4		6.0-8.5	7.3	8.4	6.7	13	0
9	Salinity										0.08						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001			0	0		0.005	0.000	0.001	0.000	3	1
11	Fe	mg/L		0.7	0.4	0.3	0.4	0.7	1.1	0.7	0.5	0.5	0.5	0.6	1.1		-	0.6	1.1	0.3	12	0
12	Cd	mg/L												0	0		0.010	0.000	0.000	0.000	2	0
13	Cr	mg/L										0.13	0.03	0	0		-	0.040	0.130	0.000	4	1
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L						0.03						0	0		0.10	0.010	0.030	0.000	3	0
16	Zn	mg/L			0.32	1.78	0.04	0.23	0.68	0.22	0.61	1.31	0.52	0.40	0.38		1.0	0.59	1.78	0.04	11	2
17	Cu	mg/L						0.01						0	0		0.10	0.003	0.010	0.000	3	0
18	Pb	mg/L												0	0		0.10	0.000	0.000	0.000	2	0
19	Mg	mg/L			1.08	0.19	0.77	0.73	0.88	0.69	0.81	0.72	0.86	0.86	0.71		-	0.75	1.08	0.19	11	
20	NH_3	mg/L	14.15		12.03	4.99	21.59	7.78	21.66		15.18	30.37	13.27	14.48	7.75		-	14.84	30.37	4.99	11	0
21	F	mg/L	0.23		0.55	0.11						0.67					-	0.39	0.67	0.11	4	0
22	Cl^-	mg/L			48	13	34	440			221	332	365	318	188		-	218	440	13	9	0
23	Cl_2	mg/L							211		1.2			0.01			-	70.89	211.46	0.01	3	
24	NO_3	mg/L	0.99	0.30	0.19	0.13	0.31	0.14	1.97		0.16	0.16	0.04	0			-	0.42	1.97	0.04	11	0
25	NO_2	mg/L		0.03	0.05	0.03	0.04	0.04	0.02		0.04	0.01	0.02	0.04	0.01		-	0.03	0.05	0.01	11	0
	T-N	mg/L	15.14		12.27	5.15	21.94	7.96	23.64		15.37	30.54	13.33	14.72	7.76		-	15.26	30.54	5.15	11	0
26	PO_4	mg/L	1.75	2.64	3.10	0.61	1.73	1.68	0.82	0.54	1.36	1.49	1.81	1.35	0.70		0.50	1.51	3.10	0.54	13	13
27	SO_4	mg/L			166	185	409	251	197	153	169	155	219	195	144		100	204	409	144	11	11
28	H_2S	mg/L	35.39	27.92	5.51	1.46	11.58	0.24	0.45		0.15	8.05	9.55	23.00	3.94		-	10.60	35.39	0.15	12	0
29	Phenol	mg/L	0.03	0.01	0.01			0.02	0.02			0.02	0.09	0.04	0.04		-	0.03	0.09	0.01	9	0
30	Oil and Grease	mg/L			0.37	0.09	1.70	0.31	0.53	0.59	0.62	0.24		0.83	0.16		<0	0.54	1.70	0.09	10	0
31	Active Substance	mg/L		2.06	1.89	0.13	0.33	1.79	0.31	1.72	1.69	0.57	1.01	0.97	1.01		0.50	1.12	2.06	0.13	12	9
32	COD_{Mn}	mg/L	105	47	80	49	85	46	58	81	70	84	81	90	51		25.0	71	105	46	13	13
33	BOD	mg/L	85	28	58	28	53	25	26	57	49	67	75	71	31		20.0	50	85	25	13	13
34	COD_{Cr}	mg/L	134	87	104	63	116	88	81	102	101	120	130	128	68		30.0	102	134	63	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	3	13	28	94	7	280	0.2	23	54	9.2	8.4	35	1.7		0.02	42.8077	280	0.2	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	1.3	13	28	17	4.6	35	2.2	4.9	17	1.4	1.1	110	0.8		0.004	18.1769	110	0.8	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (62/67)

Sampling Place 43 Environmental Grade C

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.3					1.0	2.5	1.4	0.1	0.4				0.5		0.9	2.5	0.1	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	460		607	308	714	332	452	460	537	474	405	484	419	402	750	466	714	308	13	0
2	TDS	mg/L	230		308	143	332	190	174	188	157	241	208	133	210	184	500	207	332	133	13	0
3	TSS	mg/L	36		65	27	25	25	40	42	15	39	28	18	20	17	-	31	65	15	13	0
4	Turbidity	NTU	32		43	153	33	176	23	15	8	130	58	9	3	9	100	53	176	3	13	3
5	Temperature	℃	28		28	27	27	27	29	29	30	30	30	29	32	30	Normal Temp.	29	32	27	13	
6	Color	Pt-Co Scale								36	84						-	60	84	36	2	0
7	DO	mg/L	6.0		3.3	1.7		1.4	0.7	1.9	127.5	0.8	1.3	0.4	3.8	4.6	3.0	12.8	127.5	0.4	12	7
8	pH	-	7.3		7.2	6.8	7.5	7.2	7.0	6.5	7.4	7.5	7.6	7.7	7.3	7.6	6.0-8.5	7.3	7.7	6.5	13	0
9	Salinity																-	-	-	-	0	0
II	**Chemical**																					
10	Hg	mg/L									0.00			0	0	0	0.002	0.000	0.001	0.000	4	1
11	Fe	mg/L			1.2	0.1	0.9	0.7	1.2	1.4	0.7	1.2	1.0	1.2	1.4	1.3	-	1.0	1.4	0.1	12	0
12	Cd	mg/L												0	0.02	0	0.010	0.007	0.020	0.000	3	1
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03	0.88	0.04	1.70	0.35	0.04	0.37	0.07	0.09	0.02	0.49	0.35	0.050	0.37	1.70	0.02	12	8
17	Cu	mg/L												0	0	0	0.020	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.030	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.82		0.63	0.35	0.95	0.78	0.70	0.89	0.61	1.01	0.79	2.09	-	0.87	2.09	0.35	11	
20	NH_3	mg/L	1.95		8.59	2.44	39.82	3.34	5.61		3.68	8.39	6.37	8.18	5.93	8.50	2.0	8.57	39.82	1.95	12	11
21	F	mg/L	0.17		0.69			0.67	0.23			0.38	0.03				-	0.36	0.69	0.03	6	0
22	Cl^-	mg/L			62	115	58	26			58	53	34	178	39	43	20.0	67	178	26	10	10
23	Cl_2	mg/L							48		1.3			0.01			0.003	16.46	48.06	0.01	3	
24	NO_3	mg/L	0.34		0.22	0.49	0.22	0.36	0.26		0.29	0.37	0.26	0	0	0.17	-	0.26	0.49	0.05	12	0
25	NO_2	mg/L			0.02	0.42	0.04	0.04	0.01		0.01	0.01	0.20	0.03	0.07	0.05	-	0.08	0.42	0.01	11	0
	T-N	mg/L	2.28		8.83	3.35	40.08	3.74	5.88		3.97	8.77	6.83	8.32	6.05	8.72	1.0	8.90	40.08	2.28	12	12
26	PO_4	mg/L	1.03		4.00	2.17	3.66	0.49	0.76	1.40	0.97	1.27	0.79	0.65	0.45	0.55	0.50	1.40	4.00	0.45	13	11
27	SO_4	mg/L			4	45	10	10	26	15	25	14	19	10	19	20	50.0	18	45	4	12	0
28	H_2S	mg/L	0.636		2.57	0.14	0.87	0.20	0.31		0.09	0.32	0.37	3.14	0.22	0.11	0.002	0.75	3.14	0.09	12	12
29	Phenol	mg/L	0.011		0.01	0.01		0.02	0.02			0.02	0.03	0.05	0.02	0.07	<0	0.03	0.07	0.01	10	0
30	Oil and Grease	mg/L			0.50	0.27	0.37		0.25	0.12	0.35	0.04		0.15	0.06	0	1.0	0.21	0.50	0.00	10	0
31	Active Substance	mg/L	0.97		2.54	0.10	0.49	0.66	0.32	0.33	0.12	0.03	2.03	0.05	1.03	0.09	0.50	0.67	2.54	0.03	13	5
32	COD_{Mn}	mg/L	33		54	21	60	24	55	33	64	59	45	54	33	19	25.0	42	64	19	13	10
33	BOD	mg/L	22		39	19	37	20	46	24	59	56	37	43	19	14	20.0	33	59	14	13	9
34	COD_{Cr}	mg/L	73		85	29	99	42	71	43	87	110	71	80	69	35	30.0	69	110	29	13	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	2.8		280	3.5	24	11	0.79		540	160	330	3500	1.4	1.1	0.02	404.549	3500	0.79	12	12
36	Fecal Coliforms	$\times 10^6$No./100mL	1.7		140	2.2	2.2	1.7	0.17		2.8	6.3	2.1	70	0.3	0.5	0.004	19.1642	140	0.17	12	12

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (63/67)

Sampling Place 44 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.0					6.7	0.1	0.0	0.0							1.4	6.7	0.0	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	648		689	452	728	639	762	699	856						1,000	684	856	452	8	0
2	TDS	mg/L	325		312	208	352	295	288	277	205						200	283	352	205	8	8
3	TSS	mg/L	25		8	10	20	25	40	15	30						-	22	40	8	8	0
4	Turbidity	NTU	52		23	18	39	11	31	11	202						-	48	202	11	8	0
5	Temperature	℃	27		28	27	28	27	28	28	28						Normal Temp.	28	28	27	8	
6	Color	Pt-Co Scale								140	172						-	156	172	140	2	0
7	DO	mg/L	1.6		1.2	6.80	1.3	2.2	5.82	1.49	0.4						3.0	2.6	6.8	0.4	8	6
8	pH	-	7.2		7.1	7.5	8.0	7.3	7.9	7.2	7.9						6.0-8.5	7.5	8.0	7.1	8	0
9	Salinity										0.03						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.002						0.005	0.002	0.002	0.002	1	1
11	Fe	mg/L			0.6	0.0	0.5	0.9	0.8	0.6	0.4						-	0.5	0.9	0.0	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.06	1.47	0.03	0.15	0.06	0.03	0.07						1.0	0.27	1.47	0.03	7	1
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.28		0.27	0.30	0.34	0.30	0.35						-	0.31	0.35	0.27	6	
20	NH_3	mg/L	20.90		19.25	2.35	25.57	9.96	1.62		5.12						-	12.11	25.57	1.62	7	0
21	F	mg/L	0.91		0.89			0.42			0.39						-	0.65	0.91	0.39	4	0
22	Cl^-	mg/L			79	60	101	72			77						-	78	101	60	5	0
23	Cl_2	mg/L							87		0.6						-	43.55	86.51	0.59	2	
24	NO_3	mg/L	0.26		0.15	1.43	0.19	0.52	0.15		0.16						-	0.41	1.43	0.15	7	0
25	NO_2	mg/L				0.18	0.01	0.08	0.03								-	0.07	0.18	0.01	4	0
	T-N	mg/L	21.16		19.40	3.96	25.77	10.56	1.80		5.28						-	12.56	25.77	1.80	7	0
26	PO_4	mg/L	2.53		3.90	0.21	3.26	2.02	0.79	0.72	1.80						0.50	1.90	3.90	0.21	8	7
27	SO_4	mg/L			8	29	24	41	46	30	28						100	29	46	8	7	0
28	H_2S	mg/L	0.99		2.78	0.23	0.60	0.25	0.52		3.42						-	1.26	3.42	0.23	7	0
29	Phenol	mg/L	0.02		0.01	0.01		0.02	0.03		0.01						-	0.02	0.03	0.01	6	0
30	Oil and Grease	mg/L			0.37	0.30	0.28	0.37	0.35	0.30	0.62						<0	0.37	0.62	0.28	7	0
31	Active Substance	mg/L	2.89		3.72	0.66	0.46	2.57	0.21	3.80	0.16						0.50	1.81	3.80	0.16	8	5
32	COD_{Mn}	mg/L	101		52	27	35	45	72	64	97						25.0	62	101	27	8	8
33	BOD	mg/L	72		22	24	29	26	52	36	87						20.0	43	87	22	8	8
34	COD_{Cr}	mg/L	112		65	54	77	88	125	91	125						30.0	92	125	54	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	280		17	3.1	7	240	160	14	1600						0.02	290.138	1600	3.1	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	170		7.9	0.079	3.3	17	28	14	920						0.004	145.035	920	0.079	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (64/67)

Sampling Place 45 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	5.7					0.0	11.8	11.5	4.2	2.1				4.5		5.7	11.8	0.0	7	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	289		680	506	888	532	407	412	755	570	821	599	502	689	1,000	588	888	289	13	0
2	TDS	mg/L	177		382	259	398	265	140	145	183	294	340	173	265	305	200	256	398	140	13	8
3	TSS	mg/L	71		41	28	71	36	32	35	64	140	91	23	45	25	-	54	140	23	13	0
4	Turbidity	NTU	11		39	46	13	8	187	134	44	321	58	24	25	74	-	75	321	8	13	0
5	Temperature	℃	27		29	28	28	27	27	28	28	25	30	28	29	28	Normal Temp.	28	30	25	13	
6	Color	Pt-Co Scale								39	118						-	79	118	39	2	0
7	DO	mg/L	0.6		0.2	0.40	0.0	0.6	1.57	0.09	6.2	0		0			3.0	1.0	6.2	0.0	10	9
8	pH	-	6.7		7.3	7.3	7.3	7.1	7.1	5.8	8.0	7.0	7.8	6.8	6.4	6.2	6.0-8.5	7.0	8.0	5.8	13	0
9	Salinity										0.03						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001			0	0	0	0.005	0.000	0.001	0.000	4	1
11	Fe	mg/L			1.0	0.5	0.2	0.2	0.1	1.1	0.0	0.4	0.4	0.6	0.7	0.8	-	0.5	1.1	0.0	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L					0.06	2.20	0.08	0.03		0.01	0.02	0.08	0.05	0	1.0	0.28	2.20	0.00	9	1
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.73	0.48	0.49	0.47	0.48	0.77	0.73	1.46	0.67	0.84	0.61	0.60	-	0.69	1.46	0.47	12	
20	NH_3	mg/L	4.56		50.40	4.80	18.41	5.48	3.47		11.50	3.91	13.52	13.84	7.95	14.23	-	12.67	50.40	3.47	12	0
21	F	mg/L	0.25			0.30			0.02								-	0.19	0.30	0.02	3	0
22	Cl^-	mg/L			63	94	101	48			67	53	53	58	53	117	-	71	117	48	10	0
23	Cl_2	mg/L							24		0.8			0.01		0.01	-	6.20	24.03	0.01	4	
24	NO_3	mg/L	0.20		0.18	0.08	0.10	0.10	0.06		0.09	0.06		0		0.04	-	0.10	0.20	0.04	10	0
25	NO_2	mg/L			0.01	0.01	0.03	0.03	0.33		0.02	0.01	0.01	0.03	0.01	0.04	-	0.05	0.33	0.01	11	0
	T-N	mg/L	4.76		50.59	4.89	18.54	5.61	3.86		11.60	3.98	13.53	13.98	7.96	14.31	-	12.80	50.59	3.86	12	0
26	PO_4	mg/L	0.48		2.33	2.31	1.52	0.87	0.23	0.32	0.86	0.85	1.21	0.70	0.78	0.91	0.50	1.03	2.33	0.23	13	10
27	SO_4	mg/L			7	43	203	10	39	13	24	30	49	50	32	44	100	45	203	7	12	1
28	H_2S	mg/L	0.13		5.89	0.66	6.48	0.05	0.32		0.41	1.36	3.48	5.42	1.69	4.90	-	2.57	6.48	0.05	12	0
29	Phenol	mg/L	0.01		0.01	0.01		0.02	0.03			0.01	0.10	0.02	0.02	0.09	-	0.03	0.10	0.01	10	0
30	Oil and Grease	mg/L			0.31	0.14	0.57	0.34	0.08	0.11	0.24	0.14		0.06		0	<0	0.20	0.57	0.04	10	0
31	Active Substance	mg/L			2.41	1.70	0.35	0.99	0.17	0.72	0.70	0.11	1.15	0.30	0.08	1.44	0.50	0.84	2.41	0.08	12	7
32	COD_{Mn}	mg/L	35		49	50	82	67	21	45	50	34	87	44	55	31	25.0	50	87	21	13	12
33	BOD	mg/L	22		32	17	67	33	12	38	32	26	64	34	31	20	20.0	33	67	12	13	11
34	COD_{Cr}	mg/L	60		63	54	112	83	30	57	91	67	110	71	68	69	30.0	72	112	30	13	13
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	170		22	11	92	9.2	16	17	46	17	280	7	140	35	0.02	66.3231	280	7	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	28		7.9	7.9	22	5.4	2.2	7	23	11	140	1.7	1.7	2.8	0.004	20.0462	140	1.7	13	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (65/67)

Sampling Place 46 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	2.3	0.0				0.3	0.0	0.9	0.0	1.7				0.0		0.6	2.3	0.0	8	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	8,150	48,200	33,100	40,750	57,350	51,800	49,500	10,100	39,100	34,100	47,500	29,800	20,800	47,900	1,000	37,011	57,350	8,150	14	14
2	TDS	mg/L	4,320	2,700	18,970	21,500	31,800	8,190	8,200	3,540	817	14,120	20,100	8,000	11,200	24,660	200	12,723	31,800	817	14	14
3	TSS	mg/L	33	20	17	10	20	20	23	45	25	27	17	17	19	10	-	22	45	10	14	0
4	Turbidity	NTU	50	67	45	50	164	10	8	51	117	6	4	36	42	2	-	46	164	2	14	0
5	Temperature	℃	28	32	30	30	30	30	29	30	31	32	32	31	31	31	Normal Temp.	30	32	28	14	
6	Color	Pt-Co Scale								96	45						-	71	96	45	2	0
7	DO	mg/L	6.1	2.6	1.9	3.70	2.7	6.3	4.71	1.36	0.5	4.0	1.8	4.4	5.3	4.2	3.0	3.5	6.3	0.5	14	6
8	pH	-	6.7	7.6	7.3	7.9	8.1	8.2	6.8	6.6	8.0	7.6	7.1	8.3	7.2	7.4	6.0-8.5	7.5	8.3	6.6	14	0
9	Salinity										2.51						-	3	3	3	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L		0.6	0.3		0.2	0.1	0.3	1.0	0.3	0.1		0.4	0.4	0.2	-	0.4	1.0	0.1	11	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
16	Zn	mg/L			0.03	0.03	0.07	0.15	0.19	0.06	0.25	0.03		0.06	0.13	0.27	1.0	0.12	0.27	0.03	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.12	0.03	0.32	0.03	0.30	0.53	0.56	0.45	0.34	0.45	0.34	0.16	-	0.30	0.56	0.03	12	
20	NH_3	mg/L	2.24		1.29	1.54	0.72	0.58	1.40		2.80	1.37	0.56	1.01	0.99	1.20	-	1.31	2.80	0.56	12	0
21	F	mg/L	0.18		0.75	0.86	2.04	1.47	1.36		0.47	0.56	0.75		0.05	1.87	-	0.94	2.04	0.05	11	0
22	Cl^-	mg/L			11,538	10,848	519	19,104			32,681	10,958	16,340	11,571	7,714	18,417	-	13,969	32,681	519	10	0
23	Cl_2	mg/L							81,702								-	81,702.00	81,702.00	81,702.00	1	
24	NO_3	mg/L	0.21	0.06	0.07	0.28	0.07	0.06	0.07		0.17	0.16		0		0.05	-	0.12	0.28	0.05	11	0
25	NO_2	mg/L		0.03	0.03	0.02	0.01	0.02				0.03	0.01	0.02	0.02	0.01	-	0.02	0.03	0.01	10	0
	T-N	mg/L	2.45		1.39	1.84	0.80	0.66	1.47		2.97	1.56	0.57	1.15	1.01	1.26	-	1.43	2.97	0.57	12	0
26	PO_4	mg/L	0.14	0.72	0.35	0.16	0.06	0.08	0.28	0.22	0.86	0.10	0.09	0.12	0.10	0.07	0.50	0.24	0.86	0.06	14	2
27	SO_4	mg/L			1,824	1,686	269	1,582	3,324	477	590	929	255	1,172	514	2,784	100	1,284	3,324	255	12	12
28	H_2S	mg/L	0.12	0.14	0.25	0.05	0.19	0.06	0.18		0.49	0.14	0.18	0.24	0.29	0.03	-	0.18	0.49	0.03	13	0
29	Phenol	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.03		0.01	0.01	0.10	0.28	0.01	0.32	-	0.06	0.32	0.01	13	0
30	Oil and Grease	mg/L			0.17	0.07	0.27	0.10	0.08	0.11	0.11	0.27		0.04	0.07	0	<0	0.12	0.27	0.04	11	0
31	Active Substance	mg/L		0.19	0.17	0.10	0.05	0.08	0.07	0.16	0.23	0.06	0.06	0.10	0.07	0.08	0.50	0.11	0.23	0.05	13	0
32	COD_{Mn}	mg/L	25	73	90	26	84	58	79	74	48	68	98	108	55	30	25.0	65	108	25	14	13
33	BOD	mg/L	17	37	76	18	52	25	51	35	21	49	76	83	35	17	20.0	42	83	17	14	11
34	COD_{Cr}	mg/L	54	122	100	75	121	73	95	85	97	123	162	134	91	52	30.0	99	162	52	14	14
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	0.5	0.11	0.022	0.0033	0.079	0.0049	0.17	0.079	0.0049	0.079	0.11	0.11	0.11	0.03	0.02	0.10086429	0.5	0.0033	14	11
36	Fecal Coliforms	$\times 10^6$No./100mL	0.24	0.009	0.014	0.00017	0.017	0.0049	0.17	0.0049	0.0049	0.049	0.11	0.028	0.08	0.023	0.004	0.05391929	0.24	0.00017	14	13

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (66/67)

Sampling Place 47 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.4					2.2	0.6	0.1	0.1							0.7	2.2	0.1	5	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	572		1,070	520	1,025	755	573	782	1,010						1,000	788	1,070	520	8	3
2	TDS	mg/L	310		506	397	528	539	188	282	342						200	386	539	188	8	7
3	TSS	mg/L	28		43	25	32	37	66	55	39						-	41	66	25	8	0
4	Turbidity	NTU	6		85	85	199	33	25	74	243						-	94	243	6	8	0
5	Temperature	℃	26		28	27	30	27	27	27	27						Normal Temp.	27	30	26	8	
6	Color	Pt-Co Scale								215	226						-	221	226	215	2	0
7	DO	mg/L	6.5		0.1	0.50	1.4	6.7	5.21	0.00							3.0	3.4	6.7	0.1	6	3
8	pH	-	7.0		7.1	6.7	8.8	7.7	7.4	6.5	7.5						6.0-8.5	7.3	8.8	6.5	8	0
9	Salinity										0.04						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L									0.001						0.005	0.001	0.001	0.001	1	1
11	Fe	mg/L			0.4	0.2	0.5	1.0	0.8	0.5	0.1						-	0.5	1.0	0.1	7	0
12	Cd	mg/L															0.010	-	0.000	0.000	0	0
13	Cr	mg/L															-	-	0.000	0.000	0	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L															0.10	-	0.000	0.000	0	0
16	Zn	mg/L			0.02		0.04	0.63	0.14	0.03	0.04						1.0	0.15	0.63	0.02	6	0
17	Cu	mg/L															0.10	-	0.000	0.000	0	0
18	Pb	mg/L															0.10	-	0.000	0.000	0	0
19	Mg	mg/L			0.38	0.27	0.80	0.35	0.22	0.31	0.24						-	0.37	0.80	0.22	7	
20	NH_3	mg/L	15.35		22.25	6.03	21.82	9.10	6.69		5.16						-	12.34	22.25	5.16	7	0
21	F	mg/L	0.47		1.75				0.09		0.59						-	0.73	1.75	0.09	4	0
22	Cl^-	mg/L			93	217	77	62			82						-	106	217	62	5	0
23	Cl_2	mg/L							34		0.9						-	17.29	33.64	0.95	2	
24	NO_3	mg/L	0.37		0.21	0.11	0.15	0.15	0.26		0.18						-	0.20	0.37	0.11	7	0
25	NO_2	mg/L			0.01	0.01	0.03	0.02	0.01		0.01						-	0.01	0.03	0.01	6	0
	T-N	mg/L	15.72		22.47	6.15	22.00	9.27	6.97		5.34						-	12.56	22.47	5.34	7	0
26	PO_4	mg/L	1.64		1.79	1.35	2.27	1.43	0.66	0.84	2.17						0.50	1.52	2.27	0.66	8	8
27	SO_4	mg/L			39	60	126	142	14	37	64						100	69	142	14	7	2
28	H_2S	mg/L	0.63		6.95	0.38	1.32	0.36	0.39		4.50						-	2.08	6.95	0.36	7	0
29	Phenol	mg/L	0.02		0.01	0.01	0.01	0.01	0.04								-	0.02	0.04	0.01	6	0
30	Oil and Grease	mg/L			0.45	0.12	0.45	0.25	0.28	0.14	0.47						<0	0.31	0.47	0.12	7	0
31	Active Substance	mg/L	1.37		3.72	1.61	0.20	0.93	0.32	2.69	1.95						0.50	1.60	3.72	0.20	8	6
32	COD_{Mn}	mg/L	84		87	21	52	53	49	92	183						25.0	78	183	21	8	7
33	BOD	mg/L	70		69	19	43	36	32	73	113						20.0	57	113	19	8	7
34	COD_{Cr}	mg/L	124		94	61	95	98	70	125	214						30.0	110	214	61	8	8
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	14		540	35	170	540	17	35	920						0.02	283.875	920	14	8	8
36	Fecal Coliforms	$\times 10^6$No./100mL	11		3.5	12	14	14	2.2	14	920						0.004	123.838	920	2.2	8	8

Table S/R-B3-6 Result of Water Quality Survey by BPLHD (67/67)

Sampling Place 48 Environmental Grade D

No.	Parameter	Unit	2006_6	2006_12	2007_6	2007_12	2008_8	2008_10	2008_11	2009_4	2009_7	2010_3	2010_5	2010_8	2010_10	2010_11	Environmental Standard	Ave.	Max.	Min.	Sample Number	No. over Std.
A.River Flow Rate																						
	Flow Rate	m^3/sec	0.9						4.9	2.9	1.4	5.9				0.4		2.7	5.9	0.4	6	
B.Water Quality																						
I	**Physical**																					
1	EC	µS/cm	586		428	530	842	559	490	512	682	327	474	527	329	620	1,000	531	842	327	13	0
2	TDS	mg/L	260		301	255	398	433	207	210	246	151	273	196	168	319	200	263	433	151	13	10
3	TSS	mg/L	290		37	800	102	38	170	25	80	21	31	15	15	22	-	127	800	15	13	0
4	Turbidity	NTU	631		209	412	68	41	140	10	50	89	7	68	45	194	-	151	631	7	13	0
5	Temperature	℃	28		27	28	29	28	28	29	29	30	30	29	29	29	Normal Temp.	29	30	27	13	
6	Color	Pt-Co Scale								158	173						-	166	173	158	2	0
7	DO	mg/L	1.0		0.3	0.30	0.1	0.6	0.60	0.00	0.1	0.6	0.5	0.0	1.6		3.0	0.5	1.6	0.0	11	11
8	pH	-	6.9		6.6	7.3	7.9	7.7	7.3	7.2	7.7	7.4	7.2	7.2	7.2	6.2	6.0-8.5	7.2	7.9	6.2	13	0
9	Salinity										0.02						-	0	0	0	1	0
II	**Chemical**																					
10	Hg	mg/L												0	0	0	0.005	0.000	-	0.000	3	0
11	Fe	mg/L			0.6	0.1	0.5	0.5	0.5	0.8	0.3	1.0	1.0	0.5	0.8	0.5	-	0.6	1.0	0.1	12	0
12	Cd	mg/L												0	0	0	0.010	0.000	0.000	0.000	3	0
13	Cr	mg/L												0	0	0	-	0.000	0.000	0.000	3	0
14	Cr^{6+}	mg/L															0.050	-	0.000	0.000	0	0
15	Ni	mg/L													0	0	0.10	0.000	0.000	0.000	2	0
16	Zn	mg/L			0.02		0.04	0.04	0.02	0.01	0.04	0.03	0.03	0	0.19	0	1.0	0.04	0.19	0.00	11	0
17	Cu	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
18	Pb	mg/L												0	0	0	0.10	0.000	0.000	0.000	3	0
19	Mg	mg/L			0.66	0.58	0.60	0.44	0.20	0.95	0.56	0.75	0.90	0.66	0.56	0.58	-	0.62	0.95	0.20	12	
20	NH_3	mg/L	13.55		9.55	12.25	15.87	5.50	7.29		4.66	0.94	5.31	12.10	3.82	14.96	-	8.82	15.87	0.94	12	0
21	F	mg/L	0.06		3.78			0.21	0.55		0.42	1.17					-	1.03	3.78	0.06	6	0
22	Cl^-	mg/L			56	149	38	33			72	29	38	88	24	53	-	58	149	24	10	0
23	Cl_2	mg/L							43		1.0			0.01		0.01	-	11.06	43.25	0.01	4	
24	NO_3	mg/L	0.29		0.11	0.72	0.53	0.23	3.42		1.73	0.11		0	0	0.03	-	0.67	3.42	0.03	11	0
25	NO_2	mg/L			0.01	0.01	0.02	0.01	0.01				0.01	0.03	0.03	0.04	-	0.02	0.04	0.01	9	0
	T-N	mg/L	13.84		9.67	12.98	16.42	5.74	10.72		6.39	1.05	5.32	12.25	3.93	15.03	-	9.45	16.42	1.05	12	0
26	PO_4	mg/L	1.05		1.66	0.70	1.70	0.62	0.81	0.71	1.01	0.29	0.56	1.04	0.30	0.89	0.50	0.87	1.70	0.29	13	11
27	SO_4	mg/L			78	81	205	78	55	26	54	16	21	27	22	35	100	58	205	16	12	1
28	H_2S	mg/L	4.85		0.46	1.31	2.06	0.17	0.30		0.18	0.22	0.35	3.07	0.31	4.30	-	1.47	4.85	0.17	12	0
29	Phenol	mg/L	0.01		0.01	0.02	0.01	0.01	0.04			0.02	0.07	0.03	0.03	0.10	-	0.03	0.10	0.01	11	0
30	Oil and Grease	mg/L			0.22	0.06	0.54	0.19	0.31	0.09	2.09			0.08	0.11	0	<0	0.37	2.09	0.04	10	0
31	Active Substance	mg/L			1.65	0.45	0.31	0.80	0.14	1.87	0.76	0.01	1.45	0.09	0.09	1.66	0.50	0.77	1.87	0.01	12	6
32	COD_{Mn}	mg/L	83		53	82	92	58	69	47	66	24	32	90	18	81	25.0	61	92	18	13	11
33	BOD	mg/L	76		46	54	75	34	43	38	40	20	29	68	10	31	20.0	44	76	10	13	12
34	COD_{Cr}	mg/L	111		84	115	158	81	98	55	119	38	58	103	23	88	30.0	87	158	23	13	12
III	**Micro-biology**																					
35	Total Coliforms	$\times 10^6$No./100mL	50		13	22	7.9	130	63	28	170	7	33	0.17	1.7	350	0.02	67.3669	350	0.17	13	13
36	Fecal Coliforms	$\times 10^6$No./100mL	8		4.9	7	4.9	49	3.3	2.2	14	4.6	4.9	0.5	1.7	110	0.004	16.5385	110	0.5	13	13

Outline of the result of water quality is reported below.

(1) Organic Matter

The relation between BOD, COD_{Mn} and COD_{Cr} of samples taken in 67 locations along the main river in DKI Jakarta from 2006 to 2010 are shown in Table .

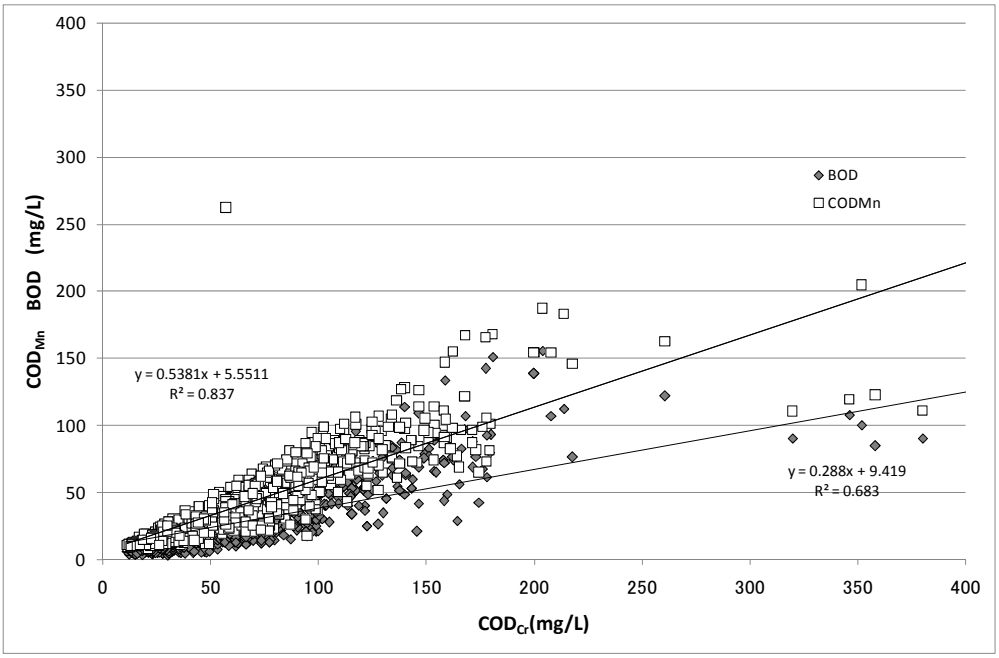


Figure S/R-B3-2 The Relation between BOD, COD_{Mn} and COD_{Cr} (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

Between BOD, COD_{Mn} and COD_{Cr} based on the samples analyzed for 14 times tend to be strong correlation and proportional relation as shown in general river.

Therefore, BOD is adopted as the indicator of organic pollution in this report, which is generally adopted in general river water.

The results of BOD conducted by BPLHD in 67 locations along the main river in DKI Jakarta from 2006 to 2010 are summarized in Figure S/R-B3-3. Horizontal axis shows the relative value of ranking number from the least concentration and vertical axis means BOD of the sample.

The average value, maximum value, minimum value, standard deviation and number of samples at each survey are shown in Table S/R-B3-7.

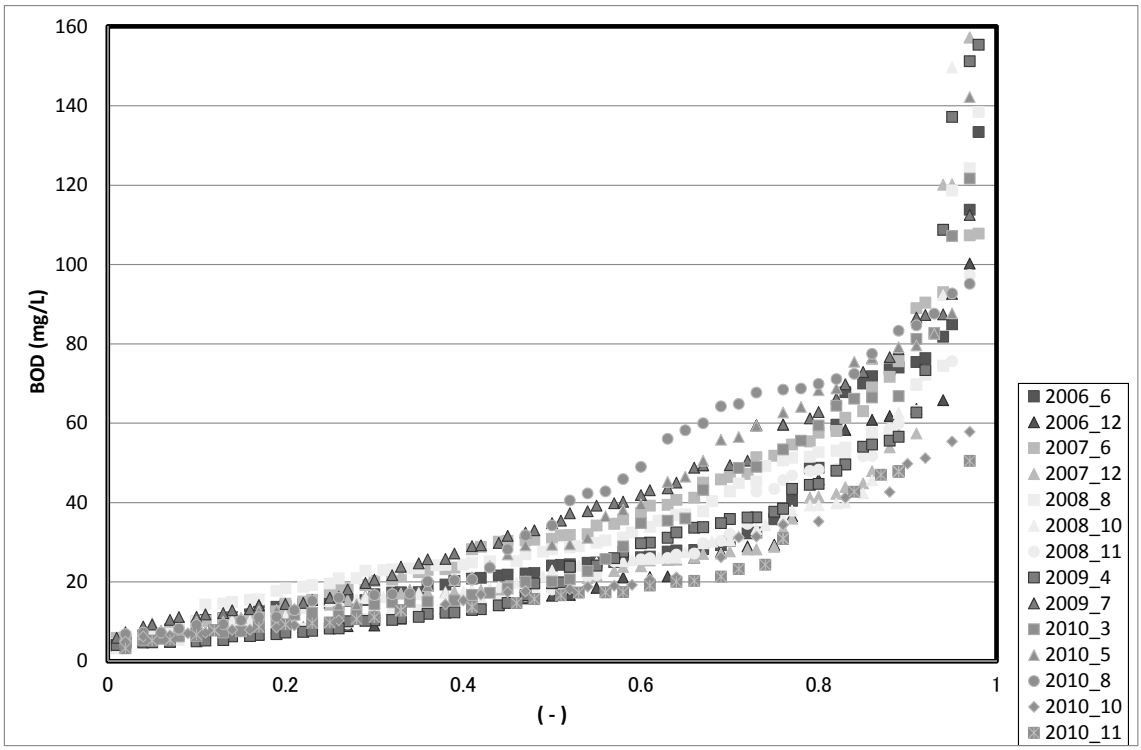


Figure S/R-B3-3 BOD along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

Table S/R-B3-7 BOD along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

	Ave.	Max.	Min.	Div.	Sample Number	Number >=50mg/L	
	mg/L	mg/L	mg/L	mg/L	Nos.	Nos.	%
2006_6	32	133	4	27	67	12	18
2006_12	25	100	5	23	35	6	17
2007_6	37	108	6	26	67	18	27
2007_12	31	157	4	31	67	8	12
2008_8	36	138	4	27	66	16	24
2008_10	34	329	3	46	66	8	12
2008_11	28	155	4	26	67	11	16
2009_4	30	155	4	33	67	10	15
2009_7	41	203	6	32	67	19	28
2010_3	33	122	5	28	45	11	24
2010_5	39	142	6	30	45	15	33
2010_8	41	95	7	28	45	17	38
2010_10	22	58	5	15	41	3	7
2010_11	20	51	3	14	38	1	3
Total	33	329	3	30	783	155	20

The results of water quality survey are summarized below.

- Average value of BOD for each survey is from 20 to 41 mg/L and average value of all samples acquired by total 14 surveys is 33 mg/L. All average values of each survey conducted 14 times are over 20 mg/L, which means water quality standard (Group D) in DKI Jakarta.
- From 3% to 38% of all locations for each survey are over 50mg/L, which is equivalent to 2.5 times of water quality standard (Group D) in DKI Jakarta. 20% of total samples acquired by total 14 surveys are over 50mg/L.

The results of BOD along main river in DKI Jakarta collected by total 14 surveys are summarized in Figure S/R-B3-4 .

Water Quality of River in Jakarta　　ITEM: BOD　　Environ Std. 20
※Average value of tolal 14 times from 2006 to 2010　　UNIT: mg/L　　Total No. 67
No.over Std. 43 64%

River Name								Kamal	
Samling No.						43		41	42
Conc.(mg/L)						33		12	50
River Name	Mookeryark							CenKareng	
Samling No.	24	24D	24C	24B	24A			21	22
Conc.(mg/L)	33	76	66	48	32			14	26
River Name	Angke								
Samling No.	19						20	20A	6
Conc.(mg/L)	23						36	53	19
River Name	Doatasmogal								
Samling No.	39								
Conc.(mg/L)	68								
River Name	Pesanggaohan				Cideng				
Samling No.	23				28				30
Conc.(mg/L)	10				95				41
River Name	Sekertaris		Kalibaruborot			Ciliwung			
Samling No.	44		7			29	29A	31	32
Conc.(mg/L)	43		17			23	16	40	40
River Name	Ciliwung								
Samling No.	1	2	2A	3	3A	4	5	5A	27
Conc.(mg/L)	14	9	15	13	18	16	24	17	48
River Name	Krukut								
Samling No.	16	14	15						
Conc.(mg/L)	14	11	24						
River Name	Grogol								
Samling No.	25	25A	26						
Conc.(mg/L)	9	35	46						
River Name						Kaliharutimur		Sentong	Ancol
Samling No.						33	33A	34	13
Conc.(mg/L)						17	34	54	38
River Name	Lipinang								
Samling No.	8	8B	8F	8C	8A	9	18		
Conc.(mg/L)	11	20	29	107	64	41	8		
River Name	Sunter								
Samling No.	10	10A	11	11A				12	45
Conc.(mg/L)	11	13	14	29				44	33
River Name	Buaran			Petukangan					
Samling No.	36			40			47		
Conc.(mg/L)	31			80			57		
River Name	Jarikpmat								Cakung Drain
Samling No.	17	36A		48	37				38
Conc.(mg/L)	9	37		44	46				42
River Name				Cakung				Bendyanganmerah	
Samling No.				35				46	38A
Conc.(mg/L)				45				42	36

Upstream → Jakarta Bay

Figure S/R-B3-4　The results of BOD along main river in DKI Jakarta （Periods：2006- 2010, Times Surveyed :14times, Number of Locations：67 Locations, Value is the average value of total 14 surveys）

Figure S/R-B3-5 is summarized below. Following study is conducted using average value of BOD for total 14 surveys at 67 locations.

- BOD at 64% of locations is over 20mg/L, which is equivalent to water quality standard (Group D) in DKI Jakarta.
- BOD is relatively high at most parts of northern DKI Jakarta. The locations where BOD is especially high are as follows;
- 50mg/L at Kamal river near Jakarta Bay (Location 42), 48mg/L at Pluit (Location 27), 41mg/L at Ancol (Location 30), 42mg/L at Cakung river near Jakarta Bay (Locations 38).
- The locations where BOD is high except for the northern DKI Jakarta are as follows;
- 76mg/L at Karideras along Mookeryek river (Location 24D), 107mg/L at Dukuh along Lipinang (Location 8C), 46mg/L at Chakung Barat along Jarikrpmat (Location 37)
- BOD at the locations of upstream from Melayu (Jakarta center) are less than 20 mg/L. That is, BOD at the locations are relatively low in DKI Jakarta. The concentration of BOD tends to be increasing with close to downstream from upstream. (Refer to Figure)

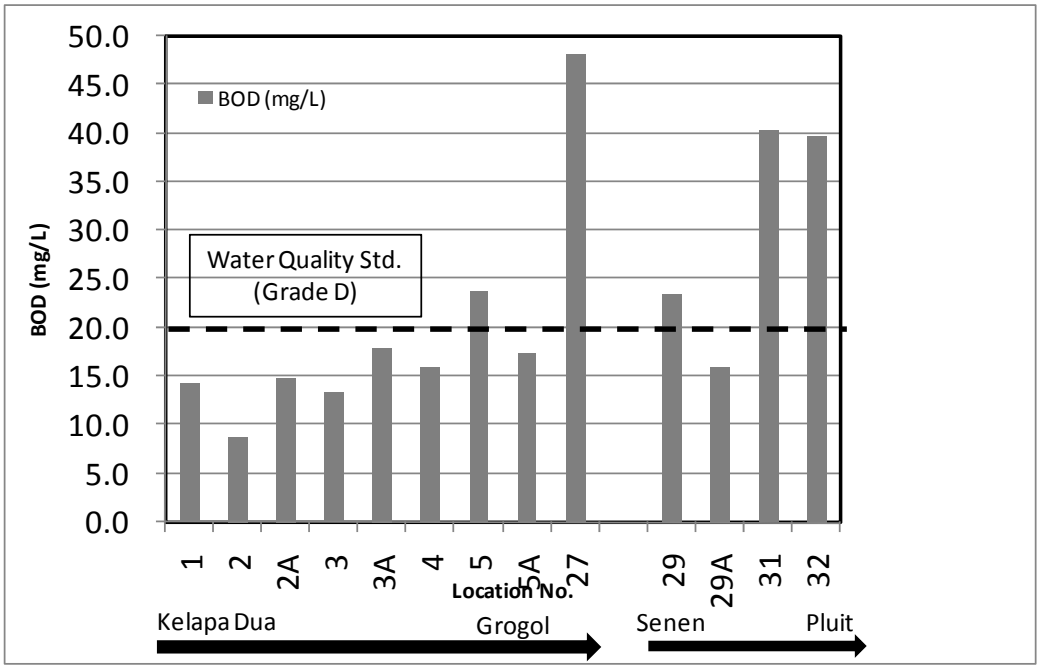


Figure S/R-B3-5 BOD along Ciliwung River

Surveying runoff of BOD by acquiring the more date of rainfall, flow rate of river and BOD value along the river is required to clarify the phenomenon described above. Most of BOD generated at upstream or midstream of river in DKI Jakarta is assumed to be accumulated as bottom sludge in the river near northern DKI Jakarta. Acquiring more data of bottom sludge is required to clarify the characteristic of water quality around northern DKI Jakarta.

The comparison of BOD along main river in DKI Jakarta on between dry season and rainy season is conducted below. Monthly rain fall for 5 years (2006-2010) is shown in Figure S/R-B3-6 and average monthly rainfall for 5 years in DKI Jakarta are shown in table .

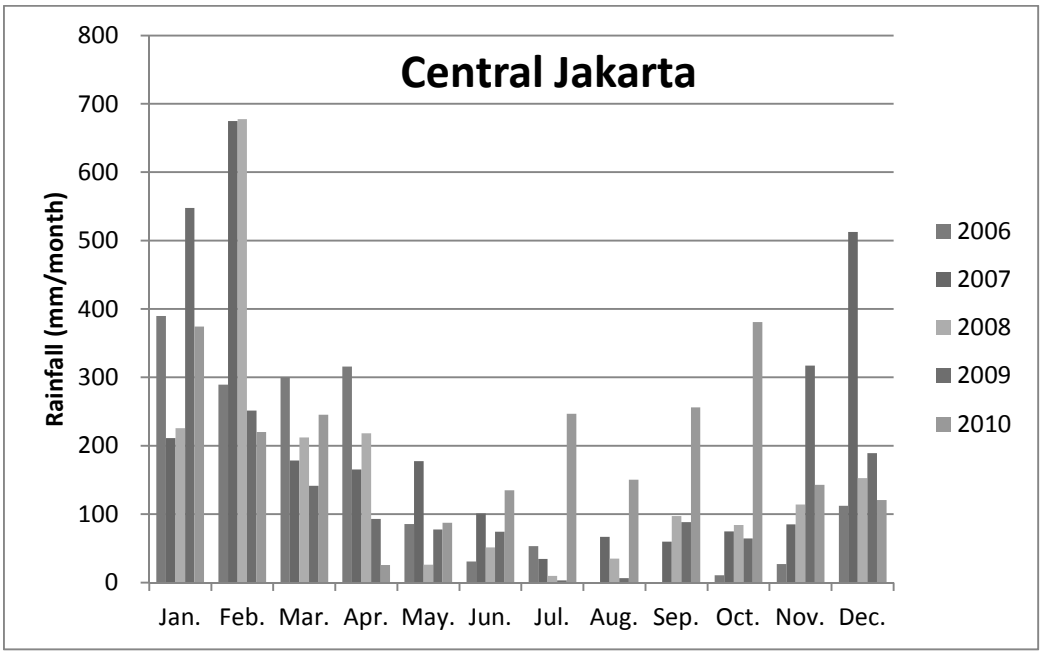


Figure S/R-B3-6 Monthly Rainfall at DKI Jakarta (Year Surveyed: 2006-2010, Location Measured: Central Jakarta)

Table S/R-B3-8 Average Monthly Rainfall for 5 years at DKI Jakarta (Year Surveyed: 2006-2010, Location Measured: Central Jakarta)

	2006	2007	2008	2009	2010	Ave.
Jan.	390	211	226	548	375	350
Feb.	289	675	678	251	220	423
Mar.	300	178	212	141	245	215
Apr.	316	166	218	93	26	164
May.	85	177	26	78	87	91
Jun.	31	101	51	74	135	78
Jul.	53	35	10	3	247	69
Aug.	0	67	35	7	151	52
Sep.	0	60	97	88	256	100
Oct.	11	75	84	64	381	123
Nov.	27	85	114	317	143	137
Dec.	112	513	153	189	121	218
Total	1,614	2,341	1,903	1,854	2,386	2,020

Note: The month of low rainfall is shown with light gray and the month of high rainfall is shown with charcoal gray.

Annual rainfall at DKI Jakarta (location measured: central Jakarta) is approximate 2,000mm/year. The least rainfall is approximate 50mm/month in August and the most rainfall is approximate 400mm/month in February.

BOD value at each location is categorized by the month of low rainfall (the column shown with light gray in Table S/R-B3-8, average 62mm/month) and the month of high rainfall (the column shown with charcoal gray in Table, average 237 mm/month).

Table S/R-B3-9 Differences of BOD on the Month of between Low Rainfall and High Rainfall along Main River in DKI Jakarta (Year Surveyed: 2006-2010, Number of analysis: 14 times, Location Measured: 67 Locations)

		Ave.	Max.	Min.	Div.	Sample Number	Number >=50mg/L	
		mg/L	mg/L	mg/L	mg/L	Nos.	Nos.	%
Dry Month	2006_6	32	133	4	27	67	12	18
	2007_6	37	108	6	26	67	18	27
	2008_8	36	138	4	27	66	16	24
	2008_10	34	329	3	46	66	8	12
	2009_4	30	155	4	33	67	10	15
	2009_7	41	203	6	32	67	19	28
	2010_5	39	142	6	30	45	15	33
	7 samples	35	329	3	32	445	98	22
Rainy Month	2006_12	25	100	5	23	35	6	17
	2007_12	31	157	4	31	67	8	12
	2008_11	28	155	4	26	67	11	16
	2010_3	33	122	5	28	45	11	24
	2010_8	41	95	7	28	45	17	38
	2010_10	22	58	5	15	41	3	7
	2010_11	20	51	3	14	38	1	3
	7 samples	29	157	3	26	338	57	17

The results are summarized below.

- Average BOD along main river in DKI Jakarta on the month of low rainfall (average 62mm/month) and on the month of high rainfall are 35mg/L and 29 mg/L, respectively. These values mean that BOD on the dry season is approximate 6 mg/L higher than on the rainy season.

(2) Fecal Coliform

It is reported that fecal Coliform has the strong relation with morbidity of water borne disease.

The results of Fecal Coliform conducted by BPLHD in 67 locations along the main river in DKI Jakarta from 2006 to 2010 are summarized in Figure S/R-B3-7. Horizontal axis shows the relative value of ranking number from the least concentration and vertical axis means fecal coliform of the sample.

The average value, maximum value, minimum value, standard deviation and number of samples at each survey are shown in Table S/R-B3-10 .

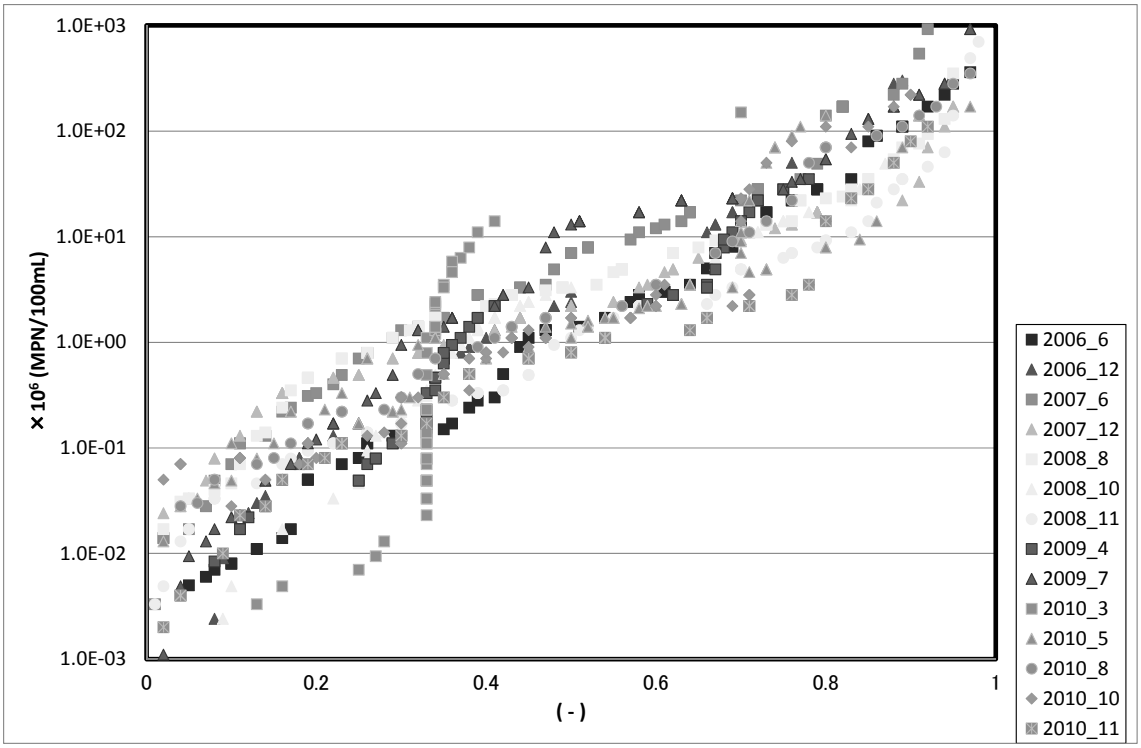


Figure S/R-B3-7 Fecal Coliform along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

Table S/R-B3-10 Fecal Coliform along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

	Ave.	Max.	Min.	Div.	Sample Number
	MPN/100ml	MPN/100ml	MPN/100ml	MPN/100ml	Nos.
2006_6	5.2E+07	1.7E+09	1.7E+02	2.1E+08	67
2006_12	7.4E+08	1.6E+10	2.4E+03	3.1E+09	35
2007_6	1.6E+08	3.5E+09	3.3E+03	5.2E+08	67
2007_12	4.4E+08	2.8E+10	1.7E+02	3.4E+09	66
2008_8	4.3E+09	2.8E+11	3.5E+02	3.4E+10	66
2008_10	3.5E+08	1.7E+10	9.2E+02	2.1E+09	66
2008_11	2.5E+07	7.0E+08	3.3E+03	1.0E+08	67
2009_4	1.4E+07	2.8E+08	4.9E+03	4.2E+07	66
2009_7	6.2E+07	9.2E+08	2.3E+02	1.7E+08	67
2010_3	5.1E+06	1.5E+08	3.3E+03	2.2E+07	45
2010_5	1.7E+07	1.7E+08	1.3E+04	4.3E+07	45
2010_8	3.4E+07	3.5E+08	2.8E+04	7.4E+07	44
2010_10	6.4E+08	2.2E+10	5.0E+04	3.5E+09	41
2010_11	1.7E+08	3.5E+09	1.0E+04	7.2E+08	38
Total	5.3E+08	2.8E+11	1.7E+02	1.0E+10	780

The results of water quality survey are summarized below.

- Average value of fecal coliform for each survey is from 5.1×10^6 MPN/100mL to 4.3×10^9 MPN/100mL and average value of all samples acquired by total 14 surveys is 5.3×10^8 MPN/100mL. All average values of each survey conducted 14 times are 1,000～1,000,000 times of 4,000MPN/100mL, which means water quality standard (Group D) in DKI Jakarta.

The results of fecal coliform along main river in DKI Jakarta collected by total 14 surveys are

summarized in Figure .

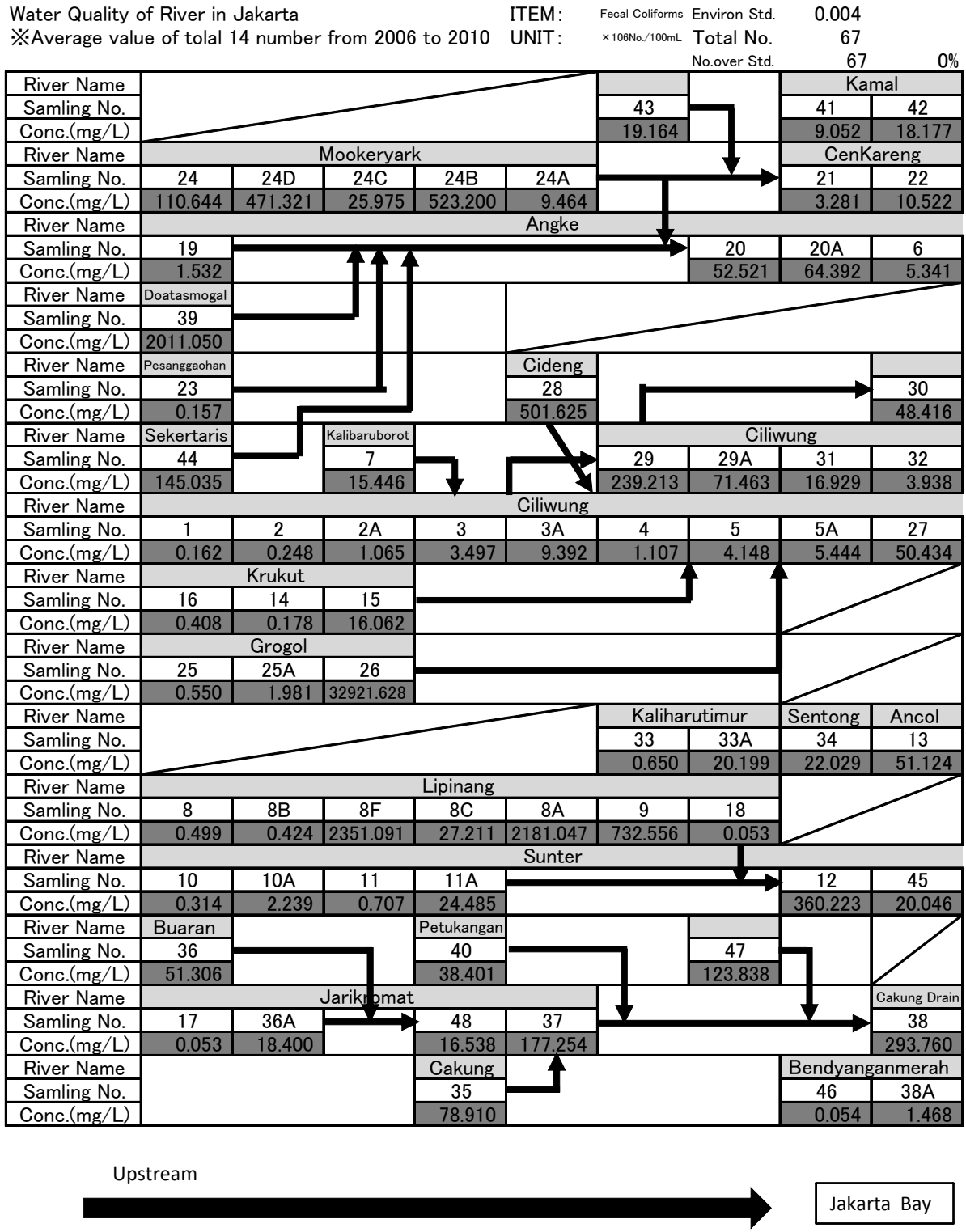


Figure S/R-B3-8 The results of Fecal Coliform along main river in DKI Jakarta (Periods : 2006- 2010, Times Surveyed :14times, Number of Locations : 67 Locations、Value is the average value of total 14 surveys)

Figure S/R-B3-8 is summarized below. Following study is conducted using average value of fecal coliform for total 14 survey at 67 locations.

- Fecal coliform at all locations are over 4,000MPN/100mL, which is equivalent to water quality

standard (Group D) in DKI Jakarta.

- Fecal Coliform at Kurapa Dua (Location 1) located in upstream of Ciliwung river reaches 6×10^5MPN/100ml, which is equivalent to over 10 times of water quality standard(Group D) in DKI Jakarta. The concentration of Fecal Coliform is increasing with close to downstream from upstream and the concentration reaches 5.0×10^7MPN/100mL at Pluit near Jakarta Bay (Location 27).
- Fecal Coliform at Pasar Rebo (Location 33) located in upstream of Kaliharutimur river reaches 6.5×10^5MPN/100mL, which is equivalent to over 10 times of water quality standard (Group D) in DKI Jakarta. The concentration of Fecal Coliform is increasing with close to downstream from upstream and the concentration reaches 5.1×10^7MPN/100mL at Ancol near Jakarta Bay (Location 13).
- Fecal coliform at Kalideras located in Mookeryark river reaches 5.0×10^8MPN/100mL. and severe water pollution generates at the location.

(3) Nitrogen

The results of total nitrogen(T-N), which is calculated by the sum of ammonium nitrogen (NH_4-N), nitrite nitrogen (NO_2-N) and nitrate nitrogen (NO_3-N), conducted by BPLHD in 67 locations along the main river in DKI Jakarta from 2006 to 2010 are summarized in Figure S/R-B3-9 . Horizontal axis shows the relative value of ranking number from the least concentration and vertical axis means T-N of the sample.

The average value, maximum value, minimum value, standard deviation and number of samples at each survey are shown in Table S/R-B3-11 .

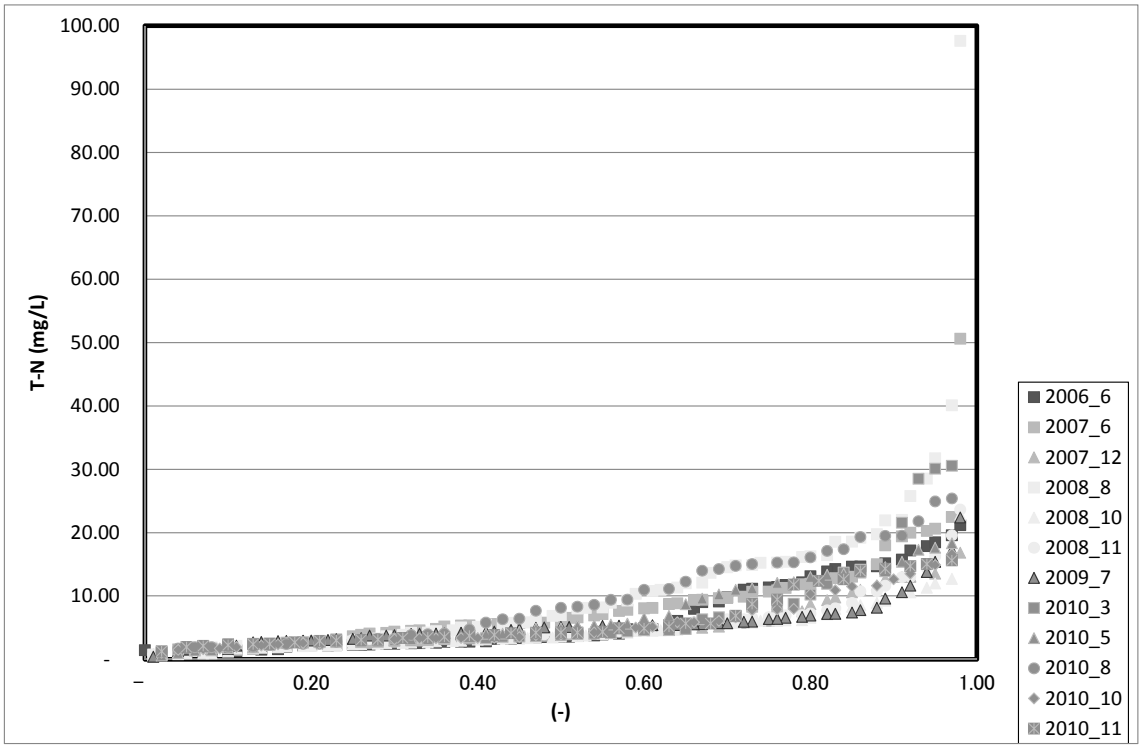


Figure S/R-B3-9 T-N along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 12 times, Number of Location: 67 Locations)

Table S/R-B3-11 T-N along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

	Ave.	Max.	Min.	Div.	Sample Number	Number >=10mg/L	
	mg/L	mg/L	mg/L	mg/L	Nos.	Nos.	%
2006_6	6.5	21.2	0.4	5.7	67	19	28
2007_6	8.2	50.6	0.7	7.5	67	18	27
2007_12	5.3	16.8	0.8	3.9	67	10	15
2008_8	11.0	97.6	0.8	13.6	66	27	41
2008_10	4.7	22.8	0.6	3.7	66	5	8
2008_11	5.5	23.6	0.7	4.3	67	9	13
2009_7	5.5	22.4	0.4	3.7	67	6	9
2010_3	7.0	30.5	1.1	7.5	45	9	20
2010_5	7.0	18.3	0.6	5.2	45	14	31
2010_8	9.6	25.4	1.2	7.0	45	18	40
2010_10	5.7	16.6	1.0	4.0	41	8	20
2010_11	6.1	15.6	1.3	4.4	37	8	22
Total	6.8	97.6	0.4	6.8	680	151	22

The results of water quality survey are summarized below.

- The average value of T-N for each survey is from 4.7 to 11.0 mg/L and the average value of all samples acquired by total 12 surveys is 6.8 mg/L.
- T-N at from 8% to 41% of locations for each survey are over 10mg/L※1. T-N at 22% of all samples acquired by total 12 surveys are over 10mg/L.

※1 Nitrogen is not set in water quality standard in DKI Jakarta. Therefore T-N 10mg/L, which is WHO standards, is referred in this report.

The results of T-N along main river in DKI Jakarta collected by total 12 times surveys are summarized in Figure S/R-B3-10 .

Water Quality of River in Jakarta　　ITEM: T-N　　Environ Std. 10.0
※Average value of tolal 12 number from 2006 to 2010　　UNIT: mg/L　　Total No. 67
No.over Std. 17 25%

River Name									
Samling No.						43		41	42
Conc.(mg/L)						8.9		2.1	15.3
River Name	Mookeryark							CenKareng	
Samling No.	24	24D	24C	24B	24A			21	22
Conc.(mg/L)	8.2	4.0	3.8	4.0	5.5			3.5	5.0
River Name	Angke								
Samling No.	19						20	20A	6
Conc.(mg/L)	3.8						10.4	13.2	4.8
River Name	Doatasmogal								
Samling No.	39								
Conc.(mg/L)	13.2								
River Name	Pesanggaohan				Cideng				
Samling No.	23				28				30
Conc.(mg/L)	2.5				8.8				11.5
River Name	Sekertaris		Kalibaruborot			Ciliwung			
Samling No.	44		7			29	29A	31	32
Conc.(mg/L)	12.6		2.4			14.3	3.8	9.7	8.4
River Name	Ciliwung								
Samling No.	1	2	2A	3	3A	4	5	5A	27
Conc.(mg/L)	2.2	2.7	2.9	3.0	3.2	3.8	4.6	4.3	11.4
River Name	Krukut								
Samling No.	16	14	15						
Conc.(mg/L)	2.2	2.8	6.7						
River Name	Grogol								
Samling No.	25	25A	26						
Conc.(mg/L)	3.3	4.0	11.2						
River Name						Kaliharutimur		Sentong	Ancol
Samling No.						33	33A	34	13
Conc.(mg/L)						4.0	5.5	16.1	12.7
River Name	Lipinang								
Samling No.	8	8B	8F	8C	8A	9	18		
Conc.(mg/L)	4.5	4.4	6.2	6.2	6.5	7.2	2.0		
River Name	Sunter								
Samling No.	10	10A	11	11A				12	45
Conc.(mg/L)	1.7	4.3	3.7	4.2				8.9	12.8
River Name	Buaran			Petukangan					
Samling No.	36			40			47		
Conc.(mg/L)	11.3			11.4			12.6		
River Name	Jarikpmat								Cakung Drain
Samling No.	17	36A		48	37				38
Conc.(mg/L)	1.9	9.5		9.4	12.1				5.9
River Name				Cakung				Bendyanganmerah	
Samling No.				35				46	38A
Conc.(mg/L)				12.8				1.4	5.0

Upstream → Jakarta Bay

Figure S/R-B3-10　The results of T-N along main river in DKI Jakarta (Periods：2006- 2010, Times Surveyed :12times, Number of Locations：67 Locations、Value is the average value of total 12 surveys)

Figure S/R-B3-11　is summarized below. Following study is conducted using average value of T-N for total 12 surveys at 67 locations.

- T-N at 25% of locations is over 10mg/L.

- T-N is relatively high at most parts of northern DKI Jakarta. The locations where T-N is especially high are as follows;
- 15mg/L at Kamal river near Jakarta Bay（Location 42）, 11mg/L at Pluit（Location 27）, 12mg/L at Ancol（Location 30）, 13mg/L at Koja Selatan （Locations 13）.

The portion of NO_2-N + NO_3-N in the T-N along main river in DKI Jakarta are summarized in Figure to study the form of nitrogen .

Water Quality of River in Jakarta　　ITEM:　　Environ Std.
※Average value of tolal 12 number from 2006 to 2010　　UNIT:　%　　Total No.　67

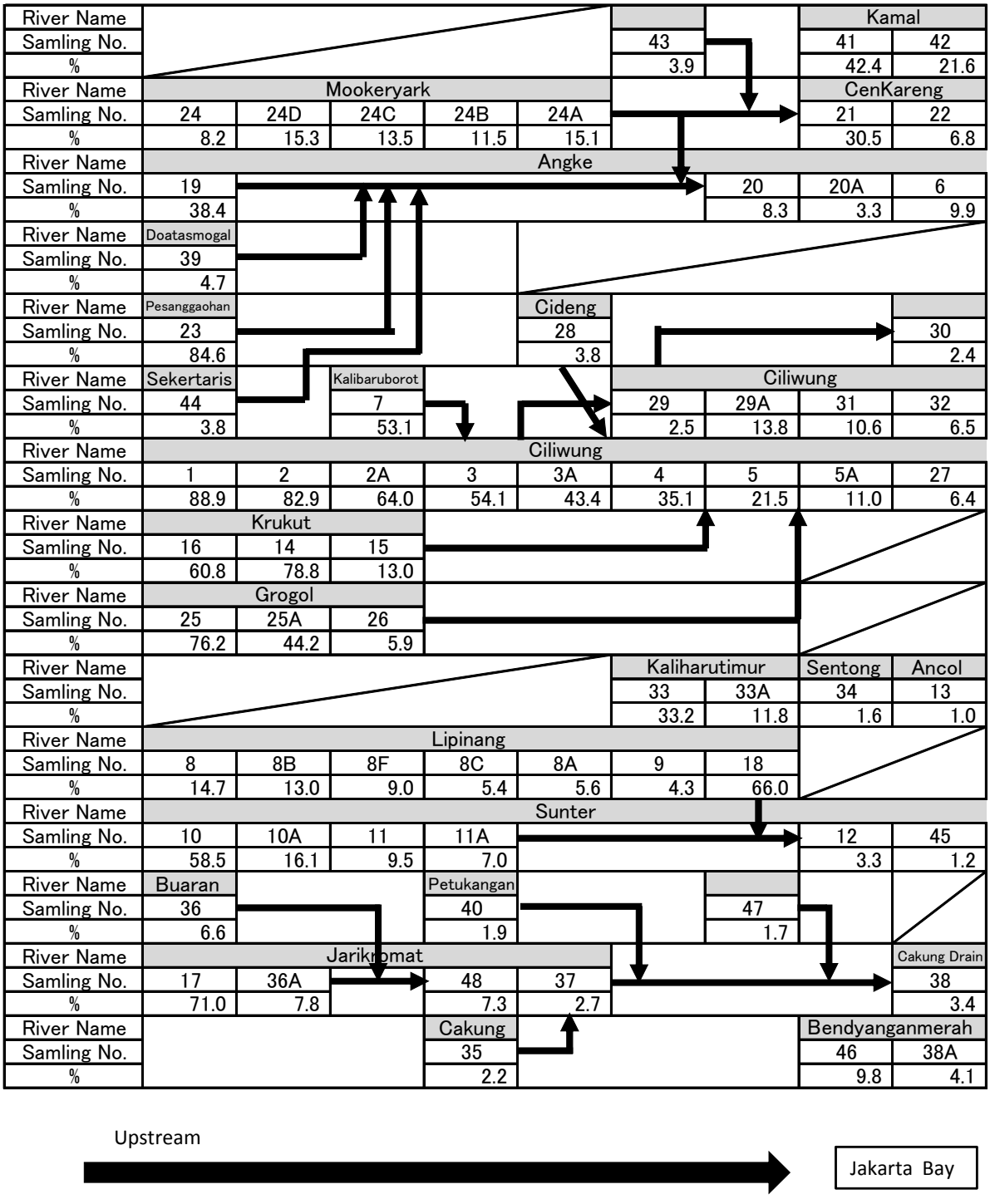


Figure S/R-B3-11　Form of T-N along main river in DKI Jakarta (Periods：2006- 2010, Times Surveyed :12times, Number of Locations：67 Locations, Value is the portion(%) of NO2-N +NO3-N in the T-N)

Figure S/R-B3-11 is summarized below.

- The portion of NO_2-N + NO_3-N in the T-N is generally decreasing with close to downstream from upstream along main river in DKI Jakarta.

- For example, the portion of NO_2-N + NO_3-N in the T-N reaches 80% at Kurapa Dua (Location 1) located in the upstream of Ciliwung river. While, the value is decreasing by less than 10% at Pluit (Location 27) near Jakarta Bay. The form of nitrogen along Ciliwung river is shown in Figure S/R-B3-12.

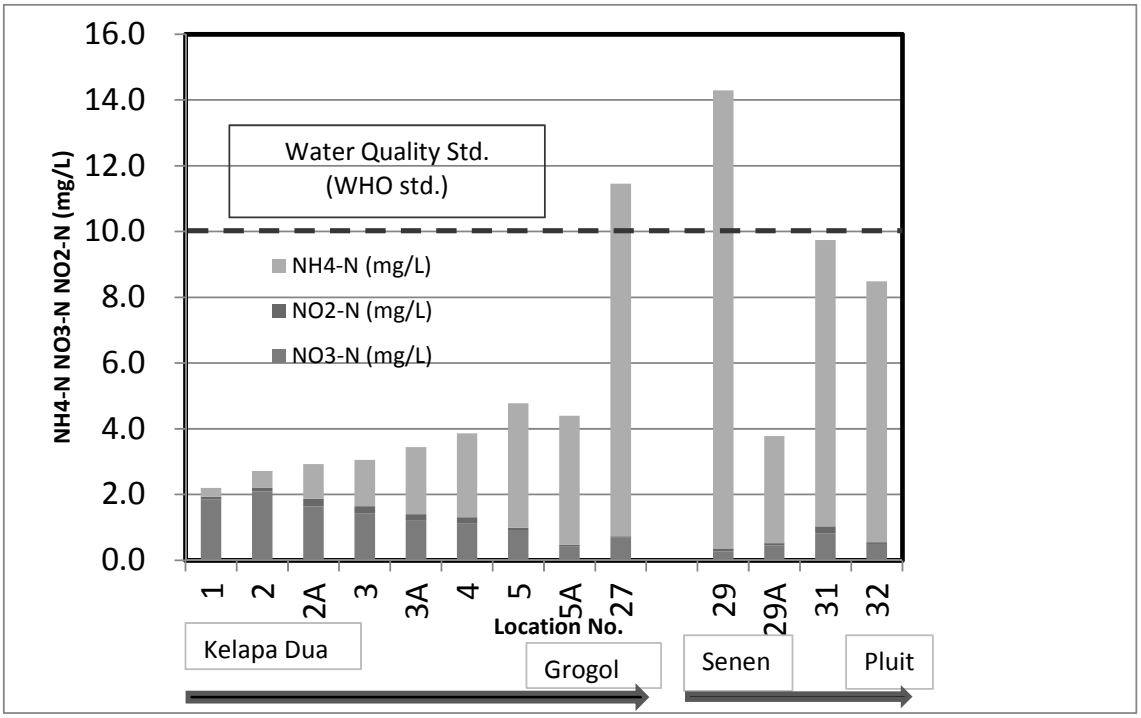


Figure S/R-B3-11 Form of Nitrogen along Ciliwung River

The reason of this phenomenon is assumed below.

- Because intake load of organic matter at upstream of DKI is relatively low comparing with that at downstream and flow rate of river is relatively high, a lot of oxygen is taken into river from surface water. As the result, by dissolved oxygen (DO) being high and being become oxidizing atmosphere, self-cleaning ability is being high.
- Oxygen volume consumed by decomposition of BOD, which comes from domestic wastewater etc., is increasing with close to downstream from upstream. In addition, flow rate decreasing with close to downstream, intake volume of oxygen from surface water also decreases. As the result, the condition changes to reduction atmosphere and the self-cleaning ability decrease.
- The oxidation- reduction potential (ORP) decreasing with close to downstream, the portion of NO_2-N + NO_3-N in the T-N also decreases and the portion of NH_4-N increases on the contrary.
- Following changes to reduction atmosphere, methane gas or odor by hydrogen sulfide etc. is generated and landscape is deteriorated.

More data regarding flow rate in addition to composition and volume of bottom sludge etc. is required to clarify the mechanism of the phenomenon described above.

T-N value at each location is categorized by the month of low rainfall (the column shown with yellow in Table, average 62mm/month) and the month of high rainfall (the column shown with green in Table S/R-B3-12, average 237 mm/month).

Table S/R-B3-12 Differences of T-N on between Low Rainfall and High Rainfall along Main River in DKI Jakarta (Year Surveyed: 2006-2010, Number of analysis: 14 times, Location Measured: 67 Locations)

		Ave.	Max.	Min.	Div.	Sample Number	Number >=10mg/L	
		mg/L	mg/L	mg/L	mg/L	Nos.	Nos.	%
Dry Month	2006_6	6.5	21.2	0.4	5.7	67	19	28
	2007_6	8.2	50.6	0.7	7.5	67	18	27
	2008_8	11.0	97.6	0.8	13.6	66	27	41
	2008_10	4.7	22.8	0.6	3.7	66	5	8
	2009_7	5.5	22.4	0.4	3.7	67	6	9
	2010_5	7.0	18.3	0.6	5.2	45	14	31
	6 samples	7.1	97.6	0.4	7.7	378	89	24
Rainy Month	2007_12	5.3	16.8	0.8	3.9	67	10	15
	2008_11	5.5	23.6	0.7	4.3	67	9	13
	2010_3	7.0	30.5	1.1	7.5	45	9	20
	2010_8	9.6	25.4	1.2	7.0	45	18	40
	2010_10	5.7	16.6	1.0	4.0	41	8	20
	2010_11	6.1	15.6	1.3	4.4	37	8	22
	6 samples	6.3	30.5	0.7	5.4	302	62	21

Table S/R-B3-12 is summarized below.

- Average T-N along main river in DKI Jakarta on the month of low rainfall (average 62mm/month) and on the month of high rainfall (average 237mm/month) are 7.1mg/L and 6.3mg/L, respectively. These values mean that T-N on the dry season is approximate 0.8 mg/L higher than on the rainy season.

(4) Phosphorus

The results of total phosphorus (T-P) conducted by BPLHD in 67 locations along the main river in DKI Jakarta from 2006 to 2010 are summarized in Figure S/R-B3-12 . Horizontal axis shows the relative value of ranking number from the least concentration and vertical axis means T-P of the sample.

The average value, maximum value, minimum value, standard deviation and number of samples at each survey are shown in Table S/R-B3-13 .

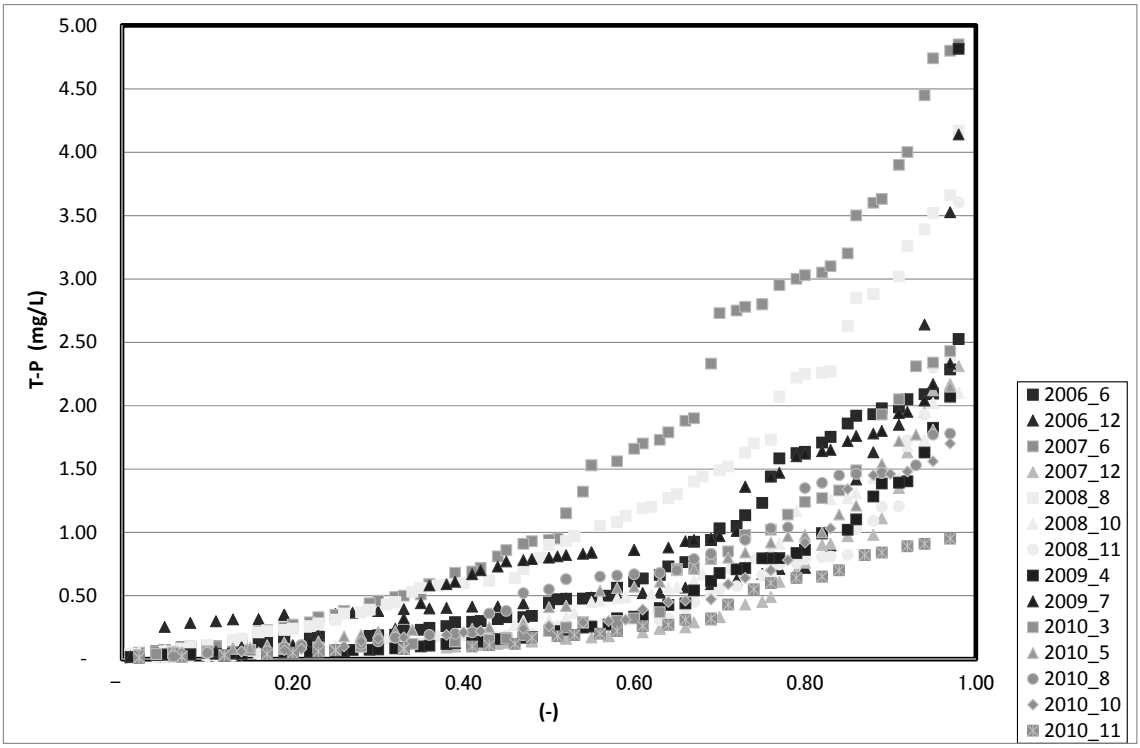


Figure S/R-B3-12 T-P along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

Table S/R-B3-13 T-P along the Main River in DKI Jakarta (Periods: 2006-2010, Times Surveyed: 14 times, Number of Location: 67 Locations)

	Ave.	Max.	Min.	Div.	Sample Number	Number >=1.5mg/L	
	MPN/100ml	MPN/100ml	MPN/100ml	MPN/100ml	Nos.	Nos.	(%)
2006_6	0.74	2.53	0.02	0.72	67	15	22
2006_12	0.70	3.53	0.05	0.71	35	4	11
2007_6	1.56	4.85	0.04	1.43	67	30	45
2007_12	0.39	2.31	0.01	0.57	67	5	7
2008_8	1.18	4.17	0.04	1.07	66	19	29
2008_10	0.56	2.10	0.05	0.57	66	5	8
2008_11	0.47	3.60	0.01	0.66	67	5	7
2009_4	0.50	4.82	0.02	0.73	67	4	6
2009_7	0.85	4.14	0.02	0.77	67	14	21
2010_3	0.59	2.43	0.03	0.71	45	5	11
2010_5	0.58	2.15	0.03	0.55	45	5	11
2010_8	0.61	1.78	0.01	0.55	45	3	7
2010_10	0.47	1.70	0.03	0.50	41	2	5
2010_11	0.29	0.95	0.01	0.30	38	0	0
Total	0.70	4.85	0.01	0.84	783	116	15

The results of water quality survey are summarized below.

- The average value of T-P for each survey is from 0.29 to 1.56 mg/L and the average value of all samples acquired by total 14 surveys is 0.70mg/L.
- T-P at from 0% to 30% of locations for each survey are over 10mg/L, which are equivalent to 3 times of water quality standard (Group D) in DKI Jakarta. T-N at 13% of all samples acquired by total 14 surveys are over 1.5mg/L.

The results of T-P along main river in DKI Jakarta collected by total 14 times surveys are summarized in Figure S/R-B3-13 .

Water Quality of River in Jakarta　　ITEM: PO4　　Environ Std. 0.5
※Average value of tolal 14 number from 2006 to 2010　　UNIT: mg/L　　Total No. 67
No.over Std. 33 51%

River Name								Kamal	
Samling No.						43		41	42
Conc.(mg/L)						1.4		0.1	1.5
River Name	Mookeryark							CenKareng	
Samling No.	24	24D	24C	24B	24A			21	22
Conc.(mg/L)	0.8	0.5	0.3	0.5	0.6			0.3	0.5
River Name	Angke								
Samling No.	19						20	20A	6
Conc.(mg/L)	0.3						1.8	1.9	0.4
River Name	Doatasmogal								
Samling No.	39								
Conc.(mg/L)	1.7								
River Name	Pesanggaohan				Cideng				
Samling No.	23				28				30
Conc.(mg/L)	0.1				3.0				1.7
River Name	Sekertaris		Kalibaruborot			Ciliwung			
Samling No.	44		7			29	29A	31	32
Conc.(mg/L)	1.9		0.0			0.6	0.5	1.4	0.9
River Name	Ciliwung								
Samling No.	1	2	2A	3	3A	4	5	5A	27
Conc.(mg/L)	0.1	0.1	0.2	0.1	0.3	0.2	0.2	0.3	1.1
River Name	Krukut								
Samling No.	16	14	15						
Conc.(mg/L)	0.2	0.1	0.5						
River Name	Grogol								
Samling No.	25	25A	26						
Conc.(mg/L)	0.1	0.3	1.7						
River Name						Kaliharutimur		Sentong	Ancol
Samling No.						33	33A	34	13
Conc.(mg/L)						0.1	1.0	2.0	1.1
River Name	Lipinang								
Samling No.	8	8B	8F	8C	8A	9	18		
Conc.(mg/L)	0.4	0.3	1.0	0.9	0.7	1.0	0.1		
River Name	Sunter								
Samling No.	10	10A	11	11A				12	45
Conc.(mg/L)	0.1	0.2	0.3	0.4				0.7	1.0
River Name	Buaran			Petukangan					
Samling No.	36			40			47		
Conc.(mg/L)	1.2			1.2			1.5		
River Name	Jarikpmat								Cakung Drain
Samling No.	17	36A		48	37				38
Conc.(mg/L)	0.1	0.7		0.9	1.1				1.0
River Name				Cakung				Bendyanganmerah	
Samling No.				35				46	38A
Conc.(mg/L)				1.6				0.2	0.3

Upstream → Jakarta Bay

Figure S/R-B3-13　The results of T-P along main river in DKI Jakarta (Periods：2006- 2010, Times Surveyed :14times, Number of Locations：67 Locations、Value is the average value of total 14 surveys)

Figure S/R-B3-14　is summarized below. Following study is conducted using average value of T-P for total 14 surveys at 67 locations.

T-P at 51% of locations is over 0.5mg/L, which is equivalent to water quality standard (Group D) in DKI Jakarta.

T-P is relatively high at most parts of northern DKI Jakarta. The locations where T-P is especially high are as follows;

1.5mg/L at Kamal river near Jakarta Bay (Location 42), 1.1mg/L at Pluit (Location 27), 1.7mg/L at Ancol (Location 30), 1.1mg/L at Koja Selatan (Locations 13).

The concentration of T-P tends to be increasing with close to downstream from upstream.

For example, while T-P at Kurapa Dua (Location 1) located in upstream of Ciliwung river is 0.1 mg/L, T-P at Pluit (Location 27) located near Jakarta Bay reaches 1.1 mg/L. T-P along Ciliwung river is shown in Figure S/R-B3-14.

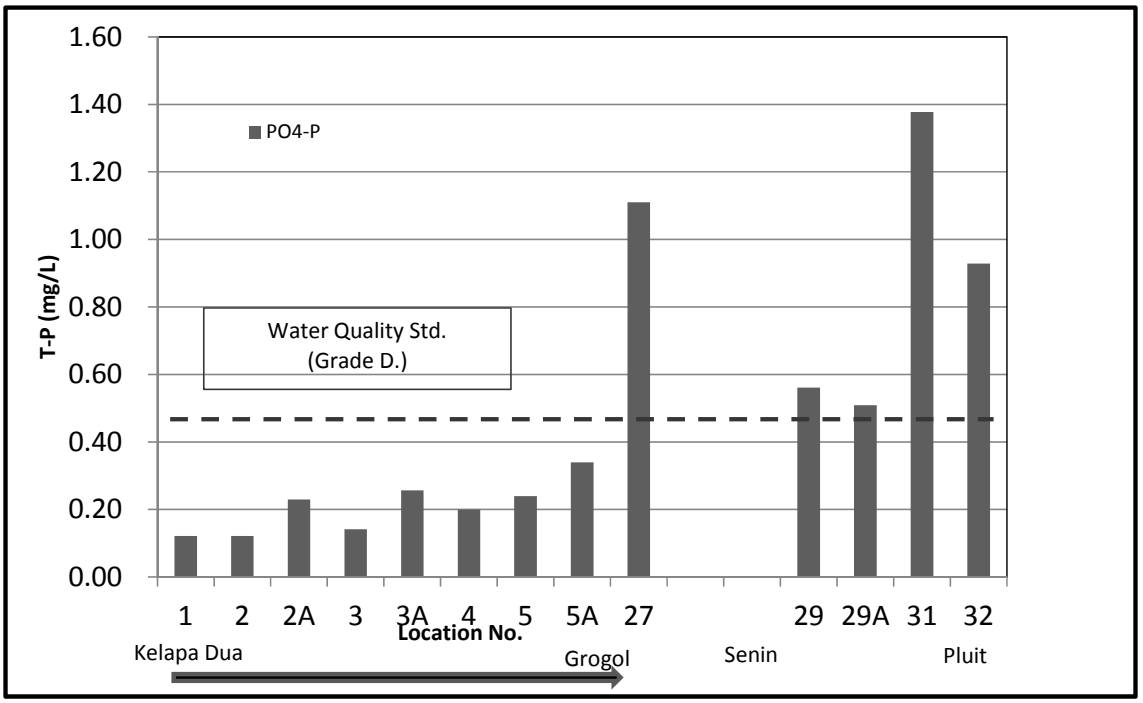


Figure S/R-B3-14 T-P along Ciliwung River

It is assumed that a lot of sludge generated from upstream or midstream of main river in DKI Jakarta is accumulated at the bottom of downstream. More data regarding bottom sludge is required to clarify the phenomena of water pollution by phosphorous.

T-P value at each location is categorized by the month of low rainfall (the column shown with yellow in Table, average 62mm/month) and the month of high rainfall (the column shown with green in Table, average 237 mm/month).

Table S/R-B3-14 Differences of T-P on between Low Rainfall and High Rainfall along Main River in DKI Jakarta (Year Surveyed: 2006-2010, Number of analysis: 14 times, Location Measured: 67 Locations)

		Ave.	Max.	Min.	Div.	Sample Number	Number>=1.5mg/L	
		MPN/100ml	MPN/100ml	MPN/100ml	MPN/100ml	Nos.	Nos.	(%)
Dry Month	2006_6	0.74	2.53	0.02	0.72	67	15	22
	2007_6	1.56	4.85	0.04	1.43	67	30	45
	2008_8	1.18	4.17	0.04	1.07	66	19	29
	2008_10	0.56	2.10	0.05	0.57	66	5	8
	2009_4	0.50	4.82	0.02	0.73	67	4	6
	2009_7	0.85	4.14	0.02	0.77	67	14	21
	2010_5	0.58	2.15	0.03	0.55	45	5	11
	7 samples	0.87	4.85	0.02	0.96	445	92	21
Rainy Month	2006_12	0.70	3.53	0.05	0.71	35	4	11
	2007_12	0.39	2.31	0.01	0.57	67	5	7
	2008_11	0.47	3.60	0.01	0.66	67	5	7
	2010_3	0.59	2.43	0.03	0.71	45	5	11
	2010_8	0.61	1.78	0.01	0.55	45	3	7
	2010_10	0.47	1.70	0.03	0.50	41	2	5
	2010_11	0.29	0.95	0.01	0.30	38	0	0
	7 samples	0.49	3.60	0.01	0.60	338	24	7

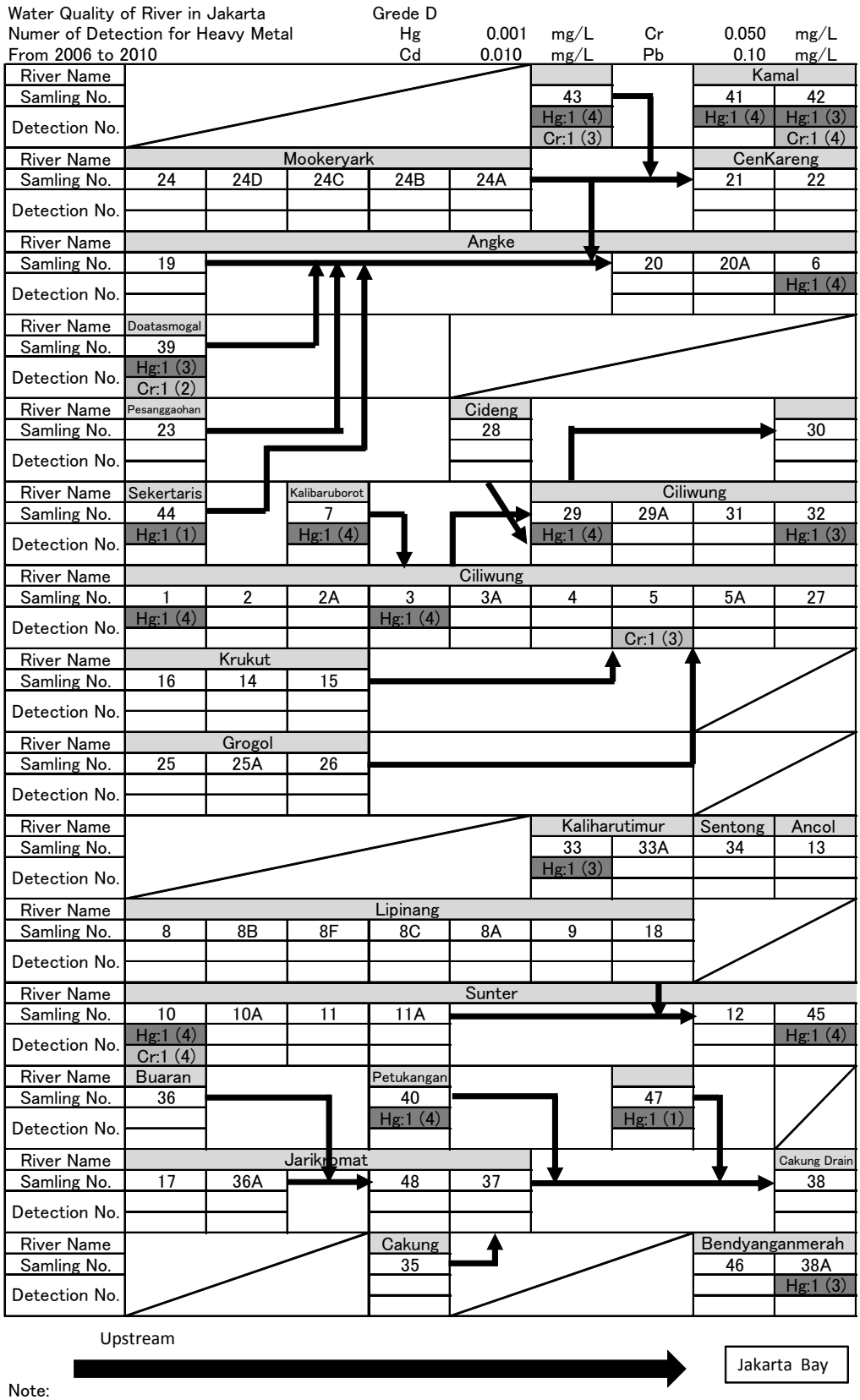
Table S/R-B3-14 is summarized below.

- Average T-P along main river in DKI Jakarta on the month of low rainfall (average 62mm/month) and on the month of high rainfall (average 237mm/month) are 0.87mg/L and 0.49mg/L, respectively. These values mean that T-P on the dry season is approximate 0.38 mg/L higher, that is, approximate 1.8 times higher than on the rainy season.

(5) Heavy Metal

Figure S/R-B3-15 shows the frequency which the concentration of mercury, total chromium, cadmium and lead are detected above 0.001mg/L, 0.05mg/L, 0.010mg/l and 0.10mg/L, respectively at the 67 locations on the mail rivers in DKI Jakarta by total 14 times analysis.

Ref: Water quality standards based on WHO guideline for drinking water are as follows; Mercury: 0.001mg/L, Total Chromium: 0.05mg/L, Cadmium: 0.003mg/L, Lead: 0.01mg/L



Note:
Hg: 1(4) means that merqury was analyzed total 4 times and merqury which was water quality standard, 0.001mg/L or more was detected.

Figure S/R-B3-15 Detection Frequency of Mercury, Total Chromium, Cadmium and Lead on the Main Rivers in DKI Jakarta (Periods : 2006- 2010, Times Surveyed :14times, Number of Locations : 67 Locations)

Figure S/R-B3-15 is summarized below.

- Mercury over WHO guideline standard is detected at the following 17 locations;
- Cenkareng along Kamal（Location 41, 42）, Bintaro （Location 43）,industrial site at Pulo Gadung （Location 39）, Penjaringan along Angke river （Location 6）, Kubayoran Lama along Sekrtaris river (Location 44), Cianjur along Kalibaruborot river (Location 7), Kurala Dua along Ciliwung river (Location 1), Manggarai (Location 3), Pluit (Location 32), Pasar Rebo along Kaliharutimur river (Location 33), Cibubur (Location 10), Kurapa Gading (Location 45), Puro Gadung along Petukangan river (Location 40), Cakung along Molong river (Location 47), Murunda along Bendynganmerah river (Location 38A).
- Total Chromium over WHO guideline standard is detected at the following 5 locations;

Bintaro along Pesonggrahan river (Location 43), Cenkareng along Kamal river (Location 42), industrial site at Pulo Gadung (Location 39), Melati along Ciliwung river (Location 5), Cibubur along Sunter river (Location 10)

It is assumed that mercury or chromium detected at location described above is resulted from the wastewater withdrawn without appropriate treatment from factory.

B4 Present Conditions and Issues of Off-Site Sanitation

B4.1 Existing Off-Site Sanitation Facilities Constructed Under JSSP

B4.1.1 Wastewater Treatment Plant

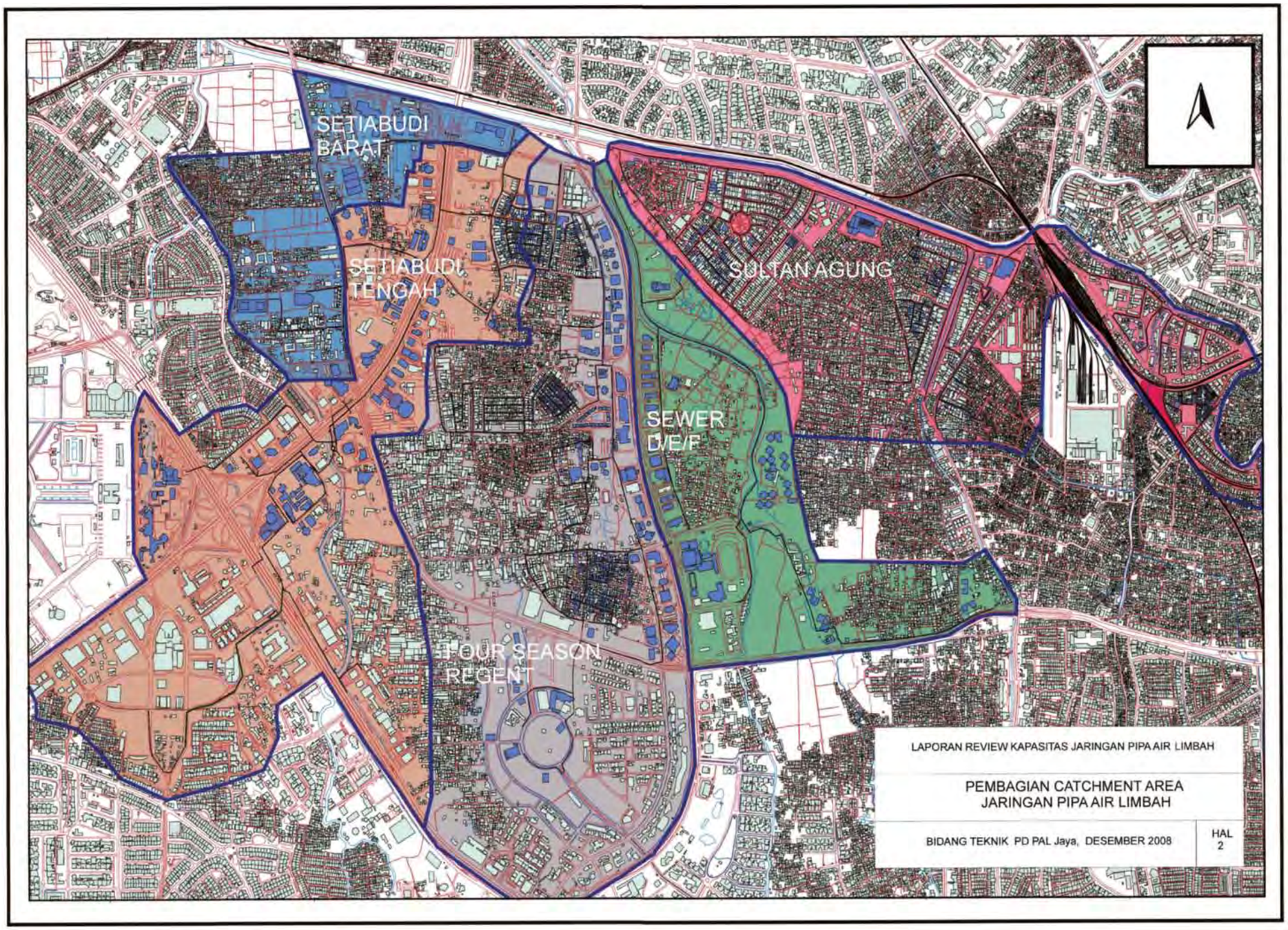


Figure S/R-B4-1 Layout of Wastewater Treatment Plant

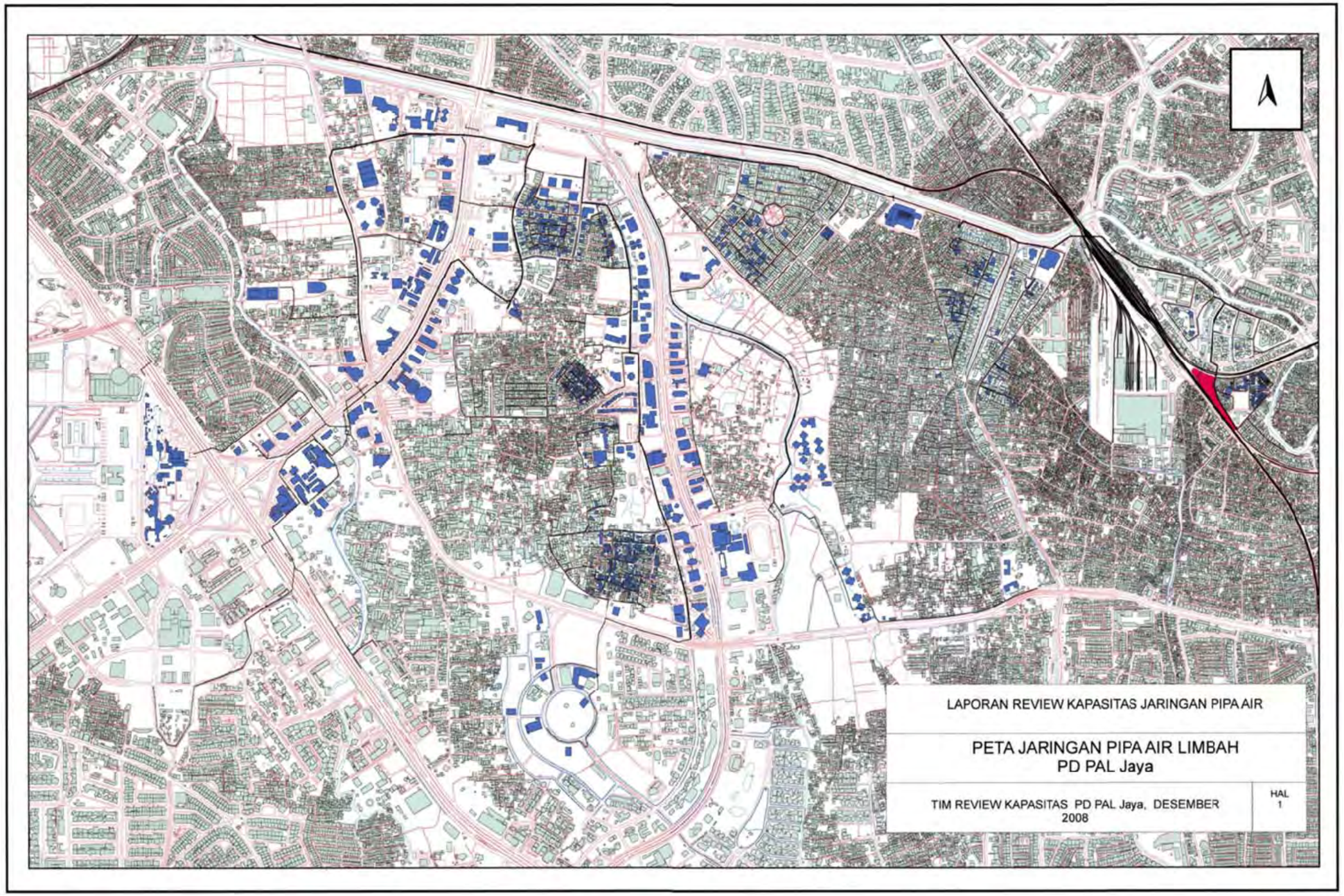


Figure S/R-B4-2 Layout of Sewer Pipeline (1/6)

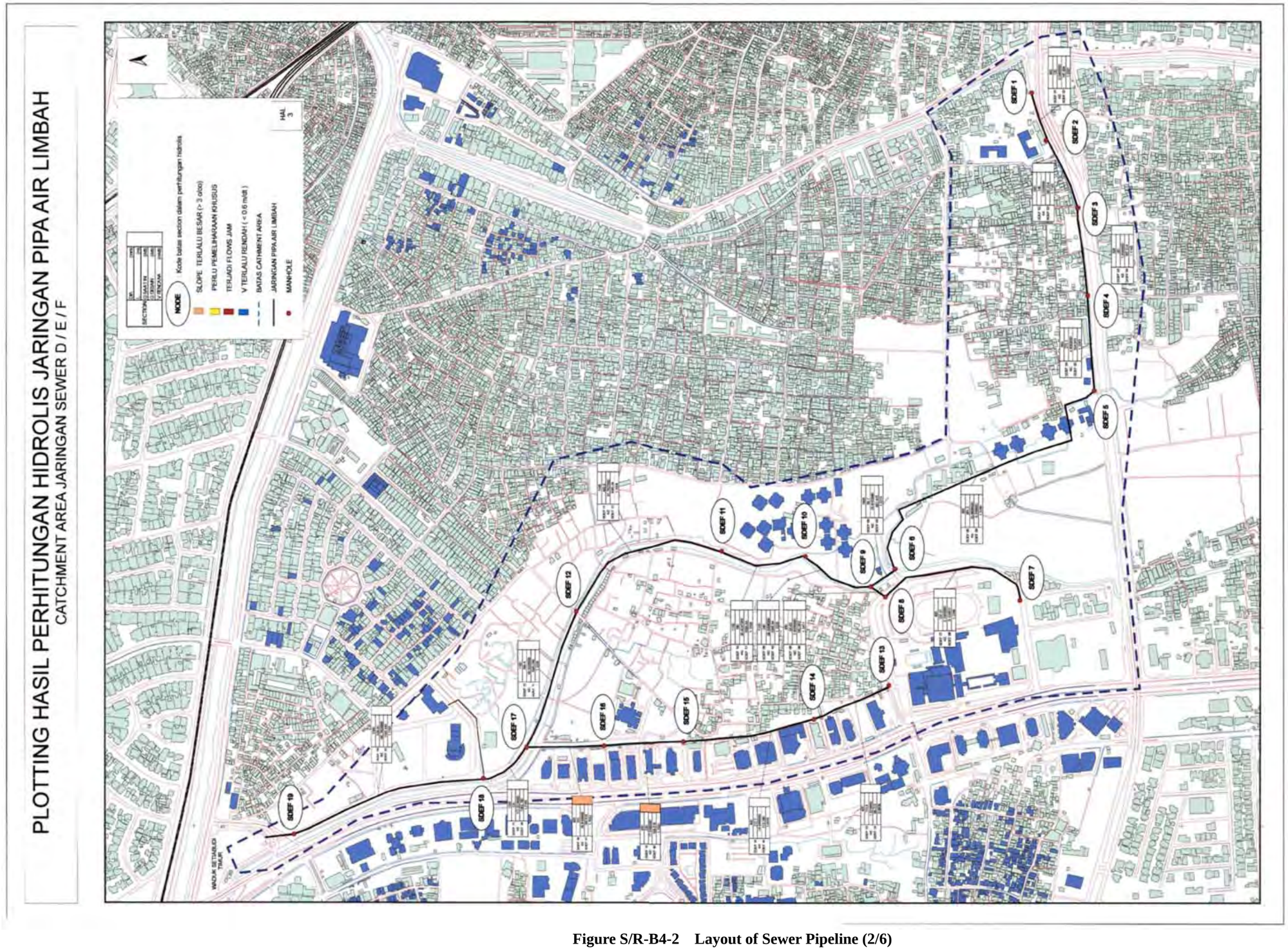


Figure S/R-B4-2 Layout of Sewer Pipeline (2/6)

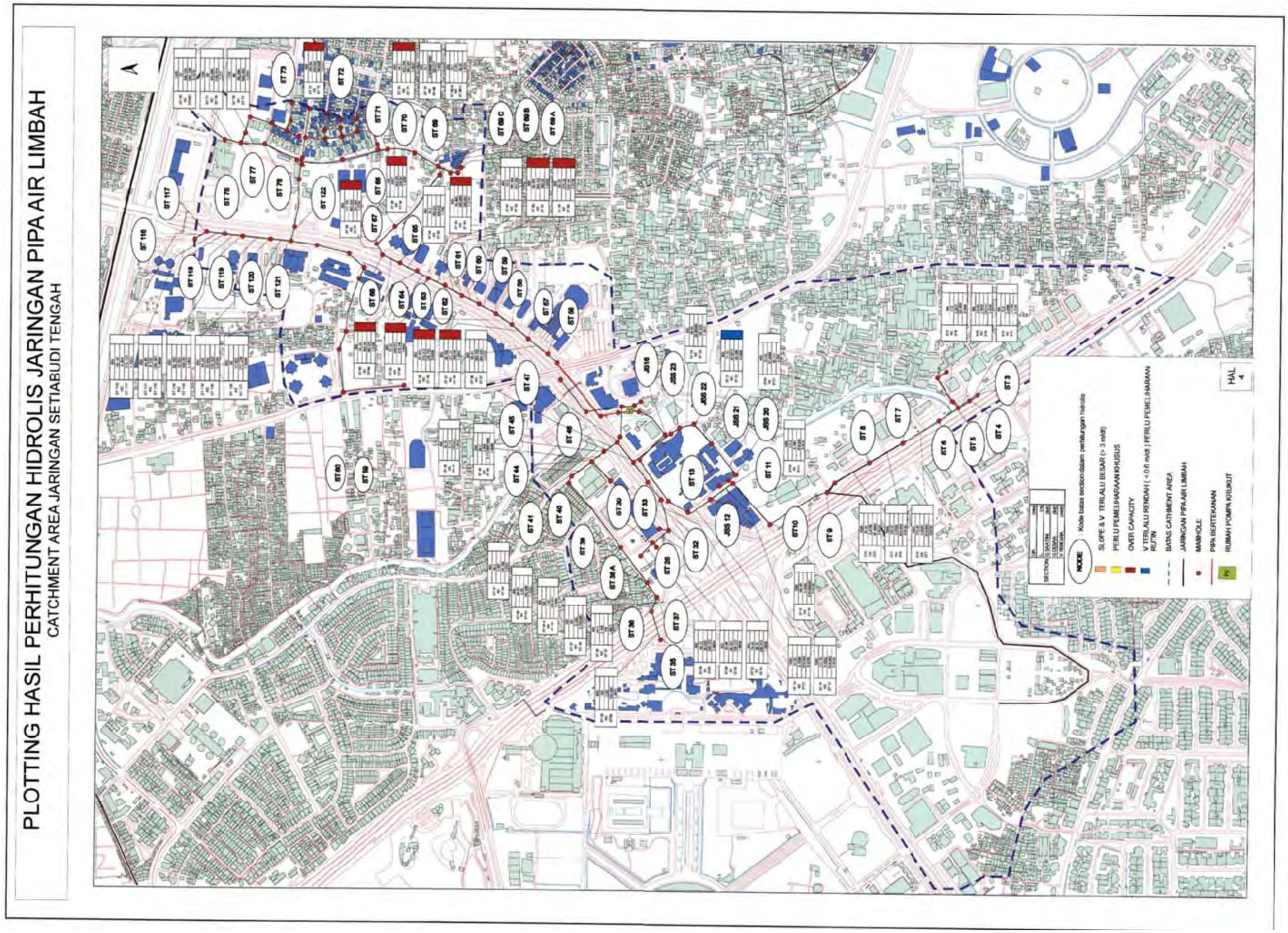


Figure S/R-B4-2 Layout of Sewer Pipeline (3/6)

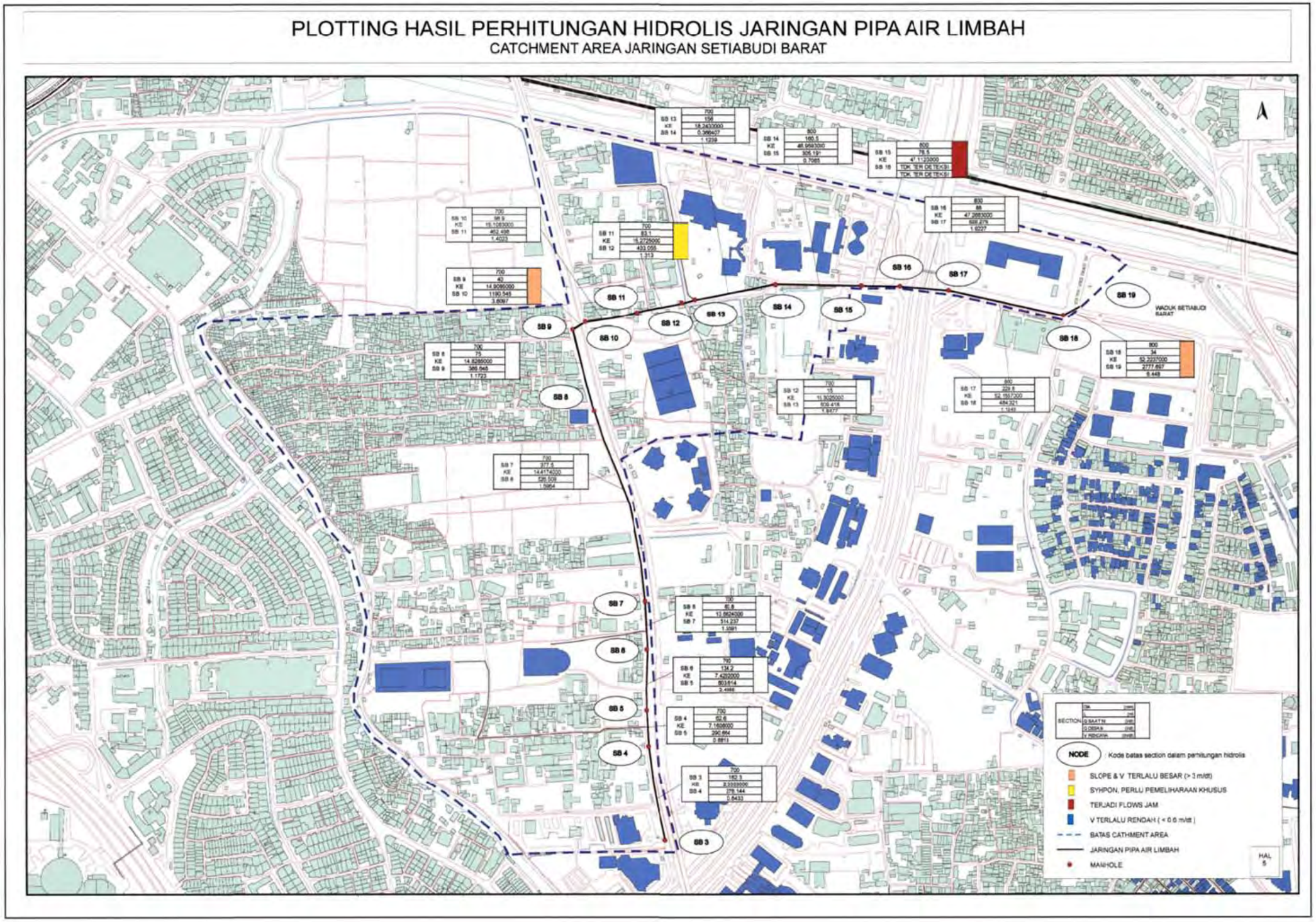


Figure S/R-B4-2 Layout of Sewer Pipeline (4/6)

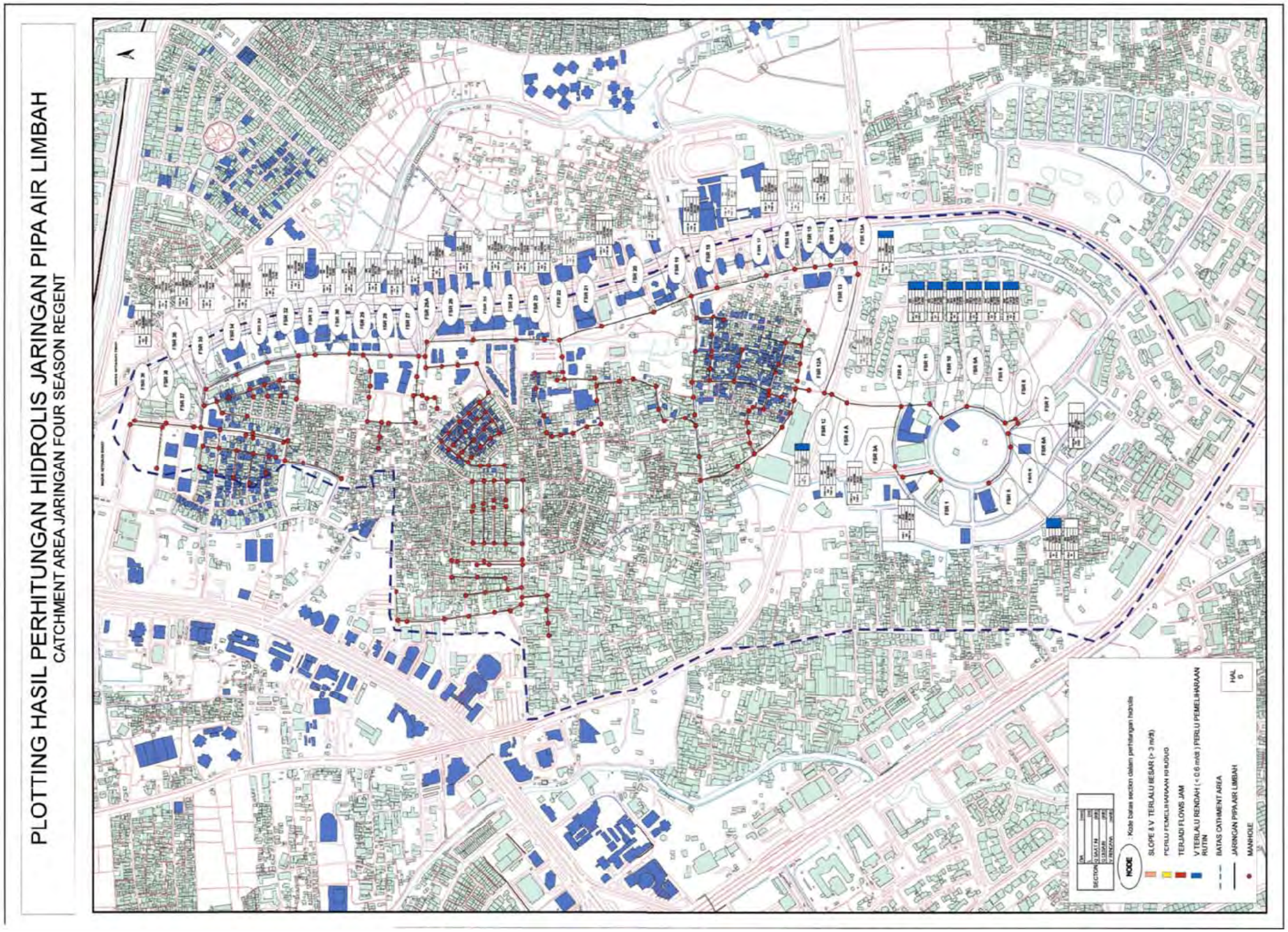


Figure S/R-B4-2 Layout of Sewer Pipeline (5/6)

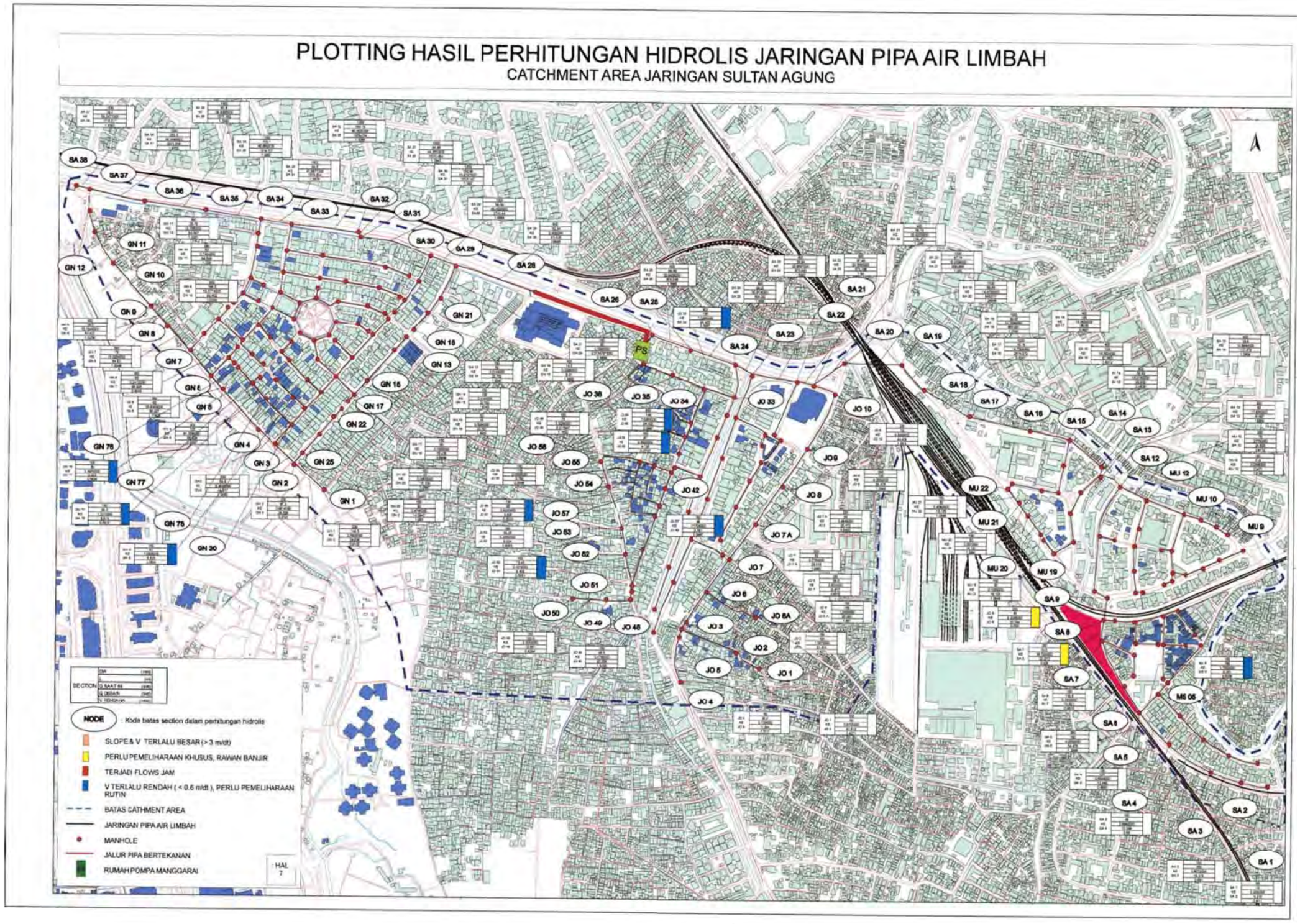


Figure S/R-B4-2 Layout of Sewer Pipeline (6/6)

B4.1.3 Sewer Network

Table S/R-B4-1 Existing sewerage pipe system (by each catchment area)

Pipe Diameter (mm)	Catchment Area														Recapilation of Existing Pipe Line			
	Sultan Agung			Sewer D, E, & F			Four Season Region			Setiabudi Tengah			Setiabudi Barat					
	Pipe (m)	Manhole (Unit)	Service Pipe (m)	Inspection Chamber (Unit)	Pipe (m)	Manhole (Unit)	Service Pipe (m)	Inspection Chamber (Unit)	Pipe (m)	Manhole (Unit)	Service Pipe (m)	Inspection Chamber (Unit)	Pipe (m)	Manhole (Unit)	Service Pipe (m)	Inspection Chamber (Unit)	Pipe (m)	Manhole (Unit)	Service Pipe (m)	Inspection Chamber (Unit)
100	-	-	8,781.45	1,413.00	-	-	-	-	2,199.20	76.00	4,715.95	985.00	-	1.00	28.00	1.00	-	-	5.00	-	2,199.20	77.00	13,530.40	2,399.00
150	11,138.61	282.00	184.00	14.00	-	-	-	-	4,115.40	196.00	2,237.35	588.00	1,092.46	43.00	944.00	229.00	-	-	300.00	1.00	16,346.47	521.00	3,665.35	832.00
200	4,288.55	118.00	16.00	2.00	-	-	114.00	8.00	2,585.05	67.00	990.88	130.00	-	17.00	365.65	12.00	36.00	-	18.00	3.00	6,909.60	202.00	1,504.53	155.00
250	703.50	16.00	-	-	-	-	361.10	18.00	1,003.30	7.00	217.50	2.00	79.38	2.00	90.60	2.00	99.00	2.00	-	1.00	1,885.18	27.00	669.20	23.00
300	378.60	6.00	40.40	3.00	239.00	6.00	325.00	13.00	1,456.85	36.00	681.75	8.00	317.40	9.00	1,346.36	36.00	-	6.00	345.00	5.00	2,391.85	63.00	2,738.51	65.00
350	510.81	10.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	510.81	10.00	-	-
400	397.20	9.00	-	-	388.00	7.00	-	-	488.20	4.00	-	-	960.92	30.00	-	-	158.00	5.00	-	-	2,392.32	55.00	-	-
450	-	-	-	-	519.00	9.00	-	-	2,544.00	81.00	-	-	2,276.54	73.00	303.16	12.00	-	-	-	-	5,339.54	163.00	303.16	12.00
500	-	-	-	-	470.00	9.00	-	-	744.90	-	-	-	221.87	5.00	-	-	-	-	-	-	1,436.77	14.00	-	-
600	580.20	10.00	-	-	1,056.20	15.00	-	-	1,182.45	20.00	-	-	1,536.00	28.00	-	-	-	-	-	-	4,354.85	73.00	-	-
700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,082.20	18.00	-	-	1,082.20	18.00	-	-
800	601.01	10.00	-	-	-	-	82.27	1.00	-	-	-	-	321.10	-	-	-	808.80	17.00	-	-	1,730.91	27.00	82.27	1.00
1000	203.46	5.00	-	-	80.70	1.00	-	-	-	-	-	-	3,855.95	32.00	-	-	-	-	-	-	4,140.11	38.00	-	-
1100	-	-	-	-	1,162.50	17.00	-	-	-	-	-	-	204.52	3.00	-	-	-	-	-	-	1,367.02	20.00	-	-
1200	-	-	-	-	-	-	-	-	-	-	-	-	129.00	2.00	-	-	-	-	-	-	129.00	2.00	-	-
1300	1,028.42	14.00	-	-	669.49	12.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,697.91	26.00	-	-
1500	-	-	-	-	63.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63.00	1.00	-	-
Total	19,830.36	480.00	9,021.85	1,432.00	4,647.89	77.00	882.37	40.00	16,319.35	487.00	8,843.43	1,713.00	10,995.14	245.00	3,077.77	292.00	2,184.00	48.00	668.00	10.00	53,976.74	1,337.00	22,493.42	3,487.00

Source : PD PAL JAYA, Annual Report of Technical Section 2010

B4.2 ITP for Commercial and Institutional Entities

B4.2.1 ITP Operated by PD PAL JAYA

Table S/R-B4-2 List of ITP Operated by PD PAL JAYA

APPENDIX List of ITP operated by PD PAL JAYA

No.	ITP Name	Category	Capacity (m3/day)	Treated methods	Bacherial grouth	BOD Influent (mg/l)	BOD Effluent (mg/l)	COD Influent (mg/l)	COD Effluent (mg/l)	SS Influent (mg/l)	SS Effluent (mg/l)	Ammonia Influent (mg/l)	Ammonia Effluent (mg/l)	Location	Area
1	STP Aston *1	Hotel	400	Bio activator	Suspended-Attached growth	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Aston Slipi Jl. Jend. S. Parman Kav. 22-24 Jakarta Barat	Barat
2	STP Tifa Arum	Office	100	Bio activator	Suspended-Attached growth	92	43	157	79	63	30	4,6	4	Tifa Arum Building Jl. Kuningan Barat 26 Jakarta 12710	Selatan
3	STP Agro	Office	275	Extended Aeration process	Suspended growth	88	30	209	69	200	**50**	3	2	Agro building Jl. H.R. Rasuna Said Kav. XZ/1 Jakarta Selatan	Selatan
4	STP Cengkareng *2	Apartment	150	Extended Aeration process	Suspended growth	150	**75**	Unknown	Unknown	150	**100**	Unknown	Unknown	Perumnas Cengkareng Jakarta Barat	Barat
5	STP Menara Danamon	Office	261	Bio activator	Suspended-Attached growth	158	**66**	230	**80**	94	42	2,5	2,1	Menara Danamon Building Kompleks Mega Kuningan Jakarta Selatan	Selatan
6	STP Manara Dea	Office	120	Rotating Biological Contactor(RBC)	Attached growth	116	**71**	149	**92**	250	**50**	1,99	1,3	Menara Danamon Building Kompleks Mega Kuningan Jakarta Selatan	Selatan
7	STP Pasific Paint	Factory	29	Extended Aeration process	Suspended growth	176 203	**60** **53**	243 221	**84** **93**	80 67	30 14	10,4 9,7	5,6 6	PT. Pasific Paint Jl. Industri No.1 (Laks. R.E,Martadinata) Tanjung Priok Jakarta Utara	Utara
	Effluent Water Quality Standards *3					50		80		50		10			

*1. STP Agro still not be oparated yet (new STP)
*2. STP Cengkareng is broken, because of that PD PAL don't do water quality check. Regarding result of BOD and SS are based on hearing from PD PAL JAYA.
*3. Governor Regulation NO 122 / 2005, Domestic Wastewater Quality Standards for communal
Source :Water quality analysis report, PD PAL JAYA, 2010

B4.2.3 ITP Built by Others

Table S/R-B4-3 List of Sampling Survey for ITP built by Others

New No.	Category	Capacity	SES -No.	Buillding Name	Existing M/P
1	shops	Large	5	Ratu Plaza building	V
2		Large	6	Pasar Pagi Mangga Dua	V
3		Large	7	Plaza Blok M	
4		Large	8	Gajah Mada Plaza building	V
5		Large	9	Gedung Pasaraya Grande Blok - M	
6		Large	10	Glodok Plaza building	V
7		Large	11	Pramuka Market building (Pasar Pramka)	V
8	hotel	Small	22	Hotel Sofyan Tebet	V
9		Middle	24	Hotel Sofyan Betawi (Cut Mutia)	
10		Large	25	Hotel Menteng I	V
11		Large	26	Hotel Menteng II	
12		Large	27	Hotel Borobudur Jakarta	V
13		Large	28	Hotel The Sultan	V
14		Large	29	Hotel Nikko	V
15		Large	30	Hotel Grand Sahid Jaya	V
16	office	Small	37	PT. Indosat	
17		Large	41	Wisma Asia Slipi	
18		Large	42	Chase Plaza building	V
19		Large	43	Gedung BPPT (Menara Patra building)	V
20		Large	44	Indocement building	V
21		Large	45	Setiabudi II	V
22		Large	46	Pertambangan (mining) building (Gedung Aneka Tambang)	V
23		Large	47	Wisma BCA	V
24	factory	Small	12	CV. Mahera	
25		Large	17	PT. Pam Lyonnaise Jaya (Cilandak)	
26	restaurant	Large	19	Restoran Putri Duyung Ancol	
27	hospital	Small	31	Prodia Widya Husada Kedoya	
28		Large	36	RSPAD. Gatot Soebroto (Jiwa)	
29	school	Small	48	PT. Central International School (Sekolah Central School)	
SES-No. : Socio-Economic Survey Number					17
	Office		-	Sharp	
	Office		-	Japan Embassy	
	Office		-	Kumon	
	Hospital		-	Eeha Clinic	
	Hospital		-	Erha Clinic	
	Others		-	Apartment Gardenia Bouleuard	

Table S/R-B4-4 Results of Sampling Survey for ITP built by Others (1/2)

Results of Sampling Survey for Individual Treatment Plant(ITP) built by others

New No.	Category	Capacity	SES -No.	Buillding Name	Existing M/P	STP (Individual Treatment Plant)							Effluent Water Quality								Condition of Operation and Maintenance					
						Wastewater Treatment Method		Treatment capacity (m3/day)	Maximum Treatment capacity (m3/day)	Installation year	Year of connecting sewer pipes	Wastewater Treated		in 1991(Existing M/P)				in 2011(Inspection by BPLHD)				Operation & Maintenance	Water quality management	Frequency of De-sludging (/year)	Evaluation items		
						in 1991	in 2011 (now)					Black water and gray water	Only black water	CODcr (mg/l)	BOD 20℃,5Days (mg/l)	Fecal Coliform (/100cc)	SS (mg/l)	CODcr (mg/l)	BOD 20℃,5Days (mg/l)	SS (mg/l)	Ammonia (mg/l)				Effluent water quality	Maintenance condition of process and	Understanding of O&M
1	shops	Large	5	Ratu Plaza building	V	Extended aeration	Extended aeration	300	600	1980	-	V		96	53	2.30E+04	60	45	15	16	1	sufficient	V	1	OK	OK	OK
2		Large	6	Pasar Pagi Mangga Dua	V	Septic Tank with filter	Extended aeration	325	410	1988	-		V	1,042	940	2.30E+07	35	unknown	unknown	unknown	unknown	sufficient	V	0*	OK	OK	OK
3		Large	7	Plaza Blok M		-(unknown)	Extended aeration	250	300	1990	-	V		unknown	unknown		unknown	78	36	10	**18**	insufficient		1	ng	ng	OK
4		Large	8	Gajah Mada Plaza building	V	Extended aeration	Extended aeration	500	700	1980	-	V		514	370	2.40E+07	150	24	5	6	0	insufficient		2	OK	ng	ng
5		Large	9	Gedung Pasaraya Grande Blok - M		-(unknown)	Extended aeration	90	420	2007	-	V		unknown	unknown		unknown	**90**	27	39	**44**	insufficient		2	ng	ng	ng
6		Large	10	Glodok Plaza building	V	Extended aeration	Extended aeration	unknown	100	1987	-	V		1,516	880	1.50E+07	180	54	20	12	**75**	insufficient	V	2	ng	ng	OK
7		Large	11	Pramuka Market building (Pasar Pramka)	V	Septic Tank	Septic Tank	unknown	unknown	1984	-	V		1,239	980	1.50E+08	17	unknown	unknown	unknown	unknown	sufficient		3	Evaluated by de-sludoging		
8	hotel	Small	22	Hotel Sofyan Tebet	V	Septic Tank	Extended aeration	70	80	2002	-	V		645	486	2.30E+05	220	15	8	11	**14**	insufficient		0	Evaluated by de-sludoging		
9		Middle	24	Hotel Sofyan Betawi (Cut Mutia)		-(unknown)	Extended aeration	80	unknown	1992	-	V		unknown	unknown		unknown	**85**	25	**60**	**25**	insufficient		1	ng	ng	OK
10		Large	25	Hotel Menteng I	V	Septic Tank	Extended aeration	19	40	1998	-	V		911	617	9.30E+06	60	53	17	11	0	insufficient		1	OK	OK	OK
11		Large	26	Hotel Menteng II		-(unknown)	Extended aeration	16	40	2004	-	V		unknown	unknown		unknown	25	11	6	0	sufficient		1	OK	OK	OK
12		Large	27	Hotel Borobudur Jakarta	V	Extended aeration	Extended aeration	800	1500	1963	-	V		175	140	2.30E+05	40	26	8	7	1	sufficient		1	OK	OK	OK
13		Large	28	Hotel The Sultan	V	Extended aeration	Extended aeration / connect sewer pipe	400	600	1985	2005	V		1,509	1,164	1.10E+04	60	51	12	5	1	sufficient	V	As appropriate	OK	OK	OK
14		Large	29	Hotel Nikko(Hotel President)	V	Septic Tank	Extended aeration	800	925	1994	-	V		2,143	1,251	2.30E+06	460	46.33	16.85	45	**17**	insufficient	V	1	ng	OK	OK
15		Large	30	Hotel Grand Sahid Jaya	V	Septic Tank	Connect sewer pipe	-	-	-	1997	V		445	249	2.30E+08	20	-	-	-	-	-	-	-	-	-	-
16	office	Small	37	PT. Indosat		-(unknown)	Others(Bio tank)	unknown	unknown	unknown	-	V		unknown	unknown	unknown	unknown	27	11.1	5	**23**	insufficient	V	1	ng	OK	OK
17		Large	41	Wisma Asia Slipi		-(unknown)	Extended aeration	80	90	1997	-		V	unknown	unknown	unknown	unknown	30	13	12	5	sufficient		2	OK	OK	OK
18		Large	42	Chase Plaza building	V	Extended aeration	Connect sewer pipe	-	-	-	1991	V		184	126	9.30E+05	40	-	-	-	-	-	-	-	-	-	-
19		Large	43	Gedung BPPT (Menara Patra building)	V	Extended aeration	Extended aeration	unknown	unknown	1992	-	V		107	78	2.30E+05	10	unknown	unknown	unknown	unknown	insufficient		0	unknown	ng	ng
20		Large	44	Indocement building	V	Rotating Biological Contactor	Connect sewer pipe	-	-	-	1991	V		122	78	9.30E+05	40	-	-	-	-	-	-	-	-	-	-
21		Large	45	Setiabudi II	V	Septic Tank	Connect sewer pipe	-	-	-	1991	V		419	243	4.60E+07	20	-	-	-	-	-	-	-	-	-	-
22		Large	46	Pertambangan (mining) building (Gedung Aneka Tambang)	V	Septic Tank	Extended aeration	40	60	1990	-	V		940	720	9.30E+06	15	23	9	11	3	sufficient	V	1	OK	OK	OK
23		Large	47	International Financial Building(Wisma BCA)	V	Extended aeration	Connect sewer pipe	-	-	-	unknown	V		114	90	4.30E+07	10	-	-	-	-	-	-	-	-	-	-
24	factory	Small	12	CV. Mahera		-(unknown)	Modified septic tank (treat only black water)	unknown	12	2004	-		V	unknown	unknown	unknown	unknown	70	27	15	-	sufficient		1	OK	OK	OK
25		Large	17	PT. Pam Lyonnaise Jaya (Cilandak)		Septic Tank	Septic Tank (treat only black water)	unknown	unknown	1963-2011	-		V	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	insufficient		1	unknown	ng	ng
26	restaurant	Large	19	Restoran Putri Duyung Ancol		-(unknown)	Extended aeration	30	40	unknown	-	V		unknown	unknown	unknown	unknown	40	7	2	0	sufficient	V	0	OK	OK	OK
27	hospital	Small	31	Prodia Widya Husada Kedoya		-(unknown)	Others(anaerobic and	2	3	2009	-	V		unknown	unknown	unknown	unknown	11	47	19	**13**	insufficient		0	ng	OK	OK
28		Large	36	RSPAD. Gatot Soebroto (Jiwa)		-(unknown)	Extended aeration	791	1091	1945	-	V		unknown	unknown	unknown	unknown	78	28	10	**14**	insufficient	V	0	ng	OK	OK
29	school	Small	48	PT. Central International School (Sekolah Central School)		-(unknown)	Others(Peret dosing process)	60	70	2004	-	V		unknown	unknown	unknown	unknown	14	8	5	**39**	insufficient		0	ng	OK	OK

Table S/R-B4-4 Results of Sampling Survey for ITP built by Others (2/2)

Results of Sampling Survey for Individual Treatment Plant(ITP) built by others

New No.	Category	Capacity	SES -No.	Buillding Name	Existing M/P	STP (Individual Treatment Plant)		Recycle watsewater system								Water use(except drinking water)										Willingness to connect with sewer pipe					Inside existing sewerage area
						Wastewater Treatment Method		They have	Now planning	Now considering	Nothing	Past time used	Installation year	Method of reuse	Coments about reuse	PDAM		Private well		Wastewater reuse		Total	unit cost(IDR/m3)			Deep well depth(m)	Yes	No	Depend on cost	Cannot determine	Already connected	
						in 1991	in 2011 (now)									amount (m3/day)	rate (%)	amount (m3/day)	rate (%)	amount (m3/day)	rate (%)	amount (m3/day)	PAM charge	groundwater tax	Wastewater reuse							
1	shops	Large	5	Ratu Plaza building	V	Extended aeration	Extended aeration				V					400	100%	0	0%	0	0%	400	12,500	-	-	60			V			
2		Large	6	Pasar Pagi Mangga Dua	V	Septic Tank with filter	Extended aeration	V					2004	Sand filter and carbon filter		115	42%	40	15%	120	44%	275	12,500	23,000	unknown	150, 250				V		
3		Large	7	Plaza Blok M		-(unknown)	Extended aeration	V					1990	(1)Coagulation-sedimentation and carbon filter /(2)Membrane		429	90%	0	0%	48	10%	477	12,500	-	unknown	80			V			
4		Large	8	Gajah Mada Plaza building	V	Extended aeration	Extended aeration					V	2007	Sand filter and carbon filter	Target of reuse amount is 200m3/day coud not be	800	100%	0	0%	0	0%	800	12,500	85,000	unknown	80				V		
5		Large	9	Gedung Pasaraya Grande Blok - M		-(unknown)	Extended aeration					V	2007	Sand filter	Target of reuse rate is 40% coud not be reached.	unknown	100%	0	0%	0	0%	unknown	unknown	unknown	-	120			V			
6		Large	10	Glodok Plaza building	V	Extended aeration	Extended aeration			V						64	80%	16	20%	0	0%	80	12,500	16,500		100			V			
7		Large	11	Pramuka Market building (Pasar Pramka)	V	Septic Tank	Septic Tank				V					unknown	unknow	unknown	unknown	0	0%	unknown	unknown	unknown	-	24	V					
8	hotel	Small	22	Hotel Sofyan Tebet	V	Septic Tank	Extended aeration				V					40	50%	40	50%	0	0%	80	unknown	unknown	-	25			V			
9		Middle	24	Hotel Sofyan Betawi (Cut Mutia)		-(unknown)	Extended aeration				V					unknown		unknown		0	0%	100	unknown	unknown	-	unknown				V		
10		Large	25	Hotel Menteng I	V	Septic Tank	Extended aeration				V					18	75%	6	25%	0	0%	24	74,000	278,000	-	80				V		
11		Large	26	Hotel Menteng II		-(unknown)	Extended aeration				V					unknown		unknown		0	0%	16	unknown	unknown	-	unknown	V					
12		Large	27	Hotel Borobudur Jakarta	V	Extended aeration	Extended aeration	V					1997	Sand filter and carbon filter		210	70%	0	0%	90	30%	300	12,500	not use	4,800	-				V		
13		Large	28	Hotel The Sultan	V	Extended aeration	Extended aeration / connect sewer pipe		V							750		0	0%	0	0%	750	12,500	not use	-	-		V				V
14		Large	29	Hotel Nikko(Hotel President)	V	Septic Tank	Extended aeration	V					2006	UF filter and carbon filter		552	64%	0	0%	310	36%	862	unknown	not use	-	-		V				
15		Large	30	Hotel Grand Sahid Jaya	V	Septic Tank	Connect sewer pipe				V					1188	99%	12	1%	0	0%	1200	unknown	unknown	-	150					V	V
16	office	Small	37	PT. Indosat		-(unknown)	Others(Bio tank)				V					unknown	unknow	unknown	unknown	unknown	unknow	unknown	unknown	unknown	unknown	unknown				V		
17		Large	41	Wisma Asia Slipi		-(unknown)	Extended aeration				V					unknown		unknown		0	0%	100	unknown	unknown	-	unknown	V					
18		Large	42	Chase Plaza building	V	Extended aeration	Connect sewer pipe				V					unknown	90%	unknown	10%	0	0%	40	5,500	6,500	-	82					V	V
19		Large	43	Gedung BPPT (Menara Patra building)	V	Extended aeration	Extended aeration	V					unknown	Sand filter and carbon filter	only used for gardening	unknown	unknow	0	0%	unknown	unknow	unknown	unknown	-	-	-				V		
20		Large	44	Indocement building	V	Rotating Biological Contactor	Connect sewer pipe			V						147	100%	0	0%	0	0%	147	12,500	84,000	-	60					V	V
21		Large	45	Setiabudi II	V	Septic Tank	Connect sewer pipe		V							65	100%	0	0%	0	0%	65	12,500	60,000	-	200					V	V
22		Large	46	Pertambangan (mining) building (Gedung Aneka Tambang)	V	Septic Tank	Extended aeration		V							0	0%	30	100%	0	0%	30	-	unknown	-	unknown			V			
23		Large	47	International Financial Building(Wisma BCA)	V	Extended aeration	Connect sewer pipe				V					unknown	unknow	unknown	unknown	0	0%	200	unknown	unknown	-	unknown					V	V
24	factory	Small	12	CV. Mahera		-(unknown)	Modified septic tank (treat only black water)				V					unknown	100%	0	0%	0	0%	unknown	12,500	-	-	-	V					
25		Large	17	PT. Pam Lyonnaise Jaya (Cilandak)		Septic Tank	Septic Tank (treat only black water)				V					unknown	100%	0	0%	0	0%	0		-	-	-	V					
26	restaurant	Large	19	Restoran Putri Duyung Ancol		-(unknown)	Extended aeration				V					34	100%	0	0%	0	0%	34	12,500	-	-	-				V		
27	hospital	Small	31	Prodia Widya Husada Kedoya		-(unknown)	Others(anaerobic and				V					0	0%	3	100%	0	0%	3	-	unknown	-	34	V					
28		Large	36	RSPAD. Gatot Soebroto (Jiwa)		-(unknown)	Extended aeration				V					1753	100%	0	0%	0	0%	1753	unknown	-	-	-	V					
29	school	Small	48	PT. Central International School (Sekolah Central School)		-(unknown)	Others(Peret dosing process)				V					80	100%	0	0%	0	0%	80	10,000	-	-	-	V					

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (1/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	16-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	1		Social Economic Survey No.	5	
I - 2	Company Name / Building Name		PT. Ratu Sayang International			Ratu Plaza building		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1980	(Installed building in 1980)	
I - 5	Treatment capacity（m^3/day）(3-6)		300		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		600		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.6	6 - 9			
	2	$KMnO_4$	mg/l	29.27	85			
	3	Suspended solids (SS)	mg/l	16	50			
	4	Ammonia	mg/l	0.59	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.03	2			
	7	COD (Dichromate)	mg/l	44.9	80			
	8	BOD (20℃, 5days)	mg/l	15.05	50			
I - 8	Latest date of inspection		1-Feb-11					
I - 9	Sampling Point		Inlet pit (once a year) and Effluent storage tank (once a 3 months)					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		1 times a year (by private company. obtained record.)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source is tap water (PDAM). Private well is installed (60m) but isn't used because of groundwater quality is bad (high concentration of color) and groundwater taxes is high. If they use private well, they have to install water treatment plant.						
		* O&M : Implement by themselves (24 hours).						
		* Own water quality management : They check effluent pH every day. Effluent water quality is checked by private company every 3 months except for submitting to BPLHD.						
		* Problem : There are a lot of scum in inlet pit.Therefore, everyday they remove the scum manually. In Novenber 2010, Effluent water quality was high concentration of Ammonia.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (2/37)

Ⅱ Conditions of the facility			Sampling Survey No.	1	Building Name	Ratu Plaza building

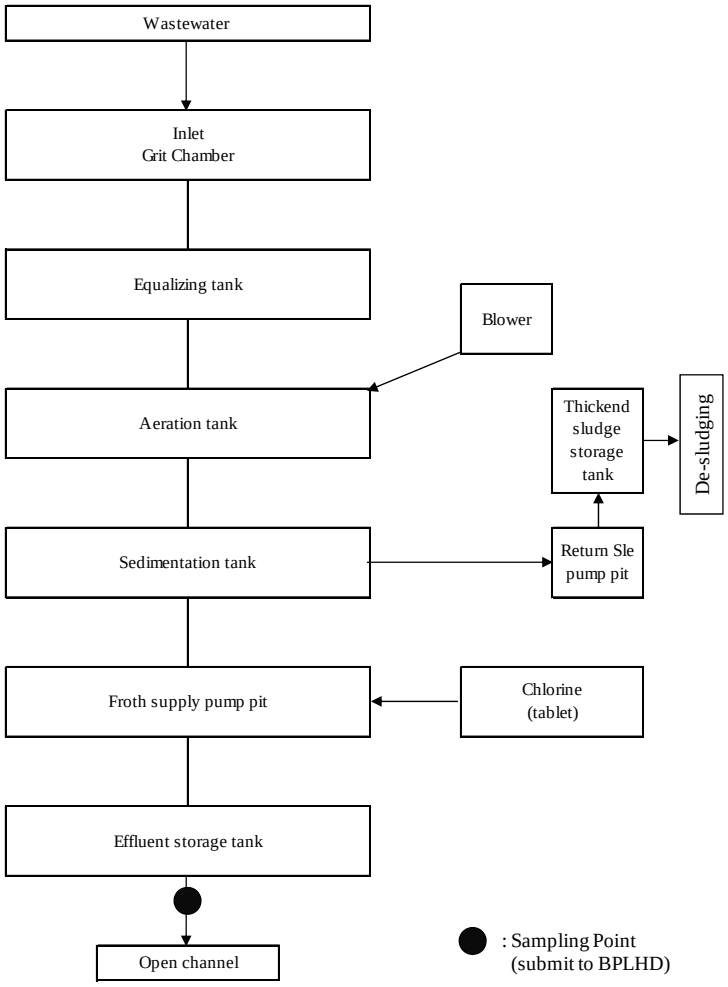
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Air lift pump	1 unit	Discharge pump	1 unit
			Blower	3 units	Froth supply pump	2 units
			Clarifier	1 unit	Chlorine (tablet)	1 unit
			Return sludge pump	2 units	Effluent pump	2 units
			Scum pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?		Yes (Tablet)			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (3/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	30-Mar-11
Investigator	Akagi

I A summary of STP

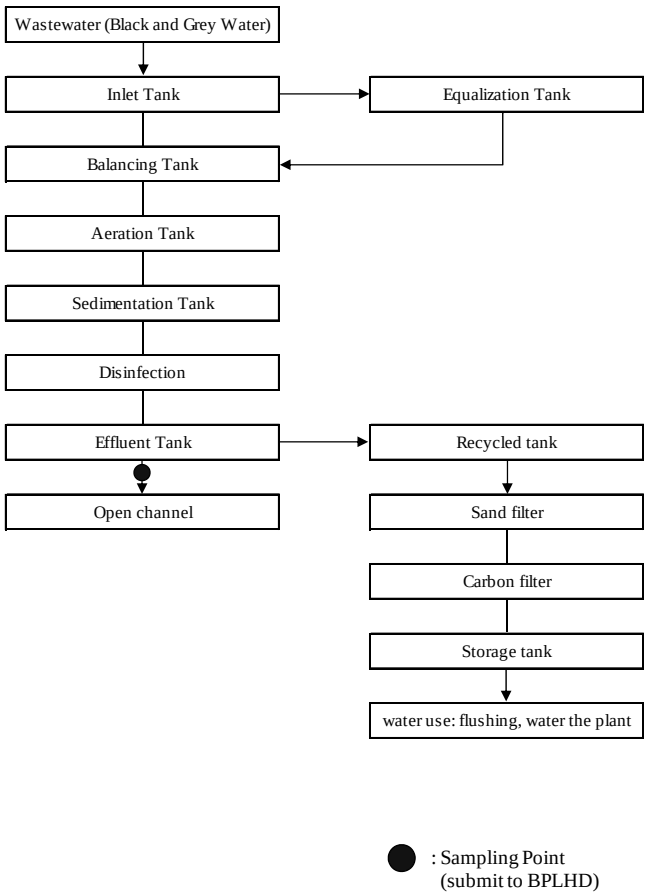
No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	2	Social Economic Survey No.	6		
I - 2	Company Name / Building Name		Maintenace : PT. Praja Putri Lestari Developer : PT. Praja Puri Indah		Pasar Pagi mangga dua			
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method	3) Extended aeration process	4) Batch mode treatment process		
			5) Contact aeration process	6) Rotary disc method	7) Modified septic tank			
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1988	In 2004, they was increased the STP volume.	
I - 5	Treatment capacity（m^3/day）(3-6)		325		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		410		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	Unknown	6 - 9	Unknown		
	2	$KMnO_4$	mg/l	Unknown	85	Unknown		
	3	Suspended solids (SS)	mg/l	Unknown	50	Unknown		
	4	Ammonia	mg/l	Unknown	10	Unknown		
	5	Oils and Fats	mg/l	Unknown	10	Unknown		
	6	Methylene Blue Compound	mg/l	Unknown	2	Unknown		
	7	COD (Dichromate)	mg/l	Unknown	80	Unknown		
	8	BOD (20℃, 5days)	mg/l	Unknown	50	Unknown		
I - 8	Latest date of inspection		Unknown					
I - 9	Sampling Point		after effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Since 2004, they never do the de-sludging, but before 2004 they do it once a year					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*Water use: they use mineral water for drinking only, and tap water (PAM) (115 m3/day) for other water use they have 2 deep well for emergency use only, deep well 1 with depth: 250 m (10 m^3/day) and deep well 2: 150 m (30 m^3/day) since 2008, they also have recycle system with 50 % ratio of water use about 120 m^3/day						
		Total water use are about 300 m^3/day, with prices: Rp. 12,500/m^3 (PAM) and Rp. 23,000/m^3 (deep well)						
		*O&M: for O&M is done by themselves before 2004 they had used private company to do the de-sludging						
		and from 2004 until now they never do the de-sludging and currently they are still evaluating about it, if there is any need to do the de-sludging						
		*problems: sometimes they have higher BOD and COD concentration for effluent quality but they said it is already fixed (they said it was because of the air circulation of the blower)						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (4/37)

Ⅱ Conditions of the facility	Sampling Survey No.	2	Building Name	Pasar Pagi mangga dua

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (still not obtain yet)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		

Ⅱ - 3 Flow Diagram



Ⅱ - 4	Conposition of main facilities	Blowers	3 unit (1 unit for back up)
		Inlet Tank Pump	3 unit (2 unit to equalizing tank and 1 unit to balancing tank)
		Equalization Tank Pump	2 unit (1 unit for back up)
		Chlorine dosing tank	1 unit
		wastewater reused syste	3 unit
Ⅱ - 5	Is there a disinfection facility ?	Yes (liquid)	
Ⅱ - 6	Is there underground infiltration	No	
Ⅱ - 7	Conditions of O & M		

1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (5/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	22-Mar-11
Investigator	Akagi

I A summary of STP

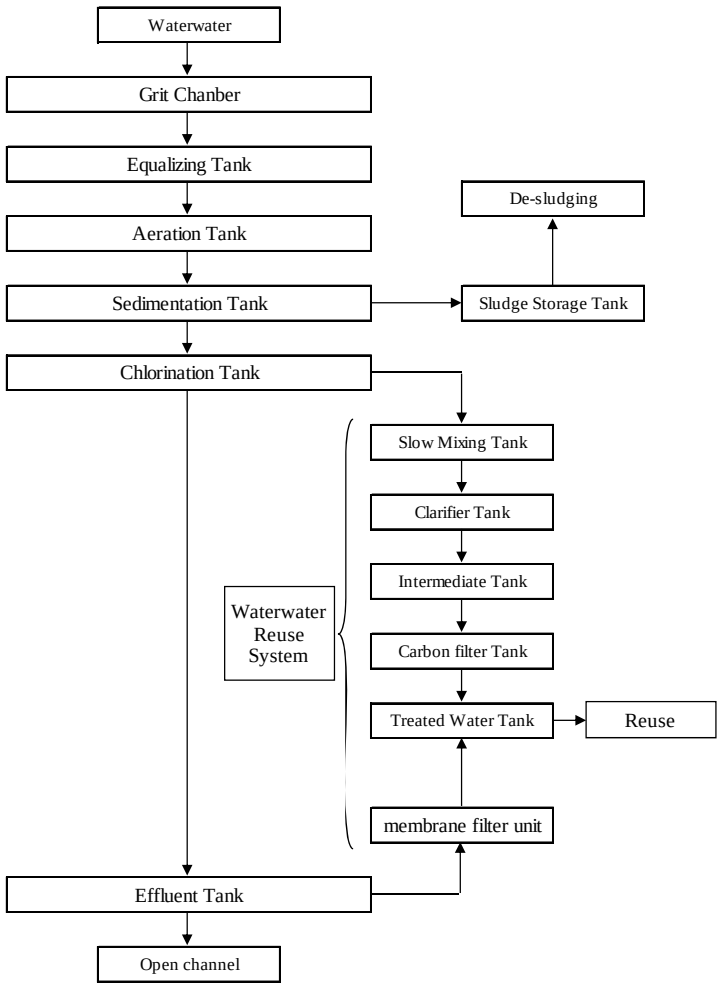
No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	3		Social Economic Survey No.	7	
I - 2	Company Name / Building Name		PT. Pakuwon Sentosa Abadi			Plaza Blok M		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1990	(Installed building in 1990)	
I - 5	Treatment capacity（m^3/day）(3-6)		250		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		300		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	6.2	6 - 9			
	2	$KMnO_4$	mg/l	50.8	85			
	3	Suspended solids (SS)	mg/l	10	50			
	4	Ammonia	mg/l	17.94	10	Exceed		
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.11	2			
	7	COD (Dichromate)	mg/l	78.46	80			
	8	BOD (20℃, 5days)	mg/l	36.4	50			
I - 8	Latest date of inspection		26-Jan-11					
I - 9	Sampling Point		Effluent Tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year (the latest :Apr-10) ((obtain the sludge removal record)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* In 1990, they installed STP(extended aeration) and wastewater reuse system (coagulation-sedimentation and carbon filtration) at the same time with the construction of the building. * The wastewater reuse system (coagulation-sedimentation and carbon filtration) had not been used until 2010. Thereafter, the system has been started operating since 2011. * In 2009, they additionaly installed and started operating the another wastewater reuse system (membrane filtration). Currently, the old and new wastewater reuse system are operating together and the reuse ratio are just only 10% (amount:1,300m^3/month) of total amount of wastewater, and not enough performance. In future, they think that they will raise more the reuse ratio, which also wanted to use for drinking water if possible. The decision is depend to cost. * Water use : almost all of water (except for drinking water) is sourced from tap water (PDAM) (amount:13,000m3/month, cost: Rp.150,000,000/month). They have a private well(depth:80m) for in case of emergency. * O&M : O&M for STP is implemented by themselves. O&M cost is Rp.20,000,000/month which used for electricity charges and chemical costs (not incl. repair costs). The chemical costs are only Rp.1,000,000/month. * Problem : Effluent water quality from STP have high concentration of Ammonia. Groundwater quality have high concentration of TDS(Total Dissolved Solids). Activated sludge looks like have light density. Therefore, the effluent quality is not so good. The blowers have noise and vibration issue.					

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (6/37)

Ⅱ Conditions of the facility			Sampling Survey No.	3	Building Name	Plaza Blok M

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		

Ⅱ - 3 Flow Diagram



Ⅱ - 4	Conposition of main facilities	Comminutor	1 unit
		Bower	4 units
		Chlorine and PAC dosing unit	1 unit (each)
		Carbon Filter unit	1 unit
		Membrane filter unit	1 unit
Ⅱ - 5	Is there a disinfection facility ?	Yes	
Ⅱ - 6	Is there underground infiltration	No	

Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (7/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	25-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	4		Social Economic Survey No.	8	
I - 2	Company Name / Building Name		PT. Graha Baru Raya			Gajah Mada Plaza building		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1980	(Installed building in 1980)	
I - 5	Treatment capacity（m^3/day）(3-6)		500		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		700		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.2	6 - 9			
	2	$KMnO_4$	mg/l	11.27	85			
	3	Suspended solids (SS)	mg/l	6	50			
	4	Ammonia	mg/l	0.14	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.06	2			
	7	COD (Dichromate)	mg/l	24.36	80			
	8	BOD (20℃, 5days)	mg/l	4.8	50			
I - 8	Latest date of inspection		23-Dec-10					
I - 9	Sampling Point		Effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		2 times a year (the record could not be obtained)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		* Water use : Water sources except for drinking is almost tap water (PDAM) (amount:800m3/day, cost: Rp.12,500/m3). They have a private well(depth:more than 80m) for in case of emergency. Groundwater tax is very expensive (Rp.85,000/m3 : approximately 7 times tap water charge).					
			* In 2007, Wastewater reuse system (sand filter and activated carbon filter) was installed and started operating by private company. However, since the reuse amount was less than 60m3/day, 200m3/day of the target could not be reached. In addition, reuse water quality was not enough. They have resolved a contract with the private company and stopped operating the reuse system.					
			* O&M : O&M is implemented by private company. O&M cost is Rp. 10,000,000/month.					
			* Problem : It seemed effluent water quality was poor transparency. Chlorine injecting unit was not moved (Chlorine tank was empty.)					

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (8/37)

Ⅱ Conditions of the facility	Sampling Survey No.	4	Building Name	Gajah Mada Plaza building

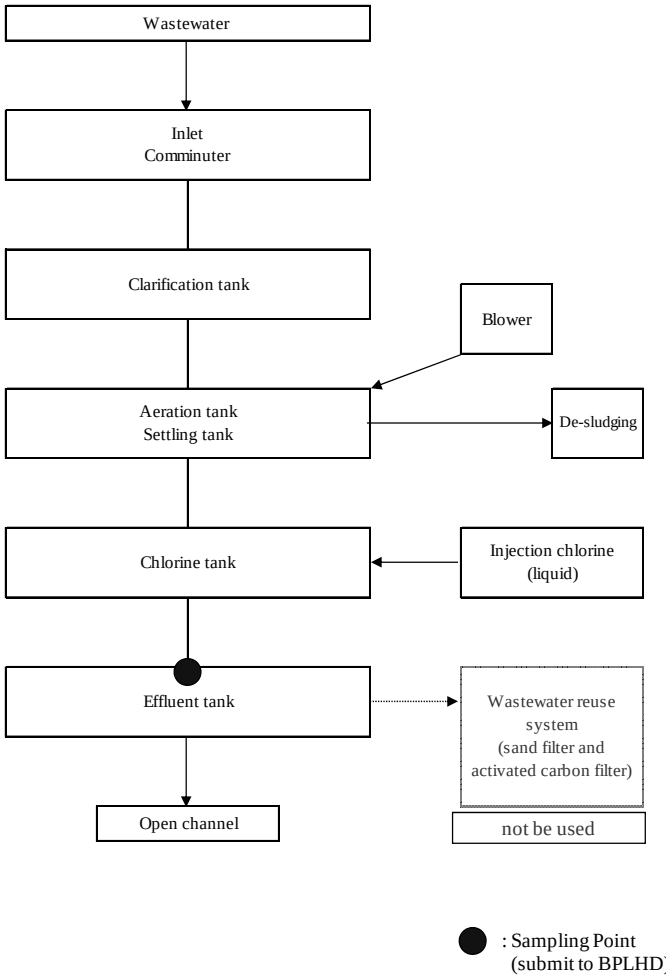
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (the drawing could not be obtained)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Comminuter	1 unit		
		Blower	2 units		
		Chlorine injection equipment	1 unit		
		Effluent pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?	Yes (liquid)			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	－ (Not necessary)
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	－ (Not necessary)
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (9/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	22-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	5		Social Economic Survey No.	9	
I - 2	Company Name / Building Name		PT. Pasaraya Tosersajaya			Gedung Pasaraya Grande Blok M		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2007	(Installed building in 1974)	
I - 5	Treatment capacity（m^3/day）(3-6)		90		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		420		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.3	6 - 9			
	2	$KMnO_4$	mg/l	58.69	85			
	3	Suspended solids (SS)	mg/l	39	50			
	4	Ammonia	mg/l	44.22	10	Exceed		
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.05	2			
	7	COD (Dichromate)	mg/l	89.65	80	Exceed		
	8	BOD (20℃, 5days)	mg/l	26.77	50			
I - 8	Latest date of inspection		14-Dec-10					
I - 9	Sampling Point		Effluent Tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		* STP (Settling tank) : 2 times a year * grease pit (each restrants) : once up to 3 times a month (depend on the condition)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* In 2007, Wastewater reuse system (sand filter unit) was installed and started operating by private company. However, since the reuse rate was less than 10%, 40 % of the target could not be reached, they have resolved a contract with the private company and stopped operating the reuse system two months ago (Apr-2011). * They planning to have contract with other private company which produce a new wastewater reuse system in order to decrease consumption of Tap water. They requested the new private company to consider more compact and effective system. * O&M : Now, O&M for STP is implemented by themselves. Until they resolved the contract with another private company which produce more efficient wastewater reuse system, the private company implemented operation STP and wastewater reuse system, the O&M cost was Rp.15,000/m^3 *80m^3/day (Rp. 1,200,000/day) including O&M for STP. * Water use : Almost all of water (except for drinking water) is sourced from tap water (PDAM). They have a private well(depth:120m) for in case of emergency. * Problem : Many solid waste are flowing into the STP. Normally, two blowers were operated alternately at 30-minute intervals. But now, One of blowers (2 units) is broken and stopped. Therefore aeration time become half.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (10/37)

Ⅱ Conditions of the facility		Sampling Survey No.	5	Building Name	Gedung Pasaraya Grande Blok M

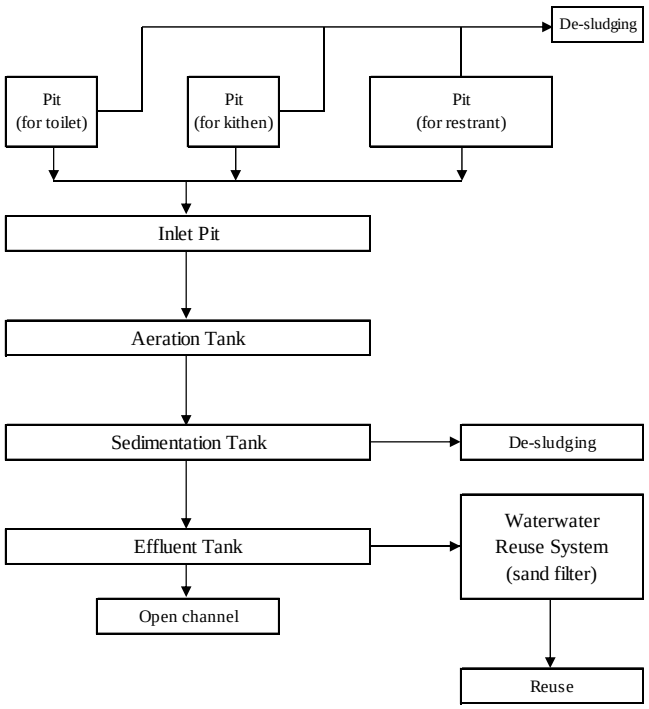
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it but could not obtained			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Bower	2 units		
		Filter unit	4 units		
Ⅱ - 5	Is there a disinfection facility ?	Unknown			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (11/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	25-Mar-11
Investigator	Akagi

I A summary of STP

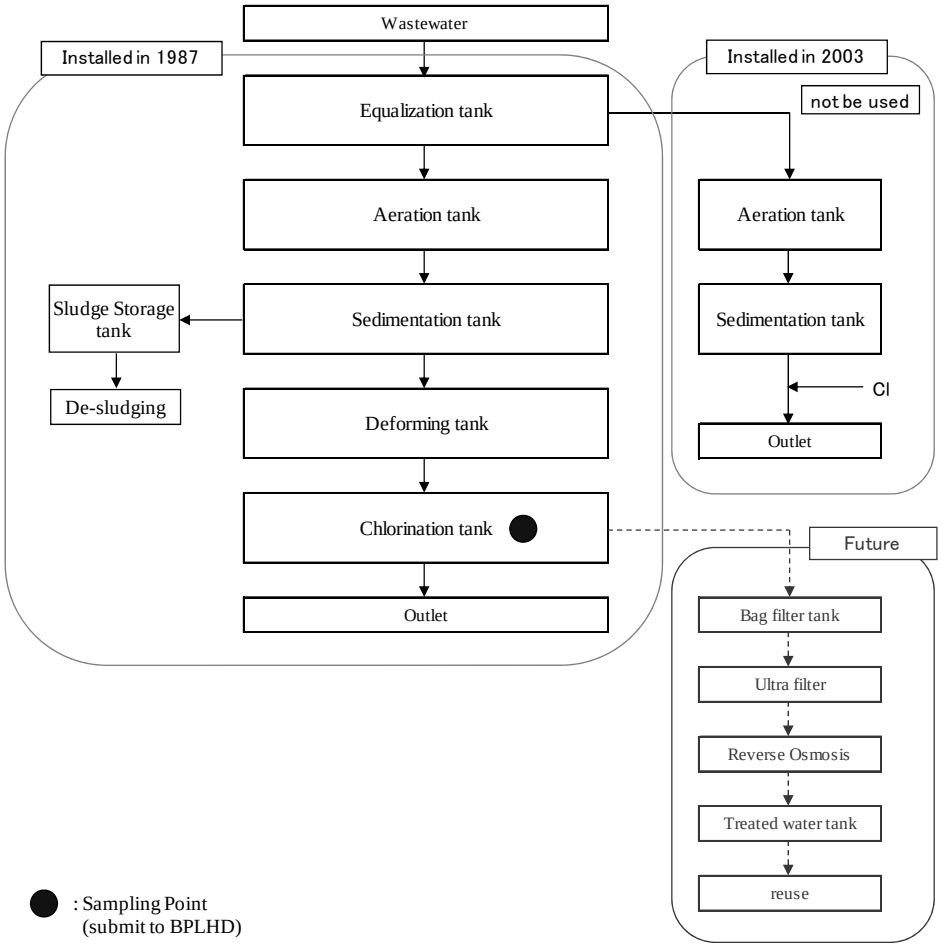
No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	6		Social Economic Survey No.	10	
I - 2	Company Name / Building Name		PT. TCP Interusa Glodok Plaza			Glodok Plaza building		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1987 (Add)2003	(Installed building in 1975)	
I - 5	Treatment capacity（m^3/day）(3-6)		unknown		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		100		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.58	6 - 9			
	2	$KMnO_4$	mg/l	<1	85			
	3	Suspended solids (SS)	mg/l	12	50			
	4	Ammonia	mg/l	74.91	10	Exceed		
	5	Oils and Fats	mg/l	-	10			
	6	Methylene Blue Compound	mg/l	-	2			
	7	COD (Dichromate)	mg/l	54	80			
	8	BOD (20℃, 5days)	mg/l	20	50			
I - 8	Latest date of inspection		06-Aug-09 (Self-inspection results, when there is a problem of smell)					
I - 9	Sampling Point		Effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		2 times a year (the record does not exist)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source are tap water (PDAM) and private well (100m). The ratio of tap water and private well is 80% : 20%. Amount of water comsumption is 80m3/day. Tap water (PDAM) charge is Rp. 12,500/m3. Groundwater tax is Rp. 16,000 - 17,000/m3.						
		* O&M : O&M is implemented by themselves. O&M cost is Rp. 500,000/month (chemical and electric) .						
		* De-sludging : The past time, they requested DK (Cleansing Agency) to remove sludge from settling tank. But, It was not effective because removing sludge was insufficient. Therfore now, they request the private company to remove sludge.						
		* Problem :Pump broken caused by too much solid waste. High concentration of Ammonia caused by luck aeration when the blowers is broken. Chlorine injecting unit was not moved (Chlorine tank was empty.) Transparency of effluent water was about 10cm.						
		* Own water quality management : With increasing concentration of the ammonia, the smell get out. By then, they do self-inspection irregular.						
		* In 2010, they staeted to discuss about installation wastewater reuse system produced by private company. The private company suggest to reuse all of amount wastewater. The private company says scale of reuse system must be at least 100m3/day. Oterwises, they can not take a profit. Effluent water amount is too little to reuse.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (12/37)

Ⅱ Conditions of the facility	Sampling Survey No.	6	Building Name	Glodok Plaza building

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		

Ⅱ - 3 Flow Diagram



Ⅱ - 4	Conposition of main facilities	Bower	2 units
		Comminutor	1 unit
		Flow control pump	2 units
		Effluent pump	2 units
		Tablet chlorinator	1 unit
Ⅱ - 5	Is there a disinfection facility ?	Yes (tablet)	
Ⅱ - 6	Is there underground infiltration	No	

Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (13/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	11-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	7		Social Economic Survey No.	11	
I - 2	Company Name / Building Name		PD. PASAR JAYA			Pasar Pramuka		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1984		
I - 5	Treatment capacity（m^3/day）(3-6)		-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	-	6 - 9			
	2	$KMnO_4$	mg/l	-	85			
	3	Suspended solids (SS)	mg/l	-	50			
	4	Ammonia	mg/l	-	10			
	5	Oils and Fats	mg/l	-	10			
	6	Methylene Blue Compound	mg/l	-	2			
	7	COD (Dichromate)	mg/l	-	80			
	8	BOD (20℃, 5days)	mg/l	-	50			
I - 8	Latest date of inspection		Never					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Three times a year by DK (Cleansing Agency)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*Water use : For drinking water they are using mineral water. And for other water use they are using water tap (PAM) and groundwater						
		*For 1st and 2nd floor are used for drug market; for 3rd, 4th, and 5th floor are used for central office of PD PASAR JAYA For 1st and 2nd floor they are using groundwater (market activity); for 3rd, 4th, and 5th floor they are using PAM (office activity)						
		*The toilets are rented to CV Mulia Sejahtera, so the management of toilets are managed by them too. For the de-sludging also managed by CV Mulia Sejahtera.						
		*According to them, the groundwater quality is not good, because the water colour is yellow and contain high Iron, also have smell						
		*In Pasar Pramuka area they have 3 market building: Drug market (Pasar Pramuka), Bird market (Pasar Burung), and traditional market (Pasar Matraman). For this survey only covered the drug market, included the office building of PD PASAR JAYA.						
		*They have their own septic tank for each building.						
		*The deep of groundwater is about 24 meter.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (14/37)

Ⅱ Conditions of the facility			Sampling Survey No.	7	Building Name	Pasar Pramuka

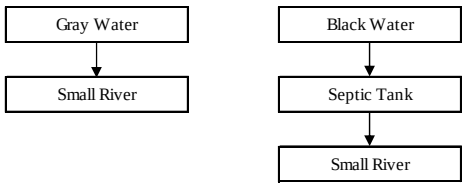
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		not			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others (Small River)	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities					
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		Yes			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (15/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	24-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	8		Social Economic Survey No.	22	
I - 2	Company Name / Building Name		PT. Hotel Sofyan Tbk			Hotel Sofyan Tebet		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2002	(Installed building in 1984)	
I - 5	Treatment capacity（m^3/day）(3-6)		70		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		80		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.2	6 - 9			
	2	$KMnO_4$	mg/l	10.33	85			
	3	Suspended solids (SS)	mg/l	11	50			
	4	Ammonia	mg/l	14.14	10	Exceed		
	5	Oils and Fats	mg/l	*	10	-		
	6	Methylene Blue Compound	mg/l	0.22	2			
	7	COD (Dichromate)	mg/l	15.44	80			
	8	BOD (20℃, 5days)	mg/l	7.85	50			
I - 8	Latest date of inspection		16-Dec-10					
I - 9	Sampling Point		Effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		never de-sludging					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source are tap water (PDAM) and private well (25m). The ratio of tap water and private well is 50% : 50%. Amount of water comsumption is 80m3/day. Tap water charge and groundwater tax is for each Rp.800,000 and Rp.400,000. In this area, groundwater tax is not so high, because of there is not many high-rise building.						
		* O & M : By outsourcing private company (small company). 3 times a week to check the facilities by private company. They pay to the company 600,000 Rp./month. Repairing machines are inplement by themselves.						
		* Problem : Effluent water quality is high concentration of Ammonia. The reason is that the blowers stops frequently and the treatment process is worse.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (16/37)

Ⅱ Conditions of the facility		Sampling Survey No.	8	Building Name	Hotel Sofyan Tebet

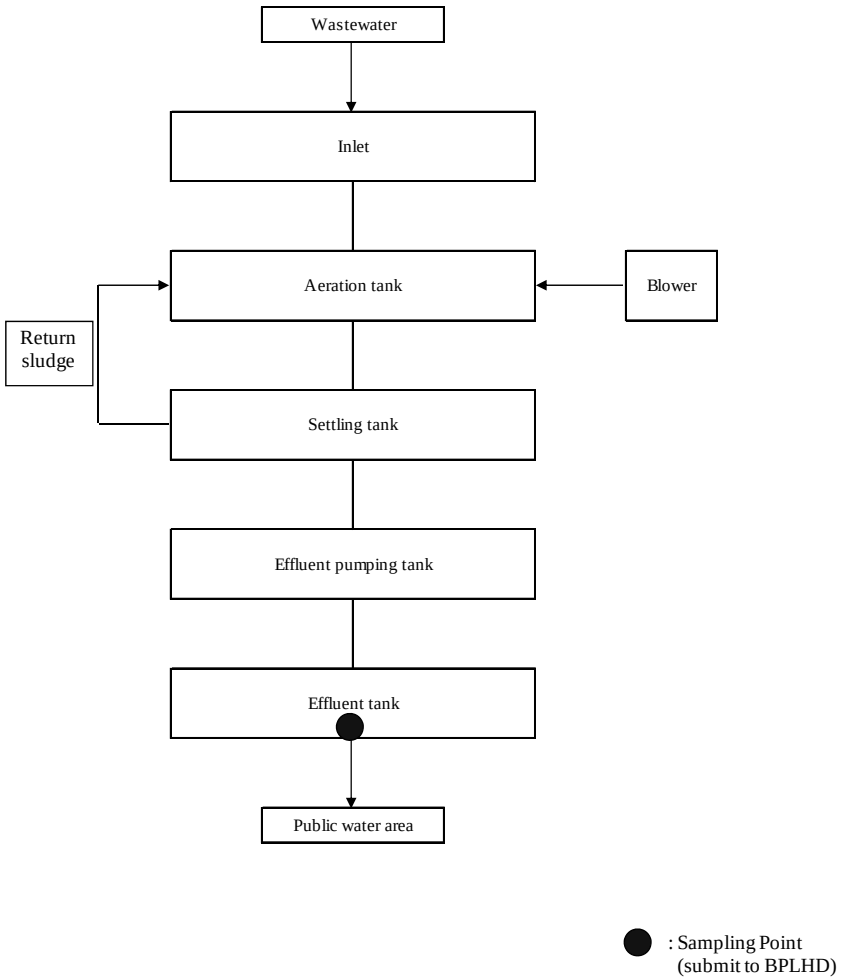
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Blower	2 units		
		Effluent pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?	Yes (tablet)			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (18/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	11-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	9		Social Economic Survey No.	24	
I - 2	Company Name / Building Name		PT. Hotel Sofyan Tbk			Hotel Sofyan Betawi (Cut Mutia)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1992	(Installed building in 1992)	
I - 5	Treatment capacity（m^3/day）(3-6)		80		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		Unknown		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.7	6 - 9			
	2	$KMnO_4$	mg/l	52.38	85			
	3	Suspended solids (SS)	mg/l	60	50	Exceed		
	4	Ammonia	mg/l	25.07	10	Exceed		
	5	Oils and Fats	mg/l	*	10	-		
	6	Methylene Blue Compound	mg/l	0.08	2			
	7	COD (Dichromate)	mg/l	84.67	80	Exceed		
	8	BOD (20℃, 5days)	mg/l	25	50			
I - 8	Latest date of inspection		28-Dec-10					
I - 9	Sampling Point		Settling tank (outflow side)					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year (not exist record of sludge removal)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* O & M : By outsourcing private company (small company).						
		* check the Flow meter : once a week						
		* Water quality management : Not conducted						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (19/37)

Ⅱ Conditions of the facility		Sampling Survey No.	9	Building Name	Hotel Sofyan Betawi (Cut Mutia)

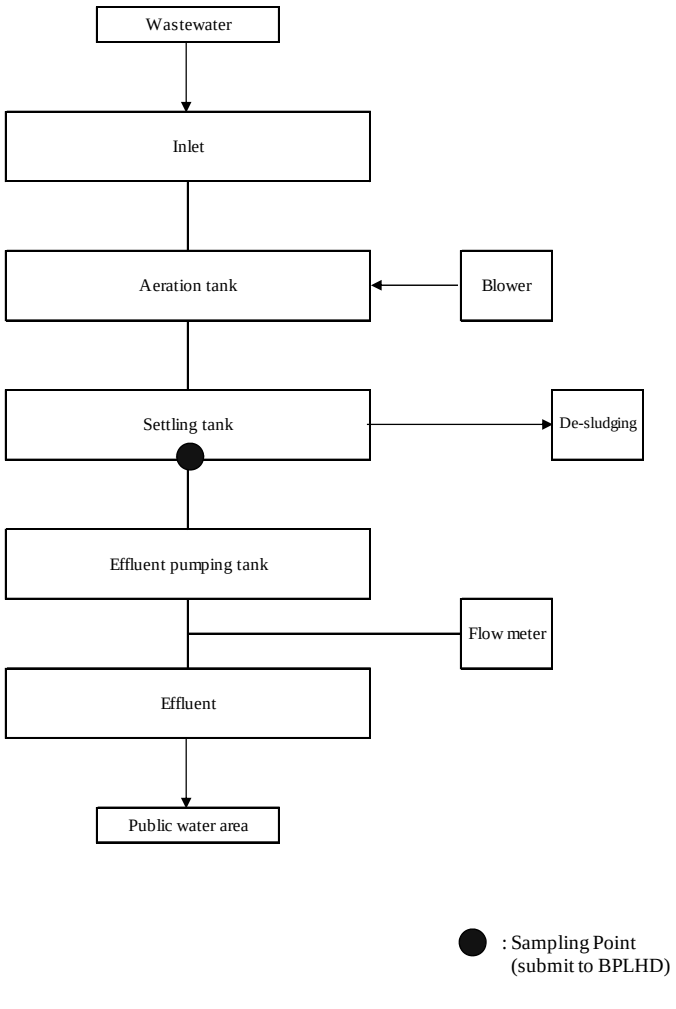
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (But can't copy. Only take photo)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Blower	2 units		
		Effluent pump	2 units		
		Flow meter	1 unit		
Ⅱ - 5	Is there a disinfection facility ?	No			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (20/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	21-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	10		Social Economic Survey No.	25	
I - 2	Company Name / Building Name		PT. Menteng Sawana Wisata			Hotel Menteng I		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1998	(Installed building in 1972)	
I - 5	Treatment capacity（m^3/day）(3-6)		19		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		40		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	5.9	6 - 9	Exceed		
	2	$KMnO_4$	mg/l	32.74	85			
	3	Suspended solids (SS)	mg/l	11	50			
	4	Ammonia	mg/l	0.1	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.02	2			
	7	COD (Dichromate)	mg/l	53.13	80			
	8	BOD (20℃, 5days)	mg/l	17.2	50			
I - 8	Latest date of inspection		19-Nov-10					
I - 9	Sampling Point		Effluent pumping tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source are tap water (PDAM) and private well (80m). The ratio of tap water and private well is 75% : 25%. Amount of water comsumption is 24.2m3/day. Tap water (PDAM) charge is 40,000,000 Rp./month. Groundwater tax is 50,000,000 Rp./month.						
		* O & M : By outsourcing private company (small company). 3 times a week to check the facilities by private company. They pay to the company 1,200,000 Rp./month. Repairing machines are inplement by themselves. The repairing cost is 500,000 Rp./month.						
		* Triggered for the regulation by DKI in 2005, they additionally installed control chamber.						
		* Problem : Groundwater quality is not good because of high concentration of iron and smell. Water quality of effluent water from STP is high concentration of Annmonia.						
		* They have positive attitude about reusing wastewater. But now, they doesn't discuss about it yet.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (21/37)

Ⅱ Conditions of the facility		Sampling Survey No.	10	Building Name	Hotel Menteng Ⅰ

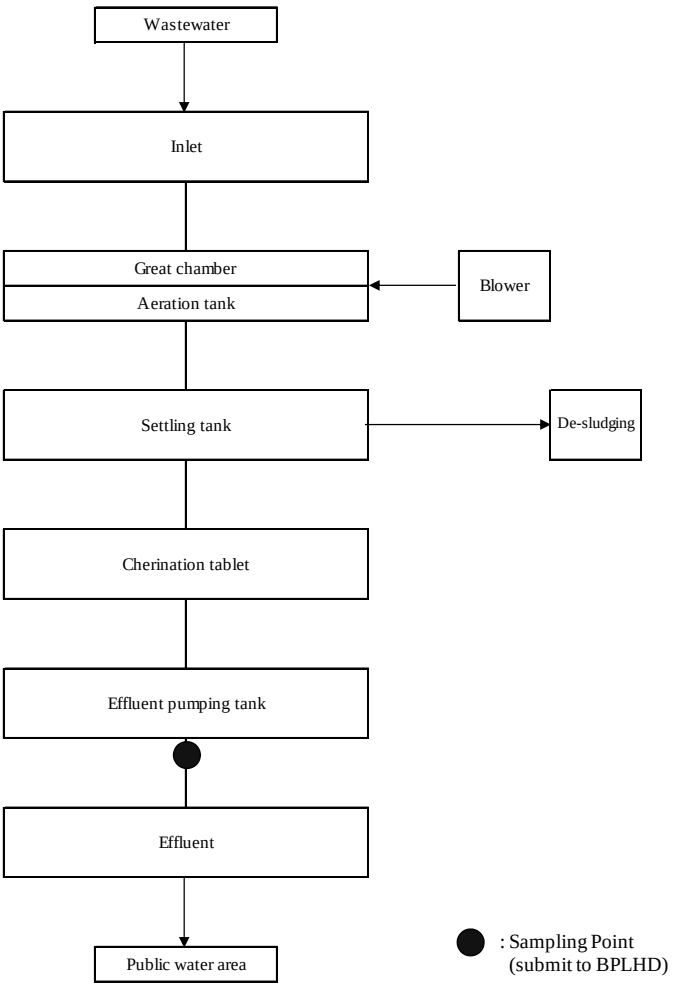
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	Nothing (but same treatment system as Hotel Menteng Ⅱ)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Inlet pump	2 units		
		Blower	2 units		
		Effluent pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?	Yes (tablet)			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (22/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	11-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	11		Social Economic Survey No.	26	
I - 2	Company Name / Building Name		PT. Menteng Sawana Wisata			Hotel Menteng II		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2004		
I - 5	Treatment capacity（m^3/day）(3-6)		16		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		40		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	6.1	6 - 9			
	2	$KMnO_4$	mg/l	13.28	85			
	3	Suspended solids (SS)	mg/l	6	50			
	4	Ammonia	mg/l	0.07	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.04	2			
	7	COD (Dichromate)	mg/l	24.7	80			
	8	BOD (20℃, 5days)	mg/l	11.2	50			
I - 8	Latest date of inspection		3-Dec-10					
I - 9	Sampling Point		before effluent pumping tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* O & M : By outsourcing private company (small company).						
		3 times a week to check the facilities by private company.						
		1 blower constantly work (2 blowers alternate work).						
		* Frequency of submitting water quality sampling for BPLHD is 2 times a year.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (23/37)

Ⅱ Conditions of the facility			Sampling Survey No.	11	Building Name	Hotel Menteng Ⅱ

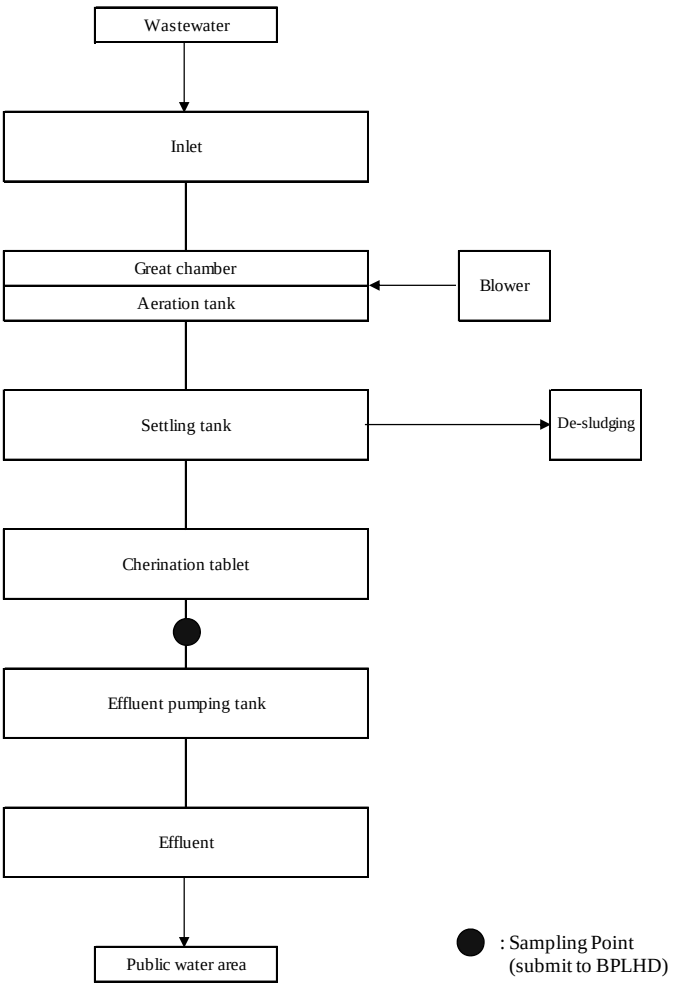
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Blower	2 units		
			Effluent pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?		Yes (tablet)			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (24/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	14-Mar-11
Investigator	Akagi

I A summary of STP

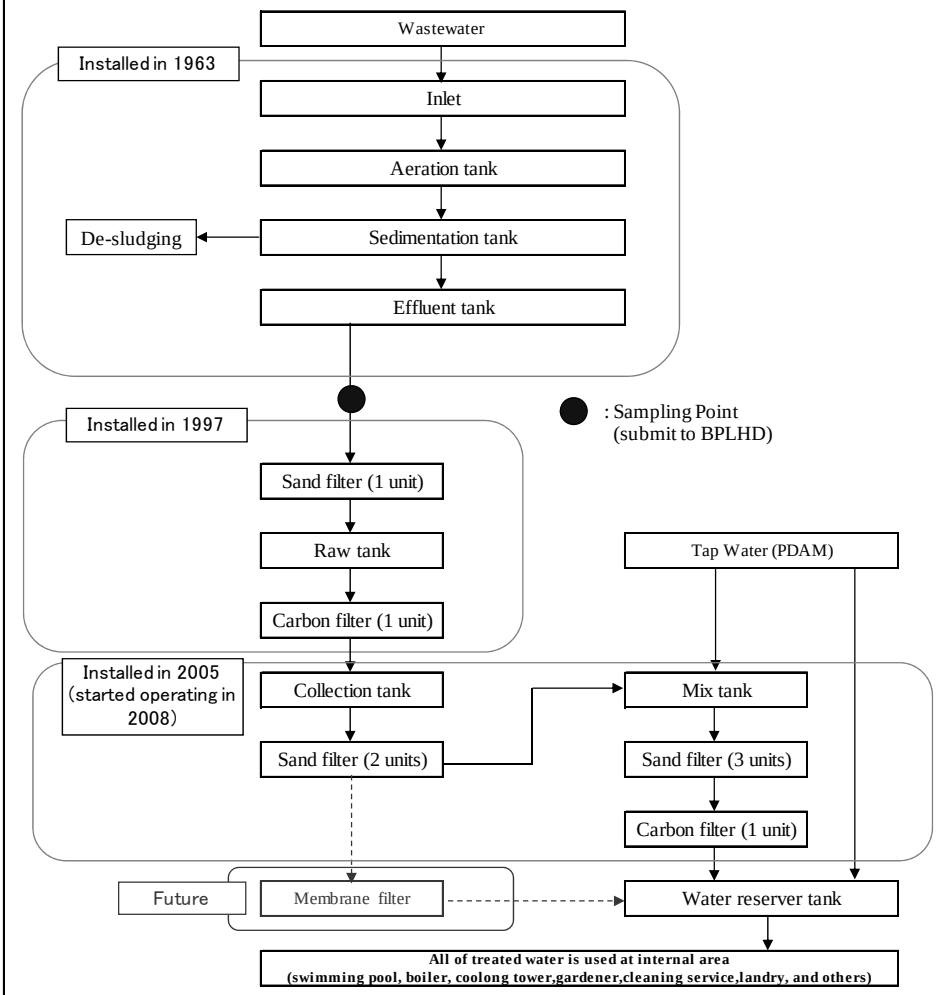
No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	12		Social Economic Survey No.	2	
I - 2	Company Name / Building Name					Hotel Borobudur Jakarta		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1963		
I - 5	Treatment capacity（m^3/day）(3-6)		800		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		1500		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7	6 - 9			
	2	$KMnO_4$	mg/l	20	85			
	3	Suspended solids (SS)	mg/l	7	50			
	4	Ammonia	mg/l	1.17	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.08	2			
	7	COD (Dichromate)	mg/l	25.76	80			
	8	BOD (20℃, 5days)	mg/l	8.1	50			
I - 8	Latest date of inspection		23-Nov-10					
I - 9	Sampling Point		Effluent pipe (after STP)					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*In 1963, they installed STP(extended aeration) at same time to construct the hotel.						
		*In 1997, they additionaly installed wastewater reuse sysytem (1 sand filter and 1 carbon filter) .						
		*In 2005, they expanded to wastewater reuse system (5 sand filter and 1 carbon filter). In 2008,they started operation it.						
		*Effluent water is nothing because of all of recycled wastewater is consumed in the hotel (swimming pool, boiler, coolong tower,gardener,cleaning service,landry, and others).						
		* In their opinion, tap water(PDAM) is very expensive (12,550 Rp./m3). Recycle water cost is only 4,800 Rp./m3.						
		* Regarding connection sewerage pipe, They can't unready decision, but, they are not welcome to missing recycle wastewater because it is directly increase consumption of tap water.						
		*In the hotel industry, They have "Hotel Engineering Association". There is once a month to have the meeting. Some of hotel has already installed wastewater reuse system has negative opinions about connection to sewer pipe.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (25/37)

Ⅱ Conditions of the facility	Sampling Survey No.	12	Building Name	Hotel Borobudur Jakarta

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others(All of effluent water and recycled wastewater is consumed in the internal hotel)		9) Unknown	

Ⅱ - 3 Flow Diagram



Ⅱ - 4	Conposition of main facilities	Blower	number of units is unknown.
		Effluent pump	number of units is unknown.
		reuse system(1)	sand filter-1, carbon filter-1
		reuse system(2)	sandfilter-2
		reuse system(3)	sand filter-3, carbon filter-1
Ⅱ - 5	Is there a disinfection facility ?	Yes	
Ⅱ - 6	Is there underground infiltration	No	

Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (26/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	21-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	13		Social Economic Survey No.	28	
I - 2	Company Name / Building Name		PT. Indo Build. Co. (Management company : Singgasara Hotel & Resort)			Hotel The Sultan		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	Main:1985 Garden:1985	*Main Tower was built in 1976. *Garden Tower was built in 1985 *Ragoon Tower was built in 1992.	
I - 5	Treatment capacity（m^3/day）(3-6)		400		m3/day	(Sum of both STP for Main Tower and for Garden Tower)		
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		600		m3/day	(Sum of both STP for Main Tower and for Garden Tower)		
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result **(Main Tower)**	Result **(Garden Tower)**	Quality standards	Excess items	Other Items (If any)
	1	pH	-	7.3	7.5	6 - 9		
	2	$KMnO_4$	mg/l	23.4	6.63	85		
	3	Suspended solids (SS)	mg/l	26	5	50		
	4	Ammonia	mg/l	0.59	0.4	10		
	5	Oils and Fats	mg/l	<1.13	<1.13	10		
	6	Methylene Blue Compound	mg/l	0.05	0.07	2		
	7	COD (Dichromate)	mg/l	50.97	9.27	80		
	8	BOD (20℃, 5days)	mg/l	12.43	3.99	50		
I - 8	Latest date of inspection		11-Nov-10					
I - 9	Sampling Point		After effluent tank (both Main Tower and Garden Tower) *Wastewater from Ragoon tower is connected to sewer pipe of PD PAL JAYA					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		When necessary to remove (by private company)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		* They have 3 towers which Main Tower, Garden Tower and Ragoon Tower. Main Tower and Garden Tower has each STP for wastewater treatment at the same place. Ragoon Tower used to have STP, but in 2005 wastewater from Ragoon Tower was connected to sewer pipe (PD PAL LAYA).					
			* Water use : Drinking water is purchased by the private water selling company. Other water source is only tap water (PDAM) (700-800m3/day) . Reason they doesn't use groundwater is high tax of groundwater using.					
			* O&M : O&M for STPs of Main Tower and Garden Tower is implemented by out-sourcing private company. They pay to the company 12,000,000 Rp./month.					
			* In their opinion, city water(PDAM) is very expensive. So they are planning to install wastewater reuse sysytem for Main Tower and Garden Tower, actually they will start construction the facilities from this year (2011). Furthermore in the long term, They want to reuse all of wastewater including Ragoon Tower.					
			* Reasons they doesn't have willingness to connect with sewer pipe are (1)they have already planed to install wastewater reuse system in 2011, and (2) they think tap water (PDAM) caharge is expencive (30,000,000 Rp./month).					
			*They join PHRI(Hotel and Restrant Association Indonesia). In the meeting of the assosiation, They discussed about wastewater recycling.					

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (27/37)

Ⅱ Conditions of the facility			Sampling Survey No.	13	Building Name	Hotel The Sultan

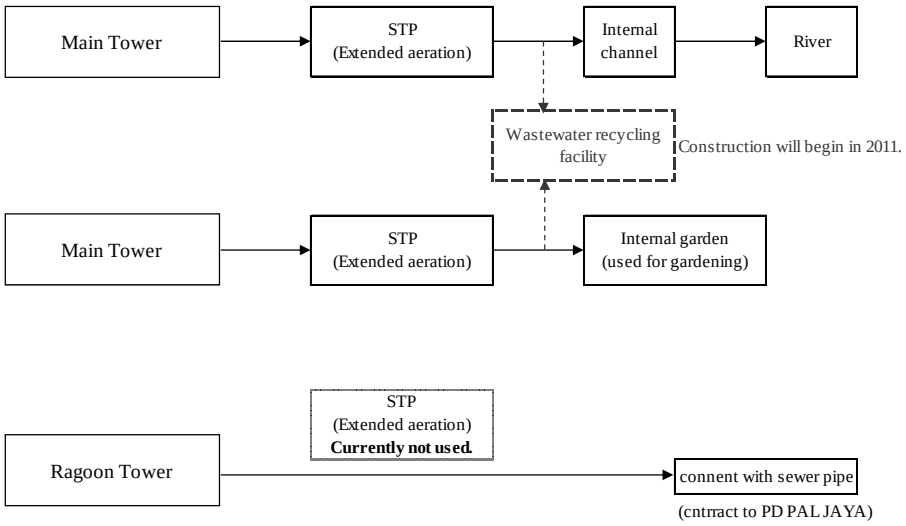
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it but could not obtained			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others (River and used for internal garden)	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Inlet pump			
			Screen			
			Blower			
			Sludge return pump			
			Effluent pump			
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (28/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	14-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	14		Social Economic Survey No.	29	
I - 2	Company Name / Building Name		PT. Wisma Nusantara International			Hotel Nikko (In 1991, This building was Hotel President)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1994		
I - 5	Treatment capacity（m^3/day）(3-6)		800		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		925		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.4	6 - 9			
	2	$KMnO_4$	mg/l	26.59	85			
	3	Suspended solids (SS)	mg/l	45	50			
	4	Ammonia	mg/l	17.09	10	Exceed		
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.02	2			
	7	COD (Dichromate)	mg/l	46.33	80			
	8	BOD (20℃, 5days)	mg/l	16.85	50			
I - 8	Latest date of inspection		16-Dec-10					
I - 9	Sampling Point		Before effluent to public water area.					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year (remove by private company. Obtained record.)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* From 1972 to 1994, they used septik tank for treatment wastewater. In 1994, they installed STP (Extended aeration).						
		* In 2006, they installed wastewater reuse system.						
		* In 2007, they put an end to pump out ground water to deep well.						
		* They implement water quality management by themselves (include recycled water quality).						
		* In their opinion city water(PDAM) is very expensive (3,000 Rp./m3).						
		* Reasons they doesn't have willingness to connect to sewage pipe are (1) they already have enough facilities for wastewater treatment and reuse, (2) they can reduce consumption of tap water by reusing wastewater.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (29/37)

Ⅱ Conditions of the facility			Sampling Survey No.	14	Building Name	Hotel Nikko (In 1991, This building was Hotel President)

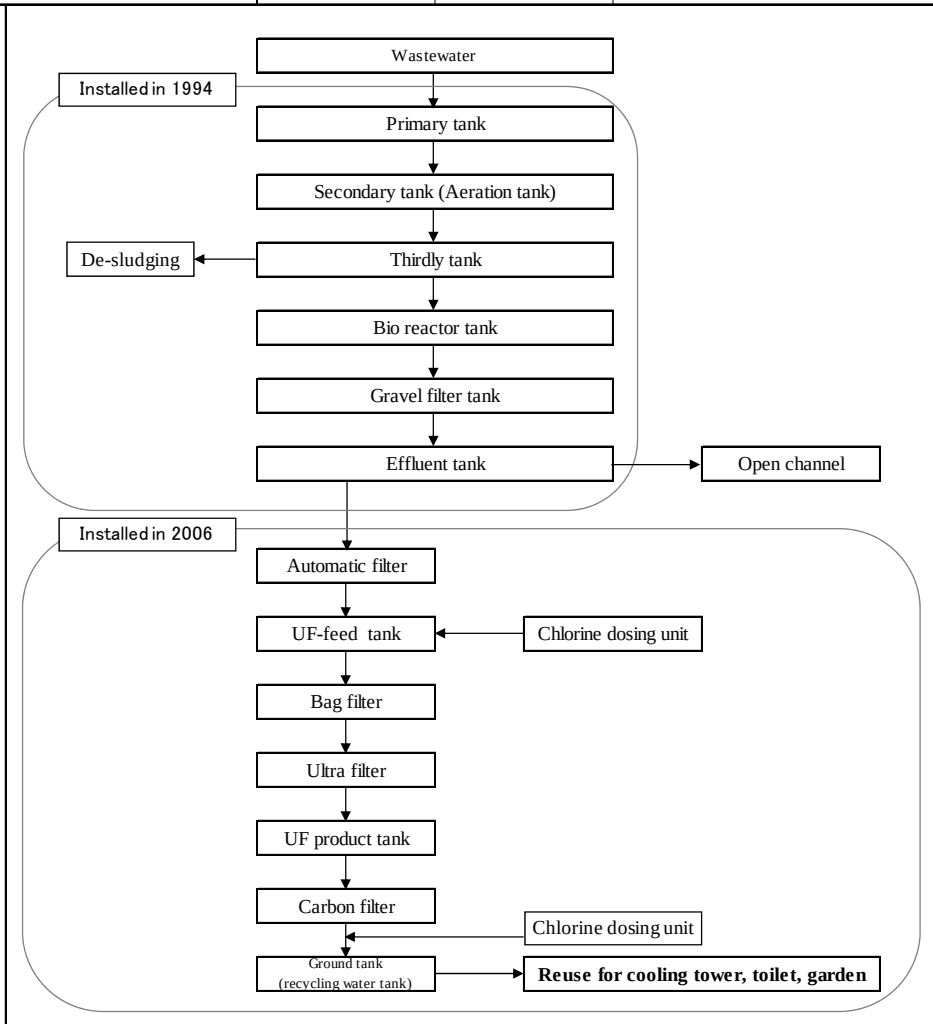
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Blower	2 units	Bag filter	1 unit
			Bio reactor	1 unit	Ultra filter	1 unit
			Effluent pump	2 units	Carbon filter	1 unit
			Automatic filter	1 unit		
			Chlorine dosing unit	2 units		
Ⅱ - 5	Is there a disinfection facility ?		Yes			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (30/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	16-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	15		Social Economic Survey No.	30	
I - 2	Company Name / Building Name		Hotel Sahid Jaya International			Hotel Grand Sahid Jaya		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility		10) Already connected to sewage pipe		
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	-	(Installed building in 1986) (Connected to sewage pipe in 1997)	
I - 5	Treatment capacity（m^3/day）(3-6)		-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-		6 - 9			
	2	$KMnO_4$	mg/l		85			
	3	Suspended solids (SS)	mg/l		50			
	4	Ammonia	mg/l		10			
	5	Oils and Fats	mg/l		10			
	6	Methylene Blue Compound	mg/l		2			
	7	COD (Dichromate)	mg/l		80			
	8	BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection		-					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		-					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source are tap water (PDAM) and private well (150m). The ratio of tap water and private well is 99% : 1 %. Amount of water comsumption is 1,200m3/day. Private well is used for backup in emergency.						
		* Water qualitiy of Private well is no problem.						
		* Before connection sewage pipe, They had 2 conventional septik tank (maximum capacity is 200m3/day * 2 units).						
		* Sewerage charge is 30,000,000 Rp./month.						
		* They join to " Building Engineering Assosiation ". The assosiation hold irregular and has same divition by sectors. They (thief engineer of this hotel) join " Engineering Superintend".						
		* They have 2 contracts to PD PAL JAYA because of there are 2 connection to sewage pipe.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (31/37)

Ⅱ Conditions of the facility			Sampling Survey No.	15	Building Name	Hotel Grand Sahid Jaya

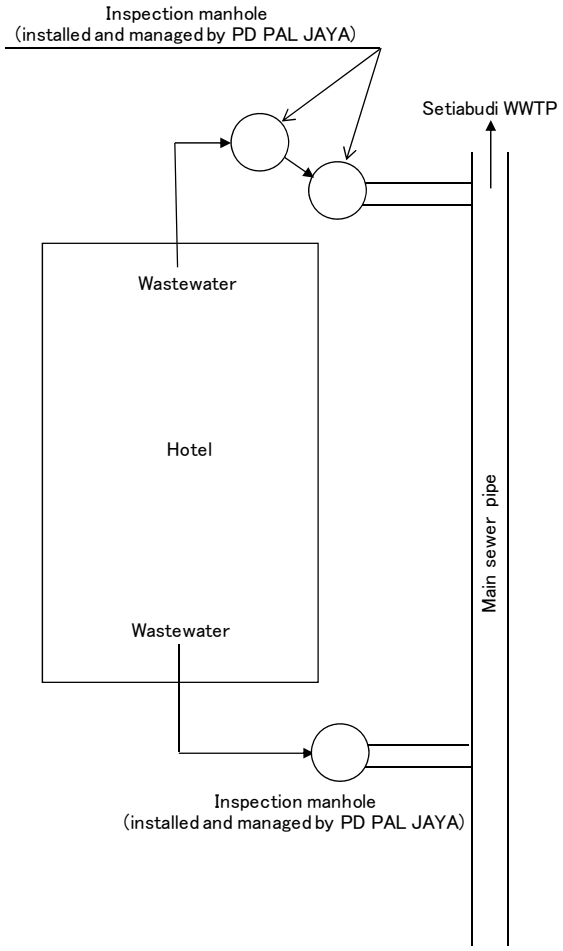
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		Nothing			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Inspection manhole			
			connection pipe			
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (32/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	11-Apr-12
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	16		Social Economic Survey No.	37	
I - 2	Company Name / Building Name		Pt. Indosat / Pt. Indosat			Telecomination Submarine		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2010		
I - 5	Treatment capacity（m^3/day）(3-6)		2.0 (actual) 3.4 (Design)		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)				m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.4	6 - 9		7.4	Influent
	2	$KMnO_4$	mg/l	20.5	85		78.4	
	3	Suspended solids (SS)	mg/l	5	50		26	
	4	Ammonia	mg/l	22.8	10	Exceed	41.3	
	5	Oils and Fats	mg/l	<1.13	10		<1.13	
	6	Methylene Blue Compound	mg/l	0.02	2		0.08	
	7	COD (Dichromate)	mg/l	27	80		90	
	8	BOD (20℃, 5days)	mg/l	11.1	50		53	
I - 8	Latest date of inspection		2011, Feb.23					
I - 9	Sampling Point		After Effluent pipe					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Until now ever					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	11. No : The STP capacity is very small and the cost of sewer pipe connection is comparatively expensive.						
		As pump is broken, effluent is over flowed by rainfall.						
		There is no MLSS in aeration tank. They explain that when much amount of rainfall buckwashed and becaouse of chloraine dosing into aeration tank, activeted sludge was damaged.(pretty doubtful)						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (33/37)

Ⅱ Conditions of the facility			Sampling Survey No.	16	Building Name	Telecomination Submarine

No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram		Separation Tank(anaerobic) → aeration of Sedimention Tank → Effluent pump Tank			
Ⅱ - 4	Conposition of main facilities		Air Pump	80L/min *80W		
Ⅱ - 5	Is there a disinfection facility ?		Yes			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (34/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	15-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	17		Social Economic Survey No.	41	
I - 2	Company Name / Building Name		PT. Bank Central Asia, Tbk			Wisma Asia Slipi		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1997	(Installed building in 1997)	
I - 5	Treatment capacity（m^3/day）(3-6)		80		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		90		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7	6 - 9			
	2	$KMnO_4$	mg/l	16.53	85			
	3	Suspended solids (SS)	mg/l	12	50			
	4	Ammonia	mg/l	5.22	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.02	2			
	7	COD (Dichromate)	mg/l	29.57	80			
	8	BOD (20℃, 5days)	mg/l	12.9	50			
I - 8	Latest date of inspection		20-Dec-10					
I - 9	Sampling Point		Effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		2 times a year (by private company. obtained record.)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* STP is only treat black water (night soil water). Gray water (rain water, hand wash water, and so on) infiltrate to underground.						
		* Groundwater pumping system is installed, but now it hasn't been used because of water quality not suitable to use (high concentration of iron).						
		* The reasons why they don't use the groundwater is because of bad groundwater quality (contained high concentration of iron), and higher tax for groundwater usage.						
		* O&M : implemented by themselves.						
		* Ploblem of O&M : effluent water quality have high concentration of ammonia, so They deal with it by injecting chlorine.						
		* They have already knew that removed sludge (de-sludging) from STP disposal was thrown to public water area (open channel, river, and so on) by private company.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (35/37)

Ⅱ Conditions of the facility			Sampling Survey No.	17	Building Name	Wisma Asia Slipi

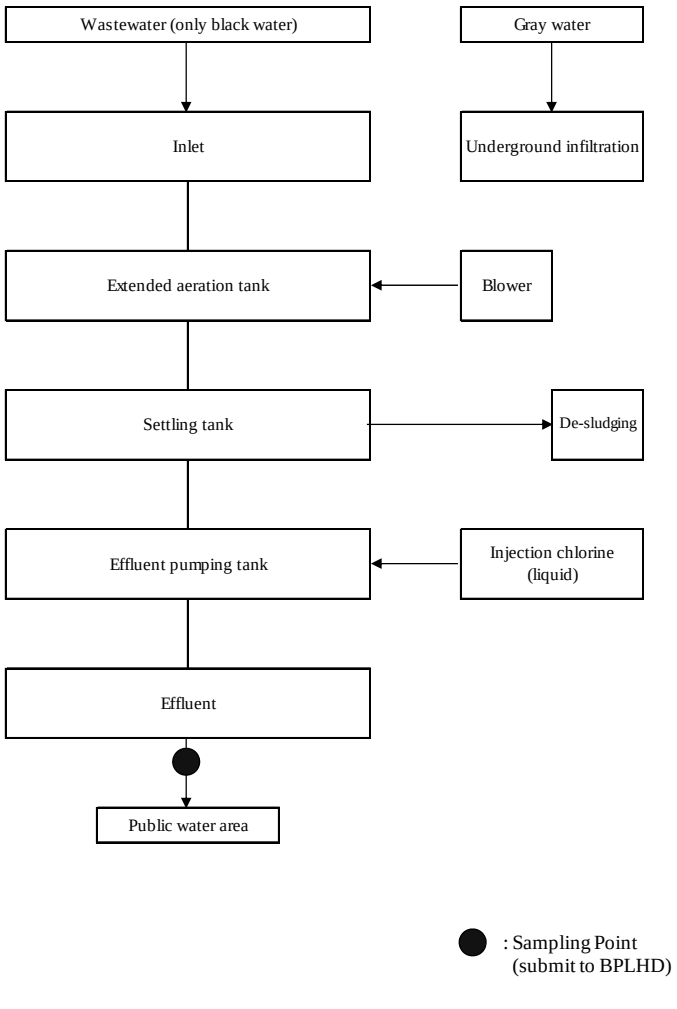
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Blower	2 units		
			Comminuter	1unit		
			Air lift pump	1unit		
			Chlorine injection equipment	1 unit (Tank 1, Injection pump 1)		
			Effluent pump	2 units		
Ⅱ - 5	Is there a disinfection facility ?		Yes (mainly for reducing ammonia)			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (36/37)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	16-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	18		Social Economic Survey No.	42	
I - 2	Company Name / Building Name		PT. Duta Telekomindo			Chase Plaza building		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility		10) Already connected to sewage pipe		
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	-	(Installed building in 1986) (Connected to sewage pipe in 1991)	
I - 5	Treatment capacity（m^3/day）(3-6)		-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-		6 - 9			
	2	$KMnO_4$	mg/l		85			
	3	Suspended solids (SS)	mg/l		50			
	4	Ammonia	mg/l		10			
	5	Oils and Fats	mg/l		10			
	6	Methylene Blue Compound	mg/l		2			
	7	COD (Dichromate)	mg/l		80			
	8	BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection		-					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		-					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Drinking water is purchased by the private water selling company. Other water source are tap water (PDAM) and private well (82m). The ratio of tap water and private well is 90% : 10 %. Private well is used for backup in emergency. Previously (before 2000), this ratio is 50% : 50%.						
		* Water qualitiy of Private well is no problem. But they decrerace groundwater consumption because of higher taxes on the use of groundwater. Groundwater taxes is paied to DKI and central government (initial tax is paied to DKI, Thereafter tax is paied to central gov.)						
		* Tap water(PDAM) cosy is 5,000-6,000 Rp./m3. Groundwater tax is 6,500 Rp./m3.						
		* Sewerage charge is 30,000,000 Rp./month.						
		* They join to " Engineering Forum for building at Sudelman street". They discuss about problem of each STP, O&M cost and so on In the forum.						
		* In their opinion, Connection to sewage pipe bring about reduction O&M cost (employee wage in charge of O&M is high) and be useful to land where STP used to be.						

Table S/R-B4-5 Sampling Survey Results of ITP (STP built by Private) (37/37)

Ⅱ Conditions of the facility			Sampling Survey No.	18	Building Name	Chase Plaza building

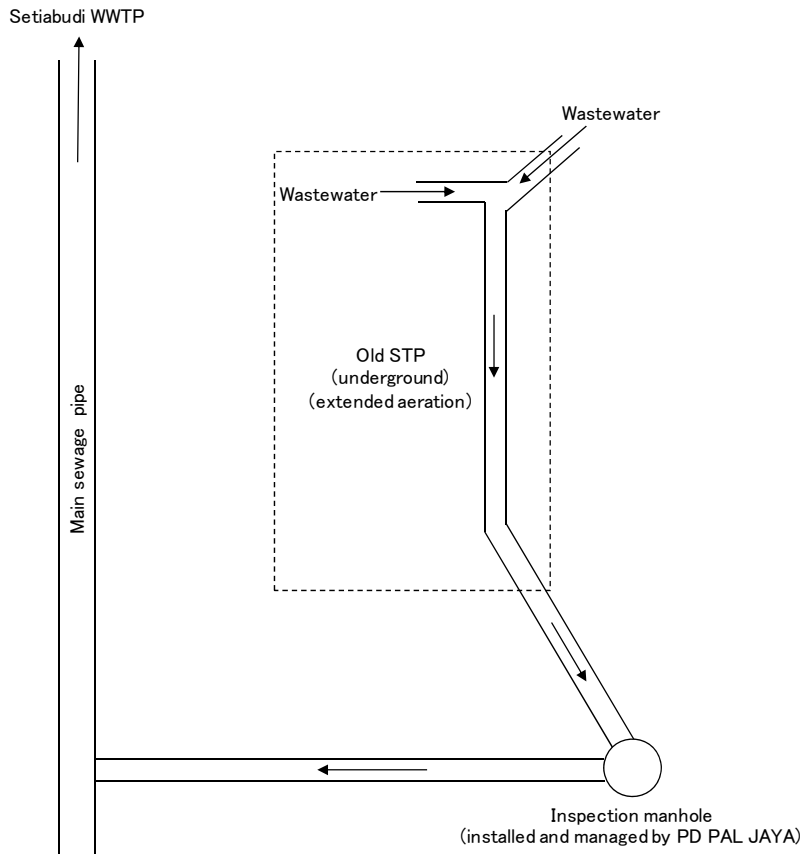
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		Nothing			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Inspection manhole			
			connection pipe			
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-6 Investigation Results of On-site Sanitation Facility built by Private (1/2)

Investigation results of On-site Sanitation Facility built by private

Date of Survey	7-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.		19	Social Economic Survey No.	43	
I - 2	Company Name / Building Name		BPPT			Gedung BPPT (Menara Patra building)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank		2) Standard activated sludge method	3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process		6) Rotary disc method	7) Modified septic tank		
			8) Other treatment methods		9) No treatment facility			
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year 1992	Construct together with the second building, in 1973, the first building was constructed		
I - 5	Treatment capacity（m^3/day）(3-6)		Unknown		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		Unknown		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-		6 - 9			
	2	$KMnO_4$	mg/l		85			
	3	Suspended solids (SS)	mg/l		50			
	4	Ammonia	mg/l		10		Never been checked	
	5	Oils and Fats	mg/l		10			
	6	Methylene Blue Compound	mg/l		2			
	7	COD (Dichromate)	mg/l		80			
	8	BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection		Never					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Never, since 15 years ago					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*Water use: The water is sourced from water tap (PAM) (Rp. 60-80 billion/month), They also have private well but it is not used anymore They have reused system only for gardening and it is using sand and carbon filter.						
		*O&M: the O&M is managed by themselves O&M costs is about Rp. 50,000,000/year						
		*Problems: Currently they have problem with the air diffuser because of the air flow rate is so low. They are suspecting maybe there are clogging or corrosion in the diffuser tube. They said they never change the diffuser tube since 10 years ago						
		*Currently there are repairment on going in the STP of BPPT, they are changing any old wastewater pipe and in next Saturday they are planning to changing the diffuser tube with a new one.						
		*When we visited the STP, the blowers are not operated						

Table S/R-B4-6 Investigation Results of On-site Sanitation Facility built by Private (2/2)

Ⅱ Conditions of the facility			Sampling Survey No.	19	Building Name	Gedung BPPT (Menara Patra building)
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		not			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram	(Unknown)				
Ⅱ - 4	Conposition of main facilities		(Unknown)			
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		Yes, because of the reused water for gardening			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (1/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	25-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items	Specification					
I－1	Investigation No.	Sampling Survey No.	20		Social Economic Survey No.	44	
I - 2	Company Name / Building Name	PT. Indocement Tunggal Prokorsa			Indocement building		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)	1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
		5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
		8) Other treatment methods	9) No treatment facility		10) Already connected to sewage pipe		
I - 4	Installation year and month of the treatment facility (3-2)	Month		Year	-	(Installed building in 1985) (Connected to sewage pipe in 1991)	
I - 5	Treatment capacity（m^3/day）(3-6)	-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)	-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**	Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1 pH	-		6 - 9			
	2 $KMnO_4$	mg/l		85			
	3 Suspended solids (SS)	mg/l		50			
	4 Ammonia	mg/l		10			
	5 Oils and Fats	mg/l		10			
	6 Methylene Blue Compound	mg/l		2			
	7 COD (Dichromate)	mg/l		80			
	8 BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection	-					
I - 9	Sampling Point	-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**	-					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)	1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Water sources except for drinking is almost tap water (PDAM) (amount:4,400m3/month, cost: Rp. 55,000,000/month, Rp.12,500/m3). They have two private wells(depth:60m) for in case of emergency. Groundwater tax is very expensive (Rp.84,000/m3 : approximately 7 times tap water charge).					
		* Water qualitiy of Private well is no problem.					
		* Sewerage charge is 15,000,000 Rp./month.					
		* In their opinion, tap water(PDAM) is expensive and supply is not stable (Once every three months, which causes water supply shortages).					
		* They started discussion of installation wastewater reuse sysytem. They have hope to undertake the construction of wastewater reuse system in the next three years. However, it has the following three failures. (1) there is no nearby land for construction of STP and reuse system. (2) The land is very expensive. (3) They have to bear the double cost which sewerage charge and O&M cost for STP and reuse system. They will have to pay Their biggest incentive is the cost.					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (2/20)

Ⅱ Conditions of the facility			Sampling Survey No.	20	Building Name	Indocement building

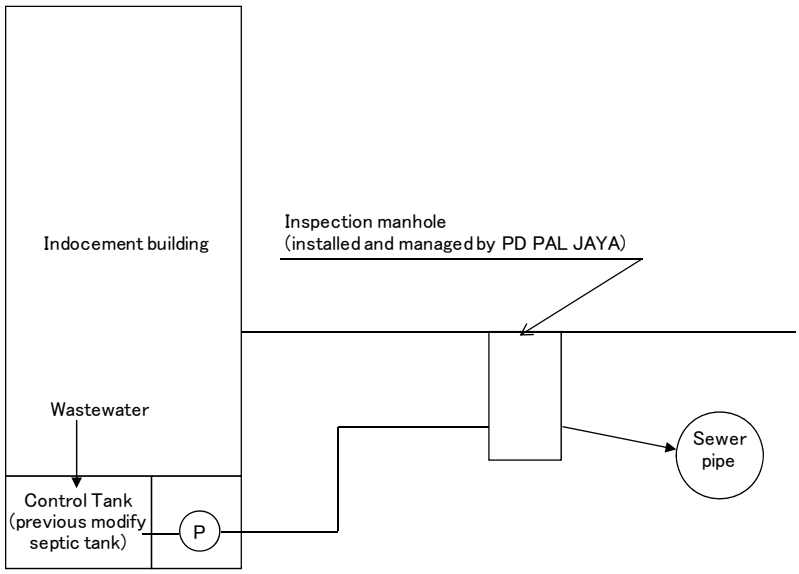
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		Nothing			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Control tank	1		
			Transfer Pump	2 units		
			Inspection manhole	1		
			connection pipe	1		
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (3/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	24-Mar-11
Investigator	Akagi

Ⅰ A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	21		Social Economic Survey No.	45	
I - 2	Company Name / Building Name		PT. Jakarta Setiabudi International			Setiabudi Ⅱ		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility		10) Already connected to sewage pipe		
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	-	(Installed building in 1981) (Connected to sewage pipe in 1990)	
I - 5	Treatment capacity（m^3/day）(3-6)		-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-		6 - 9			
	2	$KMnO_4$	mg/l		85			
	3	Suspended solids (SS)	mg/l		50			
	4	Ammonia	mg/l		10			
	5	Oils and Fats	mg/l		10			
	6	Methylene Blue Compound	mg/l		2			
	7	COD (Dichromate)	mg/l		80			
	8	BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection		-					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		-					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water use : Water sources except for drinking is almost tap water (PDAM) (amount:65m3/day, cost: Rp.12,500/m3). They have a private well(depth:200m) for in case of emergency. Groundwater tax is very expensive (Rp.60,000/m3 : 4 times tap water charge).						
		* Water qualitiy of Private well is no problem.						
		* Sewerage charge is 30,000,000 Rp./year for Setiabudi Ⅱ.						
		* The management company has 3 building, which used for shops and restrants (Setiabudi Ⅰ), offices(Setiabudi Ⅱ), and hotel (Setiabudi Ⅲ). All of the building already have been connect with sewer pipes.						
		* They is planning to contract with other private company which produce wastewater reuse system for cooling towers at Setiabudi Ⅲ (hotel) in order to decrease consumption tap water.						
		*They thinks connected with sewer pipes is cheaper than owned and managed their own STP. They believe that the sewer system should be extended more.						

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (4/20)

Ⅱ Conditions of the facility	Sampling Survey No.	21	Building Name	Setiabudi Ⅱ

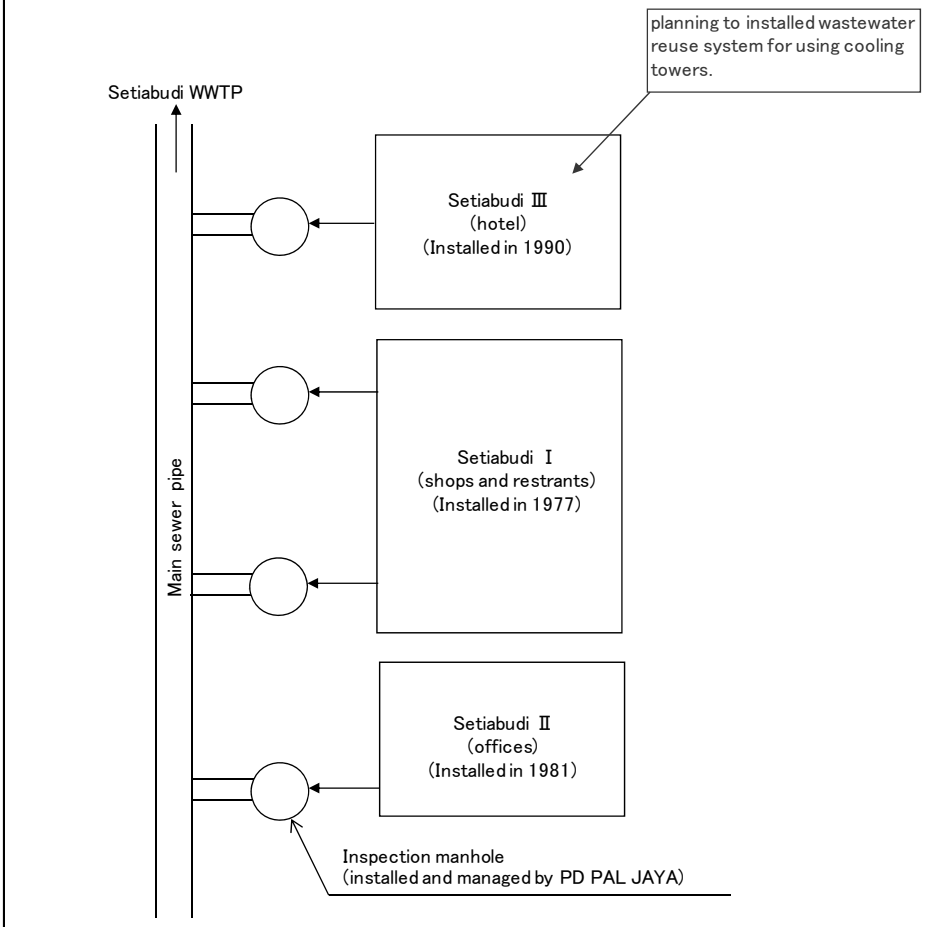
No.	Items	Specification			
Ⅱ-1	Drawing of treatment facility **(If any, please ask them to copy)**	Nothing			
Ⅱ-2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ-3	Flow Diagram				
Ⅱ-4	Conposition of main facilities	Inspection manhole			
		connection pipe			
Ⅱ-5	Is there a disinfection facility ?	No			
Ⅱ-6	Is there underground infiltration	No			
Ⅱ-7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (5/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

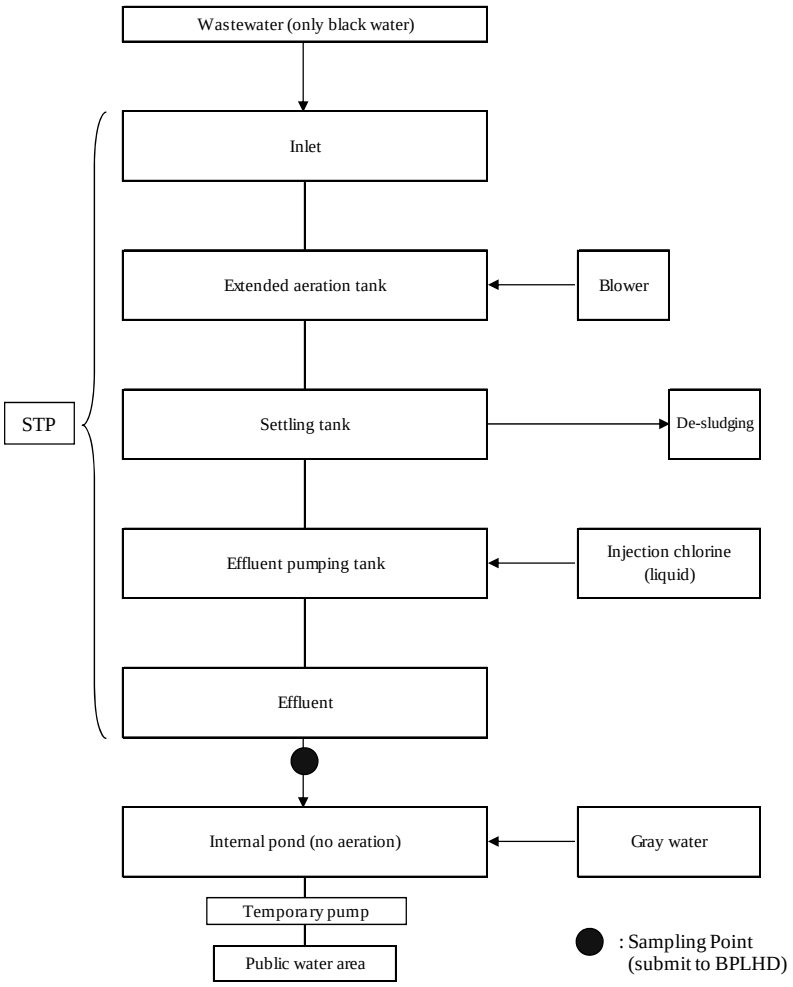
Date of Survey	15-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	22		Social Economic Survey No.	46	
I - 2	Company Name / Building Name		PT. Reksa Griya Antam			Pertambangan (mining) building (Gedung Aneka Tambang)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1990	(Installed building in 1990 - 1992)	
I - 5	Treatment capacity（m^3/day）(3-6)		40		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		60		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	6.8	6 - 9			
	2	$KMnO_4$	mg/l	16.32	85			
	3	Suspended solids (SS)	mg/l	11	50			
	4	Ammonia	mg/l	3.18	10			
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	*	2			
	7	COD (Dichromate)	mg/l	22.79	80			
	8	BOD (20℃, 5days)	mg/l	8.8	50			
I - 8	Latest date of inspection		28-Dec-10					
I - 9	Sampling Point		After effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		once a year (by private company (the same company contracted to maintain facility). (obtain sludge removal record)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* STP treat only black water (night soil water). Effluent from STP inflow to internal pond.Gray water (rain water, hand wash water, and so on) directly inflow to internal pond.						
		* All of water consumed by them is groundwater(2 deep wells), because of tap water (PDAM) isn't supplied to their area.						
		* They plan to construct additionally new building in internal area in next year. They receive the suggestion by private company to install recycle water treatment plant. They are interested to the suggestion, but not determine yet.						
		* BPLHD suggest them to install wastewater reusesystem as in order to decrease consumption of groundwater.						
		* O&M : Opereation is implemented by themselves.Maintenance is implemented by out-sourcing private company.Out-sourcing campany carry out to maintain once a 3 month. In addition, Out-sourcing company implement effluent water quality inseption before water sampling to submitting to BPLHD.						
		* Ploblem of O&M : effluent water quality is high concentration of ammonia. They deal with by injecting chlorine.						

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (6/20)

Ⅱ Conditions of the facility	Sampling Survey No.	22	Building Name	Pertambangan (mining) building (Gedung Aneka Tambang)

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				

Ⅱ - 4	Conposition of main facilities	Blower	2 units
		Comminuter	1unit
		Air lift pump	1unit
		Chlorine injection equipment	1 unit (Tank 1, Injection pump 1)
		Effluent pump	2 units
Ⅱ - 5	Is there a disinfection facility ?	Yes (mainly for reducing ammonia)	
Ⅱ - 6	Is there underground infiltration	No	

Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (7/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	30-Mar-11
Investigator	Akagi

I A summary of STP

No.	Items	Specification					
I－1	Investigation No.	Sampling Survey No.	23		Social Economic Survey No.	47	
I - 2	Company Name / Building Name	PT. Kepland Investama			International Financial Building (In 1991, This building was Wisma BCA)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)	1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
		5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
		8) Other treatment methods	9) No treatment facility		10) Already connected to sewage pipe		
I - 4	Installation year and month of the treatment facility (3-2)	Month		Year	-	(Installed building in 1986)	
I - 5	Treatment capacity（m^3/day）(3-6)	-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)	-		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**	Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1 pH	-		6 - 9			
	2 $KMnO_4$	mg/l		85			
	3 Suspended solids (SS)	mg/l		50			
	4 Ammonia	mg/l		10			
	5 Oils and Fats	mg/l		10			
	6 Methylene Blue Compound	mg/l		2			
	7 COD (Dichromate)	mg/l		80			
	8 BOD (20℃, 5days)	mg/l		50			
I - 8	Latest date of inspection	-					
I - 9	Sampling Point	-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**	-					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)	1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	* Water Use: For Drinking water they are using mineral water For other water use they are using water tap (PAM) and private well (total water use: 200 m^3/day) The reason why they still use private well is because of the small quantity of water tap (PAM)					
		*Before the pipe is connected to the main sewage pipe of PD PAL Jaya, the pipe is joined together first between Tamara Building and International Finance Center, so their inspection chamber is joined together with Tamara Building					
		*Respondent Opinion about recycle system: they think it is very good to build a recycle system but it is still depend on cost and available land, or if PD PAL can build an integrated recycle system so they just paid the recycle water to use the water.					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (8/20)

Ⅱ Conditions of the facility	Sampling Survey No.	23	Building Name	International Financial Building (In 1991, This building was Wisma BCA)

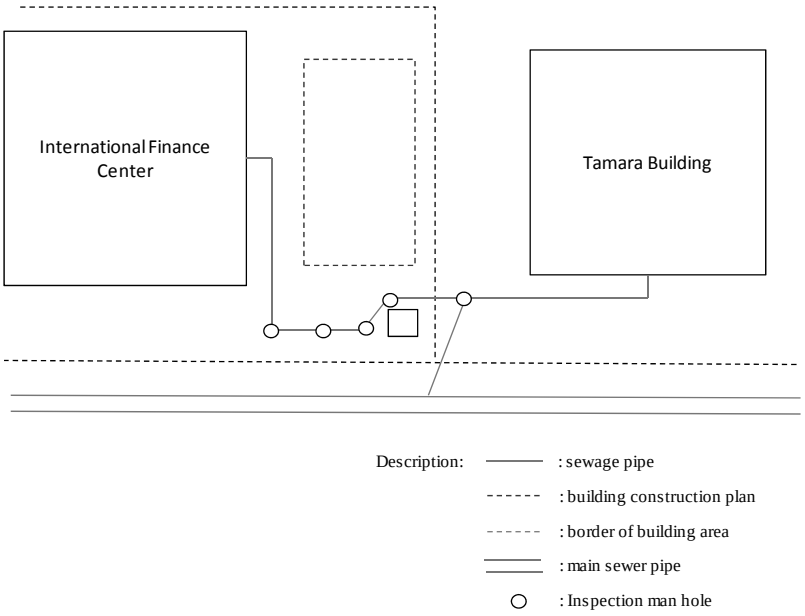
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	not			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Inspection manhole			
		connection pipe			
Ⅱ - 5	Is there a disinfection facility ?	No			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (9/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	31-Mar-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	24		Social Economic Survey No.	12	
I - 2	Company Name / Building Name		CV. Mahera					
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2004		
I - 5	Treatment capacity（m^3/day）(3-6)		unknown		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		12		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.8	6 - 9			
	2	$KMnO_4$	mg/l	44.05	85			
	3	Suspended solids (SS)	mg/l	15	50			
	4	Ammonia	mg/l	-	10		Effluent from gray water (non-treated)	
	5	Oils and Fats	mg/l	3.39	10			
	6	Methylene Blue Compound	mg/l	-	2			
	7	COD (Dichromate)	mg/l	70.34	80			
	8	BOD (20℃, 5days)	mg/l	27.15	50			
I - 8	Latest date of inspection		9-Dec-10					
I - 9	Sampling Point		Outlet; from grey water effluent of the building (untreated grey water)					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Once a year; de-sludging is done by Kecamatan office or private company (Rp. 200,000/de-sludging)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		*CV Mahera is an exporting company for jelly fish. Before 3 years ago, the production was done in this building (for washing and packing) and the wastewater thrown directly to open channel, but since 3 years ago their building is used just for storage only.					
			*Water use: for drinking water they are using mineral water, and for other water use they are using water tap (PAM) the cost for PAM is about Rp. 1,600,000/month with price per m^3 is about Rp. 12,500.					
			*Septic tank is used just for black water only and for grey water is flowing directly through to open channel.					
			*The respondent suspect that the disposal for the sludge from de-sludging truck is in Kelurahan Cawang on Penas area.					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (10/20)

Ⅱ Conditions of the facility			Sampling Survey No.	24	Building Name	0

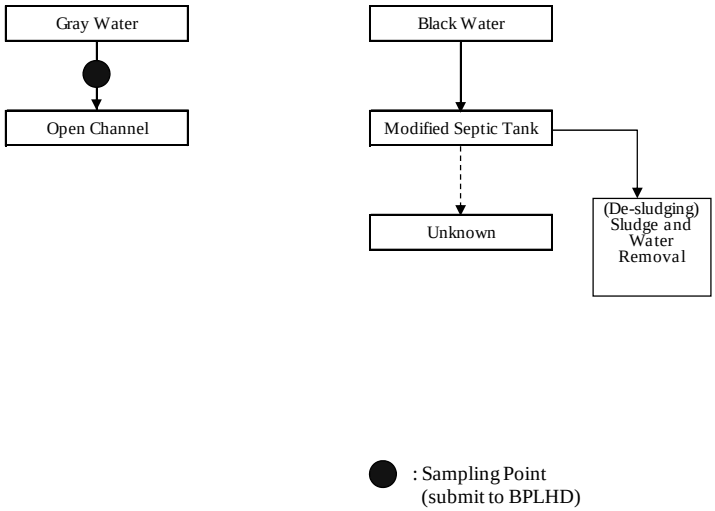
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		not			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel (Grey water)	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown (Black water)		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities					
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (11/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	01-Apr-11/05-Apr-11
Investigator	Akagi

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	25		Social Economic Survey No.	17	
I - 2	Company Name / Building Name		PT. PAM Lyonnaise Jaya					
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank (oldest)	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank (Newest)		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1963-2011	Oldest septic tank was installed in 1963 Newest septic tank was installed in 2011	
I - 5	Treatment capacity（m^3/day）(3-6)		unknown		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		unknown		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	Unknown	6 - 9	Unknown		
	2	$KMnO_4$	mg/l	Unknown	85	Unknown		
	3	Suspended solids (SS)	mg/l	Unknown	50	Unknown		
	4	Ammonia	mg/l	Unknown	10	Unknown		
	5	Oils and Fats	mg/l	Unknown	10	Unknown		
	6	Methylene Blue Compound	mg/l	Unknown	2	Unknown		
	7	COD (Dichromate)	mg/l	Unknown	80	Unknown		
	8	BOD (20℃, 5days)	mg/l	Unknown	50	Unknown		
I - 8	Latest date of inspection		Never Sent to BPLHD					
I - 9	Sampling Point		-					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Once a year, but not regularly, it is depend on the condition					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes including the discharged from WTP	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		*Septic tank is used for black water and for the grey water is flow directly through to open channel. *Discharged water (backwash water and sludge from WTP) is flow directly to the Krukut River.					
			*They have 4 office buildings in the WTP area and for each building they have their own septic tank					
			*O&M: they never do the O&M of STP, they just do the de-sludging, with the services from DK (Dinas Kebersihan) and sometimes private company.					
			*They also do the dredging to remove sediment in the Krukut River (3 times/year)					
			*Respondent opinion for reuse/recycle system: they said it is good to build a recycle system in PD PAL but there is a problem with psychological aspect about recycle water sourced from sewage, because some people do not want to use water recycled from sewage especially for drinking and praying					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (12/20)

Ⅱ Conditions of the facility		Sampling Survey No.	25	Building Name	0

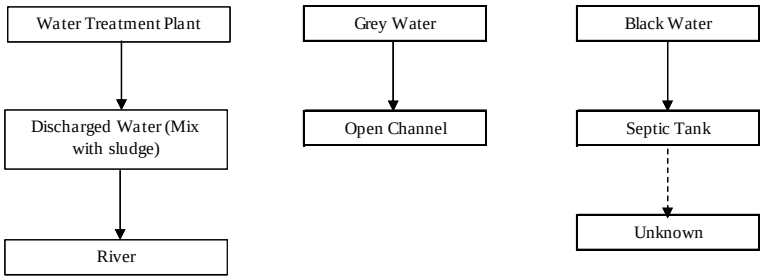
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	not			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others (Krukut River)	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities				
Ⅱ - 5	Is there a disinfection facility ?	No			
Ⅱ - 6	Is there underground infiltration	Unknown			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (13/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	31-Mar-11
Investigator	Emori

I A summary of STP

No.	Items	Specification					
I－1	Investigation No.	Sampling Survey No.	26		Social Economic Survey No.	19	
I - 2	Company Name / Building Name	PT. Pembangunan Jaya Ancol			Restoran Putri Duyung Ancol		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)	1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
		5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
		8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)	Month		Year	Unknown		
I - 5	Treatment capacity（m^3/day）(3-6)	30		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)	40		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**	Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1 pH	-	8	6 - 9			
	2 $KMnO_4$	mg/l	14.52	85			
	3 Suspended solids (SS)	mg/l	2	50			
	4 Ammonia	mg/l	0.21	10			
	5 Oils and Fats	mg/l	<1.13	10			
	6 Methylene Blue Compound	mg/l	0.03	2			
	7 COD (Dichromate)	mg/l	40	80			
	8 BOD (20℃, 5days)	mg/l	6.66	50			
I - 8	Latest date of inspection	28-Feb-11					
I - 9	Sampling Point	Outlet; there is a faucet at the effluent tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**	never do the de-sludging, but any floating sludge is filtered and put in plastic bag (about 2 plastics bag/day), then the plastics bag are carried out by garbage truck					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)	1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*Water use: For drinking water they are using mineral water, and for other water use is using from water tap (34 m^3/day) They do not have private well and sometimes the flow quantity of the water tap (PAM) is small. Total cost of water tap for all of Jakarta Bay City is about Rp. 3-4 Billion/month with water tap price Rp. 12,500/ m^3.					
		*Because of small quantity of flow from the water tap, they are planning to build a seawater treatment system with Reverse Osmosis system (RO system) to fulfill water amount about 12,000 m^3/day, and currently RO system with capacity about 5,000 m^3/day (fulfill 30 % of water use of all area) is on construction					
		*O&M: O&M is managed by private company (PT. Citra Mutia Mandiri) every day they do pH and debit quantity checking O&M costs is about Rp. 7,000,000/month.					
		*Problems: when many detergents and large quantity discharge wastewater from restaurant flow to the STP which is giving problem to the biological system, so they must add starter bacteria.					
		*There is a program from BPLHD called P3L to keep the beach and sea clean.					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (14/20)

Ⅱ Conditions of the facility	Sampling Survey No.	26	Building Name	Restoran Putri Duyung Ancol

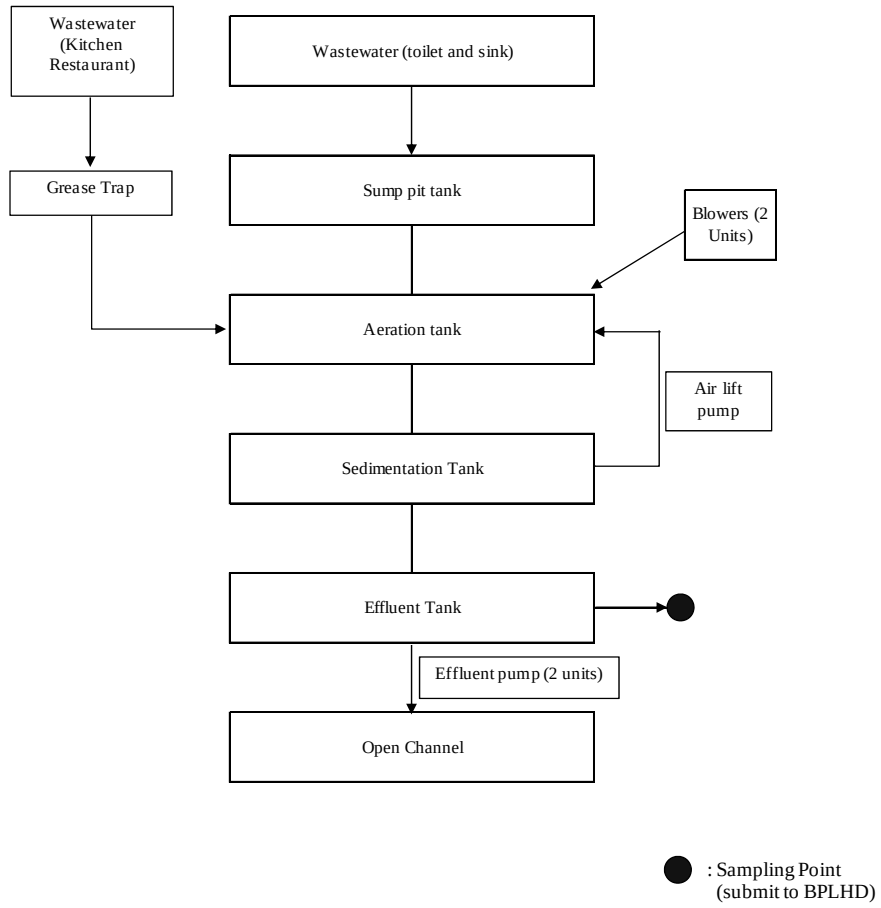
No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities	Blower (power : 2.2 kW)	2 Units		
		Effluent pump	2 Units		
		Sump pit pump	1 Unit		
		Air Lift Pump	1 Unit		
Ⅱ - 5	Is there a disinfection facility ?	No (they have a chlorine contact basin but do not have chlorine dosing tank)			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (15/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	29-Mar-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	27		Social Economic Survey No.	31	
I - 2	Company Name / Building Name		PT. Prodia Widya Husada			(Clinical Laboratorium Prodia Kodaya)		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2009		
I - 5	Treatment capacity（m^3/day）(3-6)		2		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		3		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.5	6 - 9			
	2	$KMnO_4$	mg/l	23.57	85			
	3	Suspended solids (SS)	mg/l	19	50			
	4	Ammonia	mg/l	13.46	10	Exceed		
	5	Oils and Fats	mg/l	3.45	10			
	6	Methylene Blue Compound	mg/l	0.14	2			
	7	COD (Dichromate)	mg/l	46.75	80			
	8	BOD (20℃, 5days)	mg/l	11.2	50			
I - 8	Latest date of inspection		19-Jan-11					
I - 9	Sampling Point		Outlet (Inspection Chamber)					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Never					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		*Water source is from 100% deep well with depth 34 m. Their water use is about 3 m^3/day					
			*For Hazardous waste (Wastewater from laboratorium) is handle by third party (out-sourcing): PT. Wastec International					
			*From 1990-2009 they still used septic tank, and then in 2009 the STP were constructed. The STP is using the overflow system. And also, the STP has 2 air pump with power: 40 watts					
			*O&M: For O&M is done by themselves and the O&M costs is about Rp. 150,000/month just for buying the bacteria type EM4.					
			*They have infiltration well for rainwater.					
			*besides they give report about wastewater quality to the BPLHD, they also give report about overall of their laboratorium (wastewater system and quality included) to Health sub-agency (Suku Dinas Kesehatan)					
			*They have laboratory association: PATELKI (technologists union of clinical laboratory) and ILKI (union of clinical laboratory of Indonesia)					

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (16/20)

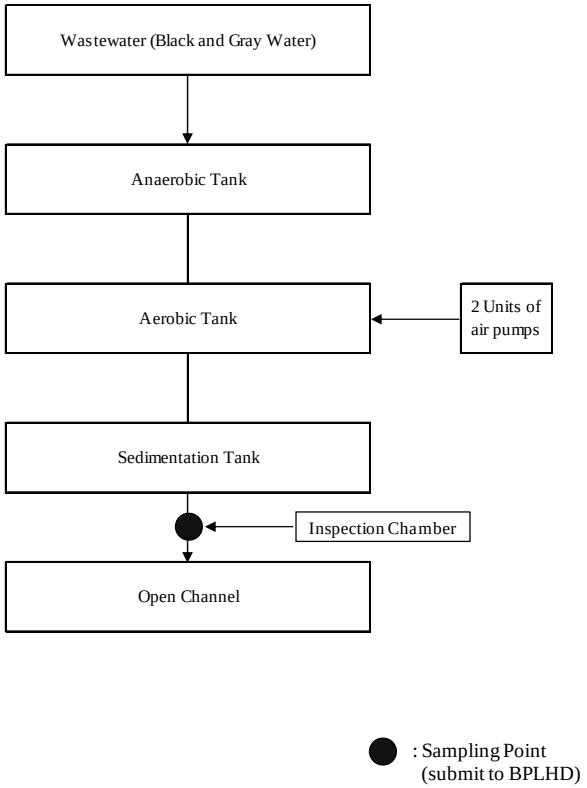
Ⅱ Conditions of the facility			Sampling Survey No.	27	Building Name	(Clinical Laboratorium Prodia Kodaya)
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Air Pump	2 Units		
Ⅱ - 5	Is there a disinfection facility ?		No			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (17/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	4-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.		28	Social Economic Survey No.		36
I - 2	Company Name / Building Name		RSPAD. Gatot Soebroto					
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank		2) Standard activated sludge method	3) Extended aeration process		4) Batch mode treatment process
			5) Contact aeration process		6) Rotary disc method	7) Modified septic tank		
			8) Other treatment methods		9) No treatment facility			
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	1945 -		
I - 5	Treatment capacity（m^3/day）(3-6)		790.96		m3/day	310.55 + 19.06 + 190.83 + 39.06 + 190.53 + 40.93		
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		1091		m3/day	390 + 45 + 240 + 50 + 240 + 126		
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.9	6 - 9			
	2	$KMnO_4$	mg/l	40.55	85			
	3	Suspended solids (SS)	mg/l	10	50			
	4	Ammonia	mg/l	14.21	10	Exceed	This water quality result is from the worst effluent quality of all six STP	
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.01	2			
	7	COD (Dichromate)	mg/l	78.46	80			
	8	BOD (20℃, 5days)	mg/l	28.45	50			
I - 8	Latest date of inspection		26-Jan-11					
I - 9	Sampling Point		Control tank (reservoir tank) before river					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Never; for all of STP					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.		5) Already connected to sewage pipes.
I - 12	memo	*RSPAD have six STP and managed by outsourcing company (CV. Juki Tirta Buana) *In the past time they have septic tank to treat the wastewater but now the septic tank was modified to become sump pit tank (wastewater inlet tank)						
		*Water use: they are using water tap for drinking water (patient) and mineral water for staff for other water use is 100 % from water tap (PAM) (1753.29 m^3/day) and they do not have any private well						
		*O&M: the O&M costs is about Rp. 150,000,000/year (it is not including repair cost for changing broken equipment) they do own pH, $KMnO_4$, TSS, and TDS checking for STP effluent quality every day.						
		*Wastewater from canteen and kitchen is treat using pre-treatment first (grease trap) then will flow to sump pit tank then to STP. Wastewater from laundy is treat using pre-treatment (chemical adding) then will flow to STP.						
		*Problems: In the past time they have problem with high pH and ammonia concentration, but for the latest date, the result is still fulfill the quality standard. STP Paru currently have problem with one of the blower (the blower is broken, so STP Paru right now is just operate with one blower).						
		*RSPAD has their own incinerator to treat hazardous solid waste and two times a week they collected the ash from the incinerator and a few times a month, the ash is carried out by PPLI (Prasadha Pramuna Limbah Industri) .						
		*RSPAD has their own treatment for hazardous wastewater but it is managed by different unit in RSPAD.						

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (18/20)

Ⅱ Conditions of the facility			Sampling Survey No.	28	Building Name	0

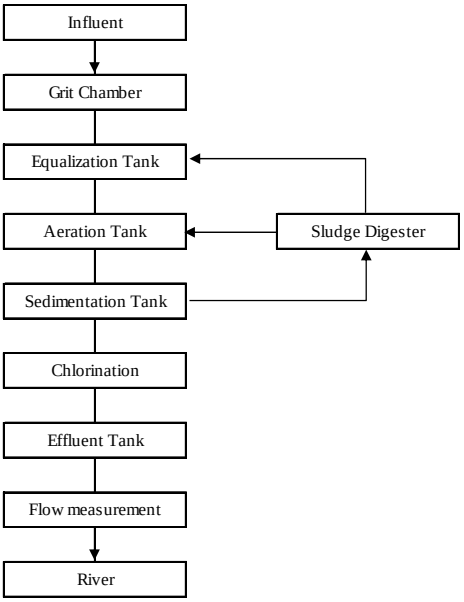
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others (Ciliwung River)	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities					
Ⅱ - 5	Is there a disinfection facility ?		Yes			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	△(Not enough)	×(Insufficient)	－ (Not necessary)
	2	Maintenance	○(Sufficient)	△(Not enough)	×(Insufficient)	－ (Not necessary)
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (19/20)

Sampling survey results of Individual Treatment Plant (STP built by private)

Date of Survey	29-Mar-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		Sampling Survey No.	29		Social Economic Survey No.	48	
I - 2	Company Name / Building Name		PT. Central International School			Central International School		
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank	2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process	
			5) Contact aeration process	6) Rotary disc method		7) Modified septic tank		
			8) Other treatment methods	9) No treatment facility				
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2004		
I - 5	Treatment capacity（m^3/day）(3-6)		60		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		70		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.7	6 - 9			
	2	$KMnO_4$	mg/l	10.65	85			
	3	Suspended solids (SS)	mg/l	5	50			
	4	Ammonia	mg/l	38.95	10	Exceed		
	5	Oils and Fats	mg/l	<1.13	10			
	6	Methylene Blue Compound	mg/l	0.03	2			
	7	COD (Dichromate)	mg/l	13.94	80			
	8	BOD (20℃, 5days)	mg/l	8.2	50			
I - 8	Latest date of inspection		31-Jan-11					
I - 9	Sampling Point		Outlet					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Never					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	*Water Use: Water source except for drinking is using tap water from Palyja (PAM Lyonnaise Jaya) (Cost: Rp. 10,000/m^3;amount: 80 m^3/day). In 2010, they stop using private well because of high tax (from Rp. 1,000/m^3 become Rp. 24,000/m^3 in last year)						
		*STP is outside the building and submerged. Also, The STP is used for treat black water and grey water.						
		*O&M: firstly they have out-sourcing company to do the O&M, but since 2009 the O&M has been implemented by themselves. The O&M cost is just for STP electrical system.						
		*Problem: The air pump is not working optimally because in January 2011, 3 of them had been broken. But this year, they already prepared the budget and plan to fix the broken air pump with estimated budget Rp. 13,000,000,-. So because of the broken air pump the result looks like are shown by the increase of the ammonia concentration						
		*The School has swimming pools which the water sourced from Palyja and they refill it two times a week.						
		*They have infiltration well for rainwater						

Table S/R-B4-7 Sampling Survey Results of ITP (STP built by Private) (20/20)

Ⅱ Conditions of the facility			Sampling Survey No.	29	Building Name	Central International School

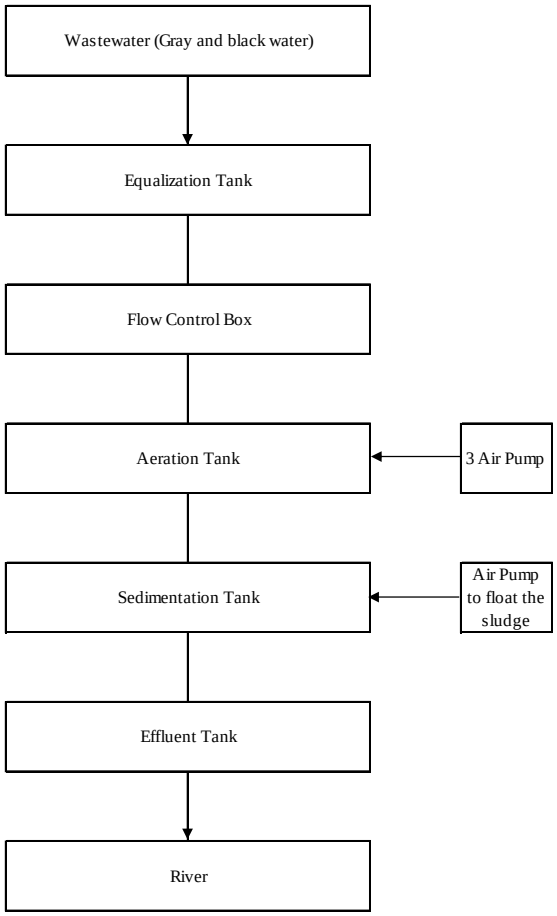
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it (obtain the document)			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others (river)	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Air Pump	4 units		
Ⅱ - 5	Is there a disinfection facility ?		Yes (Tablet)			
Ⅱ - 6	Is there underground infiltration		Yes			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-8 List of Individual Treatment Plant has Anaerobic & Contact Aeration Process

List of Individual Treatment Plant has Anaerobic & Contact aeration process

No.	Name	Category	Wastewater Treatment Method	Capacity	Effluent Water Quality				Area	Address
					CODcr	BOD	SS	NH_4-N		
				m3/day	mg/l	mg/l	mg/l	mg/l		
1	ERHA CLINIC(Kelapa Gading)	Clinic	Anaerobic & Contact aeration process	20	25.4	10.8	<10	3.42	Utara	Kelapa Gading
2	ERHA CLINIC(Kemanggisan)	Clinic	Anaerobic & Contact aeration process	6	40.3	16.8	24	unknown	Pusat	JL. Kemanggisan raya NO-50 91918 o 96/basirin
3	SHARP	Office	Anaerobic & Contact aeration process	50	6.15	4.75	8	3.54	Barat	Pulo Gadung JL.Rawa Gelam
				Average	24	11	14	3		
				Minimum	6	5	8	3		
				Maximum	40	17	24	4		

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (1/6)

Survey results of Individual Treatment Plant has Anaerobic & Contact aeration process

Date of Survey	5-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		1					
I - 2	Company Name / Building Name		Erha Clinic				Erha Clinic Kelapa Gading	
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank		2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process
			5) Contact aeration process		6) Rotary disc method		7) Modified septic tank	
			8) Other treatment methods		9) No treatment facility			
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2004		
I - 5	Treatment capacity（m^3/day）(3-6)		Close to 20		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		20		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	6.74	6 - 9			
	2	$KMnO_4$	mg/l	14.1	85			
	3	Suspended solids (SS)	mg/l	<10	50			
	4	Ammonia	mg/l	3.42	10			
	5	Oils and Fats	mg/l	<2	10			
	6	Methylene Blue Compound	mg/l	-	2			
	7	COD (Dichromate)	mg/l	25.4	80			
	8	BOD (20℃, 5days)	mg/l	10.8	50			
I - 8	Latest date of inspection		11 May 2010 (Once a year) by PT. Best Indo					
I - 9	Sampling Point		Effluent Tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Twice a year by PT. Best Indo					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		*There are no water quality result from BPLHD					
			*Water use: They are using mineral water for drinking water; for other water use they are fully using water tap (PAM) (674 m3/month) The cost of water tap is about Rp. 7,000,000/month and the price is Rp. 9,800/m3					
			*O&M: O&M is done by PT. Best Indo; but for repairment of broken equipment is done by themselves (Erha Clinic). The contract costs for O&M by PT. Best Indo is about Rp. 12,000,000/year (including effluent water analysis). O&M by PT. Best Indo is done once in a month; they have checklist paper for checking the STP condition.				
			*Problems: In the past time, they have problem with the blower but immediately fixed.					
			*The STP was constructed by PT. Best Indo					

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (2/6)

Ⅱ Conditions of the facility			Investigation No.	1	Building Name	Erha Clinic Kelapa Gading

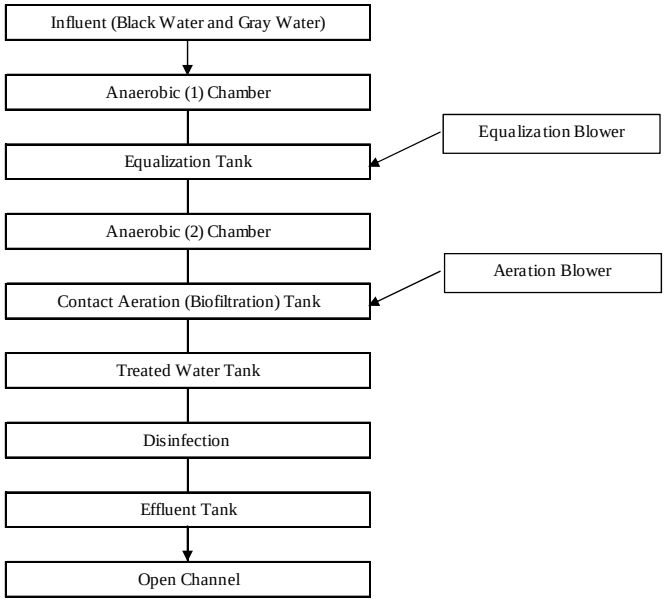
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		have it			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Equalization Blower	1 Unit		
			Aeration Blower	1 Unit		
			Backwash Blower	1 Unit		
Ⅱ - 5	Is there a disinfection facility ?		Yes (Tablet)			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (3/6)

Survey results of Individual Treatment Plant has Anaerobic & Contact aeration process

Date of Survey	7-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		2					
I - 2	Company Name / Building Name		Erha Clinic				Erha Clinic Kemanggisan	
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank		2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process
			5) Contact aeration process		6) Rotary disc method		7) Modified septic tank	
			8) Other treatment methods		9) No treatment facility			
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2004	Build the same time with the Building	
I - 5	Treatment capacity（m^3/day）(3-6)		-		m3/day			
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		6		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.69	6 - 9			
	2	$KMnO_4$	mg/l	-	85			
	3	Suspended solids (SS)	mg/l	24	50			
	4	Ammonia	mg/l	-	10			
	5	Oils and Fats	mg/l	-	10			
	6	Methylene Blue Compound	mg/l	-	2			
	7	COD (Dichromate)	mg/l	40.3	80			
	8	BOD (20℃, 5days)	mg/l	16.8	50			
I - 8	Latest date of inspection		23-Dec-10					
I - 9	Sampling Point		Effluent Tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		Twice a year by PT. Best Indo					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo		*Building capacity of Erha Clinic is about 100 people; total floor is about 3,500 m^2 and total land area is about 1,300 m^2					
			*Water use: They are using mineral water for drinking water; for other water use, they are using water tap (PAM) (12 m3/day) The price of water tap (PAM) is Rp. 12,500/m3) They are also have deep well for back up; the depth is about 25 m					
			*O&M : The O&M is done by PT. Best Indo O&M costs is about Rp. 600,000-700,000/month					
			*Problems: Currently the equlization blower is broken, they are expecting it to be fixed in this last month (changed to a new one)					
			*They do not have any recycle water system					

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (4/6)

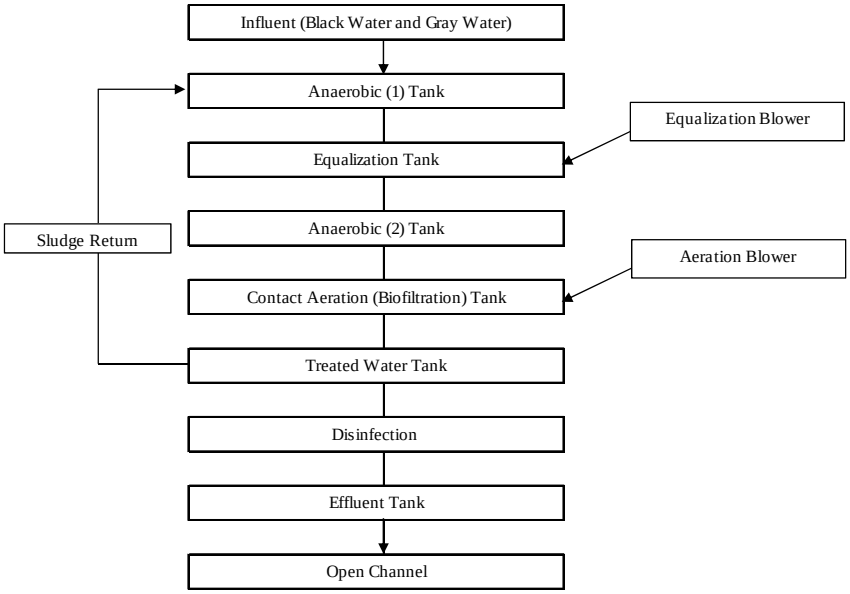
Ⅱ Conditions of the facility			Investigation No.	2	Building Name	Erha Clinic Kemanggisan
No.	Items		Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**		not			
Ⅱ - 2	Final destination of wastewater (3-14)		1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
			5) Pond	6)Water basin	7) Modified septic tank	
			8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram					
Ⅱ - 4	Conposition of main facilities		Aeration Blower	1 Unit		
			Equlization Blower	1 Unit		
			Effluent Pump	1 Unit		
Ⅱ - 5	Is there a disinfection facility ?		Yes (tablet)			
Ⅱ - 6	Is there underground infiltration		No			
Ⅱ - 7	Conditions of O & M					
	1	Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2	Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3	Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (5/6)

Survey results of Individual Treatment Plant has Anaerobic & Contact aeration process

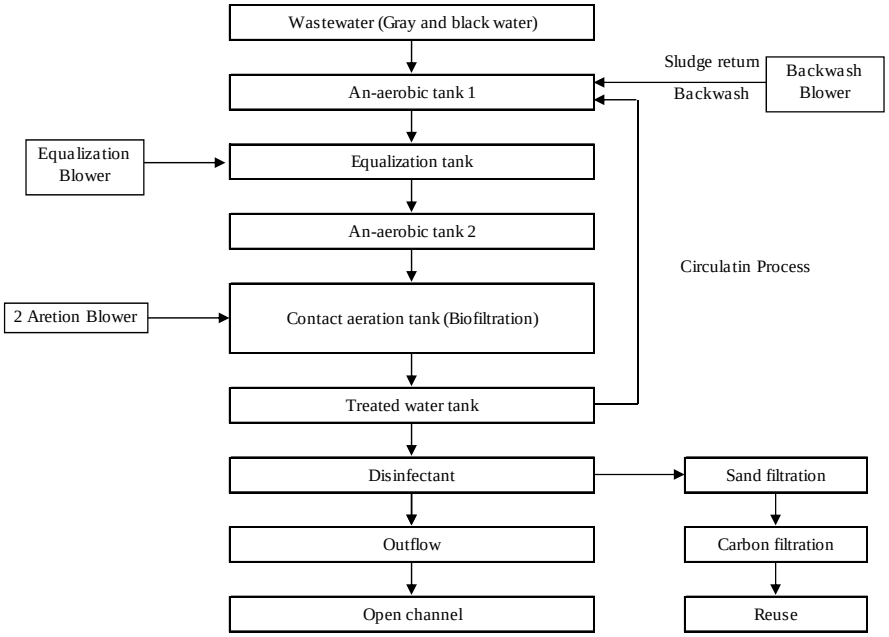
Date of Survey	12-Apr-11
Investigator	Emori

I A summary of STP

No.	Items		Specification					
I－1	Investigation No.		3					
I - 2	Company Name / Building Name		SHARP				SHARP	
I - 3	Method of wastewater treatment facility (On-site sanitation facility) (3-1)		1) Septic tank		2) Standard activated sludge method		3) Extended aeration process	4) Batch mode treatment process
			5) Contact aeration process		6) Rotary disc method		7) Modified septic tank	
			8) Other treatment methods		9) No treatment facility			
I - 4	Installation year and month of the treatment facility (3-2)		Month		Year	2008		
I - 5	Treatment capacity（m^3/day）(3-6)		Located at 5 in the site		m3/day		A 30 m3/d B 60 m3/d C 30 m3/d D 30m/d Main office 25m3/d(first) + 25 m3/d*2 (additional)	
I - 6	Achieved maximum treatment capacity（m 3/day）(3-7)		50% of Design		m3/day			
I - 7	Treatment water quality results (latest) (3-8) **(If any, please ask them to copy)**		Unit	Result	Quality standards	Excess items	Other Items (If any)	
	1	pH	-	7.2	6 - 9		A Another is almost	
	2	$KMnO_4$	mg/l	5.33	85			
	3	Suspended solids (SS)	mg/l	8	50			
	4	Ammonia	mg/l	3.54	10			
	5	Oils and Fats	mg/l	1.84	10			
	6	Methylene Blue Compound	mg/l	0.04	2			
	7	COD (Dichromate)	mg/l	6.15	80			
	8	BOD (20℃, 5days)	mg/l	4.75	50			
I - 8	Latest date of inspection		3-Jul-05					
I - 9	Sampling Point		After Effluent Tank					
I - 10	Frequency of sludge removal (3-11) **(If any, please ask them to copy record of sludge removal)**		1 time/year(Main Office)					
I - 11	If sewerage pipes are installed in your area, Are you willing to connect the wastewater to sewage pipes? (3-20)		1) Yes	2) No	3) If sewerage charge is cheaper than the current cost of O&M, I will connect it.	4) Now, I can not determine for the moment.	5) Already connected to sewage pipes.	
I - 12	memo	STP of Bestind (anearobic - earobic each with media)						
		Numbers of persons in Main Office is 500.						
		STP of Main Office is all converted to anerobic, conducted de-slusging, and effluent from it is transfered to another STP.						
		They have recycling system with sand filter and activated carbon , which rario is from 5 to 10 % of total amount. They are irrigating their garden in the site.						
		Bestind oparetes them and desluging.						
		They are checking pH, KMnO4, SS and Ammonia every day.(They said that the government recommend such check.)						
		They have each STP drawing and O&M Material in detail.						

Table S/R-B4-9 Survey Results of ITP has Anaerobic & Contact Aeration Process (6/6)

Ⅱ Conditions of the facility			Investigation No.	3	Building Name	SHARP

No.	Items	Specification			
Ⅱ - 1	Drawing of treatment facility **(If any, please ask them to copy)**	have it			
Ⅱ - 2	Final destination of wastewater (3-14)	1) Septic tank	2) Pit latrine	3) Open channel	4) Sewage pipe
		5) Pond	6)Water basin	7) Modified septic tank	
		8) Others	9) Unknown		
Ⅱ - 3	Flow Diagram				
Ⅱ - 4	Conposition of main facilities				
Ⅱ - 5	Is there a disinfection facility ?	Yes			
Ⅱ - 6	Is there underground infiltration	No			
Ⅱ - 7	Conditions of O & M				
	1 Operation	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	2 Maintenance	○(Sufficient)	×(Insufficient)	－ (Not necessary)	
	3 Own water quality management	○(Yes)	×(No, only submit sampling water to BPLHD)		

B4.4 Existing Conditions for Operation and Maintenance (O&M)

B4.4.1 O&M for Off-Site Sanitation

Table S/R-B4-10 Number of Customers of PD PAL JAYA by Category

* **number of customer**

(units : household)

category of customer	2005	2006	2007	2008	2009	Remarks
Household	1,143	1,170	1,172	1,147	1,179	Household
Small Commercial	4	6	8	10	12	Non-household
Large Commercial	119	121	130	140	143	
Social	31	32	32	28	31	
Industry	1	1	1	1	1	
total	1,298	1,330	1,343	1,326	1,366	
Ratio of change(each year)	-	2%	1%	-1%	3%	
Ratio of change (average)	-	1%				

source : Annual Report PD PAL JAYA, 2006 - 2009

* **number of customer and floor area in 2009**

category of customer	Customer		Floor area	
	Number	Rate(%)	Area(m2)	Rate(%)
Household	1,179	86.3%	130,216	2.8%
Small Commercial	12	0.9%	62,328	1.3%
Large Commercial	143	10.5%	4,201,569	90.8%
Social	31	2.3%	231,707	5.0%
Industry	1	0.1%	400	0.0%
total	1,366	100.0%	4,626,220	100.0%

* **floor area**

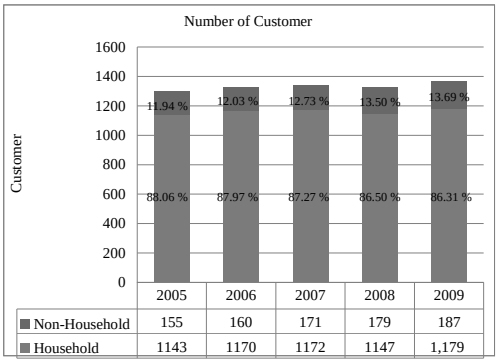
(unit : m2)

category of customer	2005	2006	2007	2008	2009	Remarks
Household	12,523	129,331	130,055	125,597	130,216	Household
Small commercial	19,428	20,768	21,591	22,700	62,328	Non-household
Large commercial	2,842,473	2,901,610	3,212,504	3,815,146	4,201,569	
Social	225,352	226,598	229,841	229,841	231,707	
Industry	400	400	400	400	400	
total	3,100,176	3,278,707	3,594,391	4,193,684	4,626,220	
Ratio of change(each year)	-	6%	10%	17%	10%	
Ratio of change (average)	-	11%				

source : Annual Report PD PAL JAYA, 2006 - 2009

* **number of customer**

category of customer	2005	2006	2007	2008	2009
Household	1143	1170	1172	1147	1,179
Household Percentage	88.06%	87.97%	87.27%	86.50%	86.31%
Non-Household	155	160	171	179	187
Non-Household Percentag	11.94%	12.03%	12.73%	13.50%	13.69%
Total	1298	1330	1343	1326	1366



* **floor area**

category of customer	2005	2006	2007	2008	2009
Household	12,523	129,331	130,055	125,597	130,216
Household Percentage	0.40%	3.94%	3.62%	2.99%	2.81%
Non-Household	3,087,653	3,149,376	3,464,336	4,068,087	4,496,004
Non-Household Percentag	99.60%	96.06%	96.38%	97.01%	97.19%
Total	3,100,176	3,278,707	3,594,391	4,193,684	4,626,220

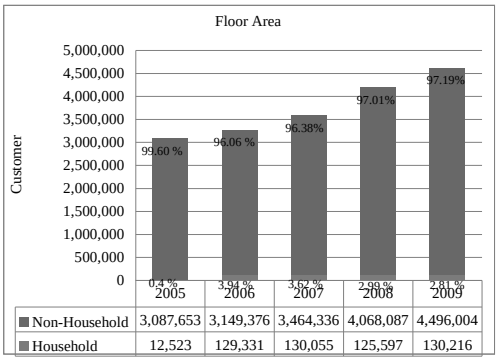


Table S/R-B4-11 Results of Water Quality Analysis of Setiabudi Ponds by PD PAL JAYA (East Setiabudi Pond)

Sampling Point: Gg. Edy

NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	8.10	8.00	7.70	7.70	7.40	7.57	8.10	8.00	7.70	7.80	8.00	7.48	8.10	7.80	7.40
2	Suspended Solids	60.00	50.00	84.00	84.00	19.51	57.33	60.00	50.00	84.00	67.50	50.00	34.50	84.00	58.40	19.51
3	BOD (20oC,5 hari)	86.00	81.00	76.00	76.00	114.75	136.33	86.00	81.00	76.00	78.00	70.00	81.75	136.33	86.90	70.00
4	COD	139.00	156.00	121.00	121.00	225.75	187.33	139.00	156.00	121.00	174.00	122.50	158.75	225.75	151.78	121.00
5	Organic Matter	70.00	74.00	75.00	75.00	125.09	105.16	70.00	74.00	75.00	97.50	85.00	104.25	125.09	85.83	70.00
6	Ammonia	1.80	2.20	3.10	3.10	8.29	8.65	1.80	2.20	3.10	4.58	3.90	3.80	8.65	3.88	1.80
7	Detergent/MBAS	1.34	1.10	1.00	1.00	0.64	0.61	1.34	1.10	1.00	1.68	1.69	1.78	1.78	1.19	0.61
8	Grease/Oil	1.20	1.56	0.88							1.34	2.70	1.75	2.70	1.57	0.88

Sampling Point: Kl. Gdg

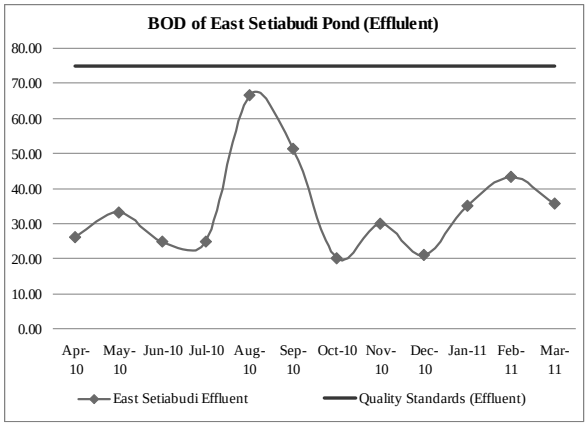
NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	7.80	8.10	8.10	8.10	7.38	7.67	7.80	8.10	8.10	7.78	8.05	7.45	8.10	7.87	7.38
2	Suspended Solids	66.00	56.00	70.00	70.00	23.26	33.67	66.00	56.00	70.00	68.75	58.00	55.00	70.00	57.72	23.26
3	BOD (20oC,5 hari)	80.00	84.00	79.00	79.00	116.50	71.00	80.00	84.00	79.00	94.00	82.00	102.25	116.50	85.90	71.00
4	COD	113.00	195.00	89.00	89.00	174.75	123.33	113.00	195.00	89.00	179.50	132.50	154.50	195.00	137.30	89.00
5	Organic Matter	84.00	80.00	79.00	79.00	111.31	70.20	84.00	80.00	79.00	102.25	92.50	125.25	125.25	88.88	70.20
6	Ammonia	2.20	2.00	2.00	2.00	9.13	6.05	2.20	2.00	2.00	4.87	5.35	4.10	9.13	3.66	2.00
7	Detergent/MBAS	1.40	1.00	2.50	2.50	0.74	0.60	1.40	1.00	2.50	1.74	2.89	1.73	2.89	1.67	0.60
8	Grease/Oil	1.00	1.20	1.70							1.31	1.70	1.55	1.70	1.41	1.00

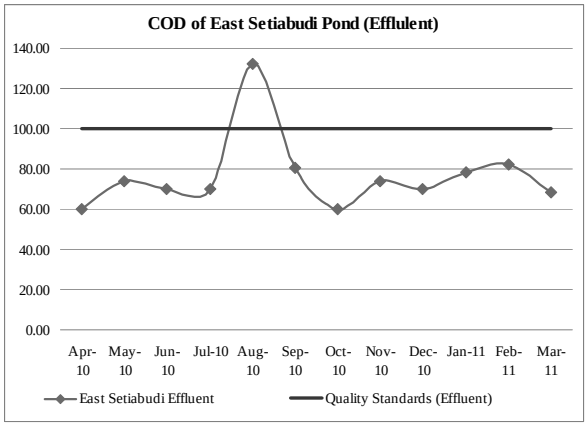
Sampling Point: Sewer D

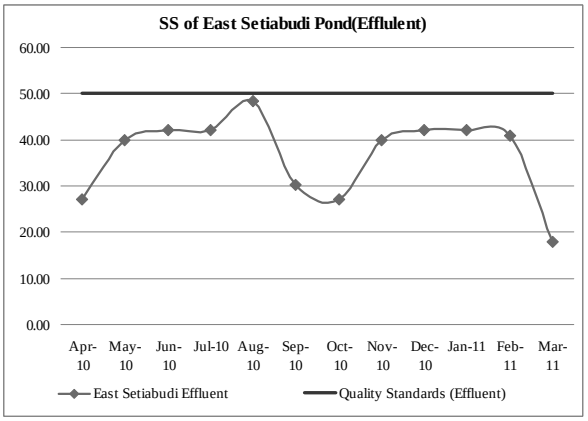
NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	8.30	7.80	8.00	8.00	7.28	7.60	8.10	7.80	8.00	7.73	7.80	7.38	8.30	7.82	7.28
2	Suspended Solids	53.00	75.00	52.00	52.00	47.02	61.67	53.00	75.00	52.00	61.50	40.00	41.00	75.00	55.27	40.00
3	BOD (20oC,5 hari)	89.00	98.00	63.00	63.00	95.75	91.00	89.00	98.00	63.00	86.75	82.50	97.75	98.00	84.73	63.00
4	COD	140.00	204.00	79.00	79.00	196.00	149.67	140.00	204.00	79.00	152.50	143.00	145.50	204.00	142.64	79.00
5	Organic Matter	72.00	85.00	70.00	70.00	110.27	102.11	72.00	85.00	70.00	98.75	94.00	132.25	132.25	88.45	70.00
6	Ammonia	1.40	1.90	1.40	1.40	9.26	7.23	1.40	1.90	1.40	5.82	3.80	4.21	9.26	3.43	1.40
7	Detergent/MBAS	0.96	0.78	1.30	1.30	0.32	0.41	0.96	0.78	1.30	1.91	1.99	1.47	1.99	1.12	0.32
8	Grease/Oil	0.87	0.88	0.95							1.35	2.50	2.25	2.50	1.47	0.87

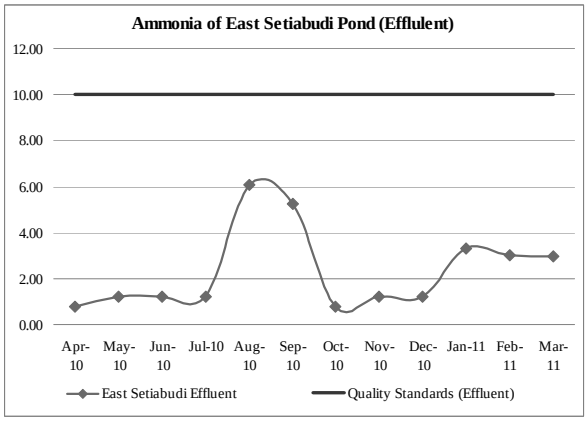
Sampling Point: East Setiabudi Effluent

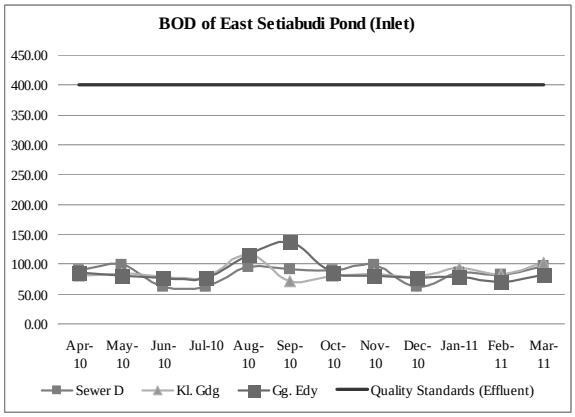
NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	7.80	7.90	7.90	7.90	7.35	7.43	7.80	7.90	7.90	7.70	7.70	7.40	7.90	7.72	7.35
2	Suspended Solids	27.00	40.00	42.00	42.00	48.50	30.33	27.00	40.00	42.00	42.00	41.00	18.00	48.50	36.65	18.00
3	BOD (20oC,5 hari)	26.00	33.00	25.00	25.00	66.75	51.33	20.00	30.00	21.00	35.00	43.50	35.75	66.75	34.36	20.00
4	COD	60.00	74.00	70.00	70.00	132.50	80.67	60.00	74.00	70.00	78.25	82.50	68.25	132.50	76.68	60.00
5	Organic Matter	59.00	79.00	64.00	64.00	63.96	52.61	59.00	79.00	64.00	68.50	71.50	74.25	79.00	66.57	52.61
6	Ammonia	0.78	1.20	1.20	1.20	6.05	5.23	0.78	1.20	1.20	3.33	3.00	2.95	6.05	2.34	0.78
7	Detergent/MBAS	0.66	0.67	0.96	0.96	0.37	0.16	0.66	0.67	0.96	0.59	1.75	0.83	1.75	0.77	0.16
8	Grease/Oil	0.80	0.85	0.68							0.70	1.50	0.08	1.50	0.77	0.08

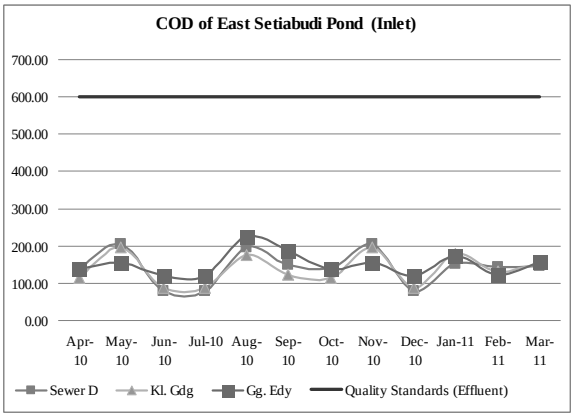


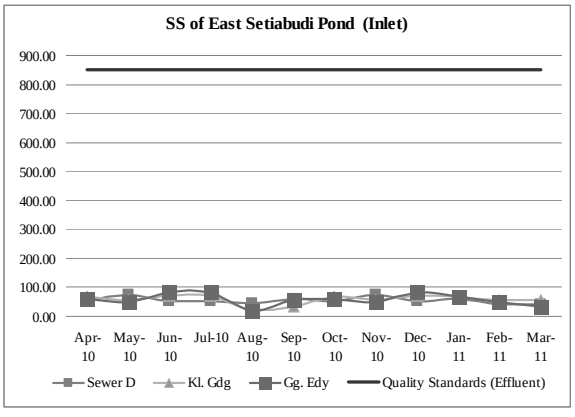












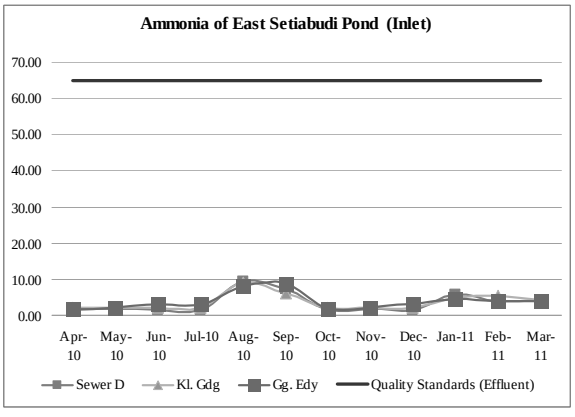


Figure S/R-B4-3 Results of Water Quality Analysis of Setiabudi Ponds by PD PAL JAYA (East Setiabudi Pond)

Table S/R-B4-12 Results of Water Quality Analysis of Setiabudi Ponds by PD PAL JAYA (West Setiabudi Pond)

Sampling Point: R. Said

NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	7.50	8.10	7.60	7.60	7.40	7.53	7.90	7.50	7.60	6.08	7.70	7.80	8.10	7.53	6.08
2	Suspended Solids	56.00	48.00	56.00	55.00	29.00	42.67	60.00	42.00	54.00	39.40	50.00	48.50	60.00	48.38	29.00
3	BOD (20oC,5 hari)	79.00	70.00	83.00	90.00	39.50	70.33	83.00	64.00	89.00	45.60	72.00	90.00	90.00	72.95	39.50
4	COD	153.00	123.00	130.00	128.00	88.50	168.33	144.00	123.00	113.00	66.40	103.50	175.00	175.00	126.31	66.40
5	Organic Matter	76.00	80.00	76.00	69.50	49.01	74.08	70.00	84.00	69.00	56.40	84.00	103.50	103.50	74.29	49.01
6	Ammonia	2.50	2.00	3.20	2.95	4.53	3.73	1.78	1.72	3.68	3.41	1.82	2.80	4.53	2.84	1.72
7	Detergent/MBAS	1.20	1.40	0.89	1.21	0.30	0.20	1.30	0.21	1.44	1.59	2.11	0.74	2.11	1.05	0.20
8	Grease/Oil	0.98	1.30	0.98							1.17	0.63	0.06	1.30	0.85	0.06

Sampling Point: Landmark

NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	7.60	7.90	7.90	7.65	7.50	7.63	8.00	7.40	7.50	5.98	7.60	7.90	8.00	7.55	5.98
2	Suspended Solids	77.00	56.00	50.00	48.00	18.00	26.33	53.00	52.00	48.00	32.40	60.00	39.50	77.00	46.69	18.00
3	BOD (20oC,5 hari)	70.00	73.00	64.00	78.00	88.00	56.67	92.00	79.00	74.00	46.80	71.50	69.75	92.00	71.89	46.80
4	COD	102.00	116.00	96.00	109.50	101.00	114.67	117.00	162.00	92.00	68.00	154.50	145.00	162.00	114.81	68.00
5	Organic Matter	74.00	72.00	70.00	78.00	59.72	73.00	81.00	75.00	77.00	62.60	79.50	95.25	95.25	74.76	59.72
6	Ammonia	2.70	2.10	2.00	3.44	6.21	5.23	0.94	2.13	3.38	3.84	4.59	3.10	6.21	3.30	0.94
7	Detergent/MBAS	1.08	1.00	1.30	1.47	0.75	0.55	1.42	0.09	1.60	1.77	2.56	0.50	2.56	1.17	0.09
8	Grease/Oil	1.30	1.00	1.00							0.85	0.52	0.07	1.30	0.79	0.07

Sampling Point: West Setiabudi Effluent

NO	PARAMETER	2010									2011					
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	MAX	AVE	MIN
1	pH	7.70	7.50	7.50	7.50	7.25	7.40	7.50	7.30	7.40	6.04	7.65	7.40	7.70	7.35	6.04
2	Suspended Solids	36.00	40.00	32.00	34.00	28.50	17.67	30.00	36.00	32.00	26.60	44.00	18.00	44.00	31.23	17.67
3	BOD (20oC,5 hari)	42.00	33.00	24.00	39.50	59.00	34.33	20.00	22.00	40.00	35.60	48.50	46.50	59.00	37.04	20.00
4	COD	79.00	64.00	69.00	76.50	153.00	73.00	58.00	89.00	75.00	59.20	75.00	63.00	153.00	77.81	58.00
5	Organic Matter	65.00	70.00	72.00	64.00	79.76	48.29	60.00	68.00	66.00	54.20	75.00	75.75	79.76	66.50	48.29
6	Ammonia	1.30	0.90	0.66	2.16	10.50	3.62	0.67	1.18	2.70	1.86	1.38	3.08	10.50	2.50	0.66
7	Detergent/MBAS	0.93	0.90	0.34	0.72	0.50	0.21	0.89	0.08	1.10	0.86	1.71	1.41	1.71	0.80	0.08
8	Grease/Oil	0.74	0.93	0.73							0.56	0.46	1.80	1.80	0.87	0.46

Quality Standards (Effluent)

NO	PARAMETER	2010									2011		
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
1	pH	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
2	Suspended Solids	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
3	BOD (20oC,5 hari)	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
4	COD	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
5	Organic Matter	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00
6	Ammonia	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
7	Detergent/MBAS	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
8	Grease/Oil	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Quality Standards (Inflow)

NO	PARAMETER	2010									2011		
		Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
1	pH	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9
2	Suspended Solids	850.00	850.00	850.00	850.00	850.00	850.00	850.00	850.00	850.00	850.00	850.00	850.00
3	BOD (20oC,5 hari)	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00
4	COD	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00
5	Organic Matter	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00
6	Ammonia	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
7	Detergent/MBAS	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
8	Grease/Oil	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

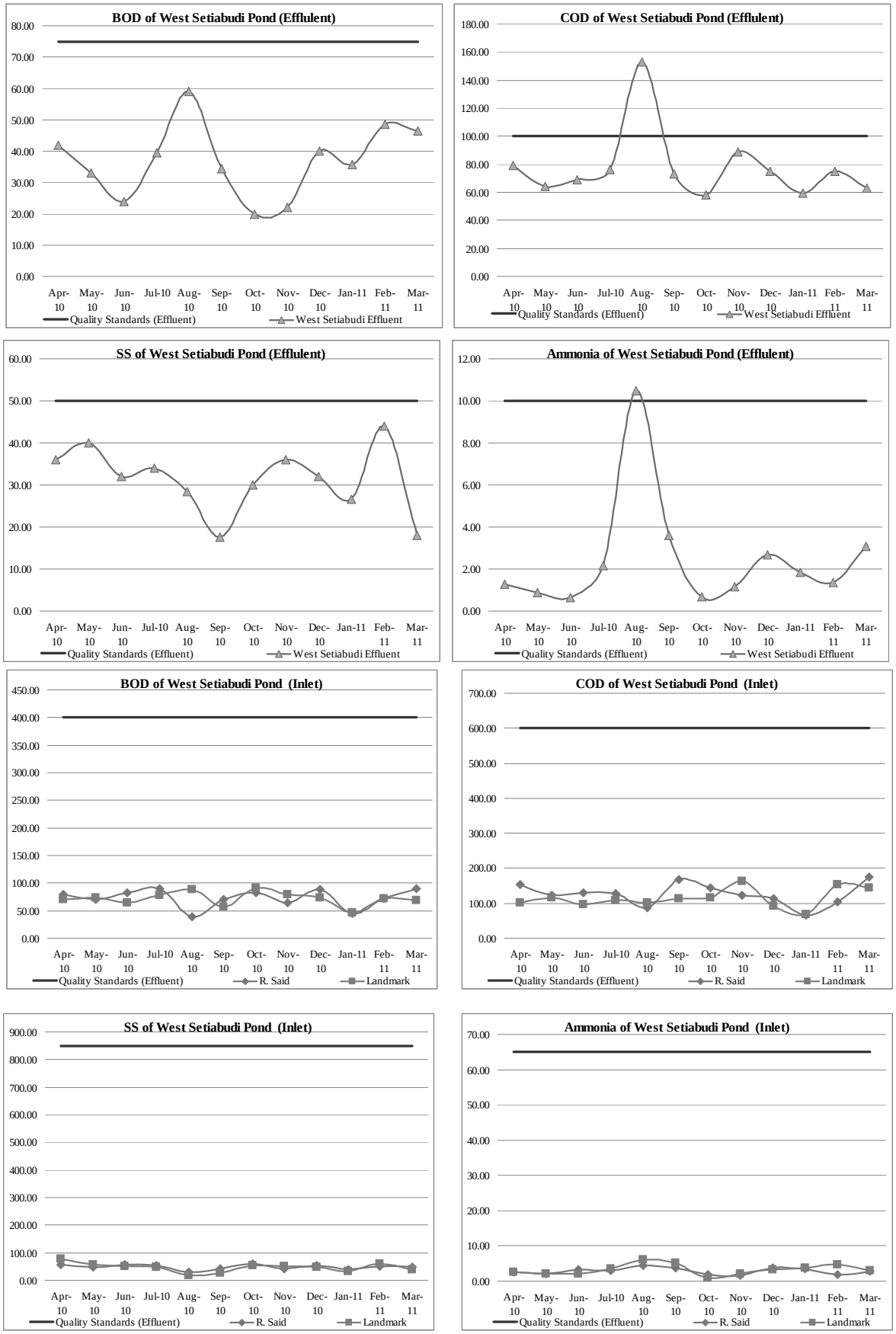


Figure S/R-B4-4 Results of Water Quality Analysis of Setiabudi Ponds by PD PAL JAYA (West Setiabudi Pond)

PART-C FUNDAMENTAL PLANNING AND DESIGN CONSIDERATIONS

Reference List of Tables and Figures

SP/R : Supporting Report
M/R : Main Report

PART-C FUNDAMENTAL PLANNING AND DESIGN CONSIDERATIONS

C1 Planning Considerations

C1.3 Future Population Projection and its Distribution in the Project Area

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
Kepulauan Seribu		Kep. Seribu Utara	001	P.Panggang	5,275	5,589	5,774	62	62	62	85	90	93
			002	P.Kelapa	5,430	5,753	5,943	258	258	258	21	22	23
			003	P.Harapan	1,964	2,081	2,150	245	245	245	8	8	9
				Total	**12,669**	**13,423**	**13,867**	**565**	**565**	**565**	**22**	**24**	**25**
		Kep. Seribu Selatan	004	P.Tidung	3,732	4,364	4,975	107	107	107	35	41	46
			005	P.U.Jawa	1,636	2,008	2,405	103	103	103	16	19	23
			006	P.Pari	2,648	2,805	2,898	95	95	95	28	30	31
				Total	**8,015**	**9,177**	**10,278**	**305**	**305**	**305**	**26**	**30**	**34**
	Total Population for Kepulauan Seribu				**20,684**	**22,600**	**24,145**	**870**	**870**	**870**	**24**	**26**	**28**
South Jakarta	KC01	Tebet	101	MANGGARAI	43,048	43,399	43,828	107	107	107	403	406	410
			102	MANGGARAI SELATAN	32,943	36,687	40,123	56	56	56	589	656	717
			103	BUKIT DURI	43,642	48,600	53,152	107	107	107	407	453	496
			104	MENTENG DALAM	40,517	45,120	49,346	250	250	250	162	180	197
			105	TEBET TIMUR	25,951	28,899	31,606	133	133	133	196	218	238
			106	TEBET BARAT	31,310	34,868	38,134	164	164	164	191	213	233
			107	KEBON BARU	49,221	54,813	59,947	126	126	126	390	435	475
				Total	**266,631**	**292,388**	**316,136**	**943**	**943**	**943**	**283**	**310**	**335**
	KC02	Setia Budi	108	SETIABUDI	4,015	4,048	4,088	67	67	67	60	60	61
			109	KARET	8,749	9,271	9,363	92	92	92	95	101	102
			110	KARET SEMANGGI	3,918	4,152	4,194	90	90	90	44	46	47
			111	KARET KUNINGAN	23,855	27,911	31,136	175	175	175	137	160	178
			112	MENTENG ATAS	37,444	43,809	48,871	96	96	96	389	456	508
			113	KUNINGAN TIMUR	8,478	8,547	8,631	221	221	221	38	39	39
			114	PASAR MANGGIS	28,320	30,011	30,308	78	78	78	364	386	390
			115	GUNTUR	6,346	7,799	9,141	66	66	66	97	119	139
				Total	**121,125**	**135,548**	**145,731**	**884**	**884**	**884**	**137**	**153**	**165**
	KC03	Mampang Prapatan	116	KUNINGAN BARAT	18,193	21,286	23,746	98	98	98	186	217	243
			117	MAMPANG PRAPATAN	24,607	30,240	35,442	80	80	80	307	378	443
			118	PELA MAMPANG	58,953	62,473	63,091	200	200	200	295	313	316
			119	TEGAL PARANG	42,738	47,595	52,052	105	105	105	408	454	497
			120	BANGKA	25,494	28,391	31,050	308	308	308	83	92	101
				Total	**169,985**	**189,985**	**205,381**	**791**	**791**	**791**	**215**	**240**	**260**

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
	KC04	Pasar Minggu	121	PEJATEN BARAT	46,054	53,883	60,109	297	297	297	155	181	202
			122	PASAR MINGGU	37,210	41,438	45,319	195	195	195	191	212	232
			123	JATI PADANG	37,955	40,222	40,620	240	240	240	158	168	169
			124	RAGUNAN	44,182	46,820	47,284	469	469	469	94	100	101
			125	CILANDAK TIMUR	42,738	45,290	45,738	383	383	383	112	118	119
			126	KEBAGUSAN	44,014	49,015	53,605	278	278	278	158	176	193
			127	PEJATEN TIMUR	58,268	61,747	62,358	298	298	298	196	208	210
				Total	**310,421**	**338,415**	**355,033**	**2,159**	**2,159**	**2,159**	**144**	**157**	**164**
	KC05	Kebayoran Lama	128	GROGOL UTARA	45,031	52,687	58,775	330	330	330	137	160	178
			129	GROGOL SELATAN	49,596	58,028	64,733	282	282	282	176	206	230
			130	CIPULIR	52,129	58,052	63,489	188	188	188	278	309	338
			131	KEBAYORAN LAMA UTARA	64,027	74,912	83,569	200	200	200	320	374	418
			132	PONDOK PINANG	63,241	81,614	100,471	679	679	679	93	120	148
			133	KEBAYORAN LAMA SELATAN	51,613	57,478	62,861	229	229	229	226	251	275
				Total	**325,638**	**382,771**	**433,898**	**1,907**	**1,907**	**1,907**	**171**	**201**	**228**
	KC06	Cilandak	134	GANDARIA SELATAN	29,033	29,270	29,560	160	160	160	182	183	185
			135	CIPETE SELATAN	25,880	27,425	27,696	238	238	238	109	115	116
			136	CILANDAK BARAT	73,079	81,383	89,006	590	590	590	124	138	151
			137	LEBAK BULUS	41,077	48,060	53,613	439	439	439	94	109	122
			138	PONDOK LABU	49,565	52,525	53,044	348	348	348	142	151	152
				Total	**218,634**	**238,663**	**252,919**	**1,775**	**1,775**	**1,775**	**123**	**134**	**142**
	KC07	Kabayoran Baru	139	SENAYAN	5,846	5,894	5,952	143	143	143	41	41	42
			140	RAWA BARAT	8,541	8,611	8,696	65	65	65	130	132	133
			141	SELONG	6,940	7,354	7,427	143	143	143	49	51	52
			142	GUNUNG	13,131	13,915	14,052	142	142	142	92	98	99
			143	KRAMAT PELA	22,755	24,113	24,352	125	125	125	182	193	195
			144	MELAWAI	5,219	5,262	5,314	128	128	128	41	41	41
			145	PETOGOGAN	21,417	22,696	22,920	85	85	85	252	267	270
			146	PULO	10,250	11,415	12,484	110	110	110	93	104	113
			147	GANDARIA UTARA	49,744	52,715	53,236	157	157	157	317	336	339
			148	CIPETE UTARA	45,662	50,851	55,613	170	170	170	269	299	327
				Total	**189,505**	**202,825**	**210,047**	**1,268**	**1,268**	**1,268**	**149**	**160**	**166**
	KC08	Pancoran	149	PANCORAN	22,468	25,021	27,364	141	141	141	159	177	194
			150	DUREN TIGA	21,489	21,664	21,879	190	190	190	113	114	115
			151	KALIBATA	44,339	49,377	54,001	245	245	245	181	202	221
			152	CIKOKO	14,951	16,650	18,210	67	67	67	224	250	273
			153	PENGADEGAN	25,196	30,964	36,290	99	99	99	255	314	368
			154	RAWAJATI	15,395	17,144	18,749	142	142	142	108	121	132

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
				Total	**143,837**	**160,820**	**176,494**	**883**	**883**	**883**	**163**	**182**	**200**
	KC09	Jagakarsa	155	TANJUNG BARAT	40,269	44,844	49,044	358	358	358	113	125	137
			156	JAGAKARSA	62,702	80,918	99,614	516	516	516	122	157	193
			157	LENTENG AGUNG	61,600	79,496	97,864	316	316	316	195	252	310
			158	SRENGSENG SAWAH	58,334	71,689	84,021	557	557	557	105	129	151
			159	CIGANJUR	34,484	46,721	60,398	366	366	366	94	128	165
			160	CIPEDAK	34,889	54,624	74,136	405	405	405	86	135	183
				Total	**292,277**	**378,291**	**465,078**	**2,518**	**2,518**	**2,518**	**116**	**150**	**185**
	KC10	Pesanggrahan	161	PETUKANGAN UTARA	59,141	69,195	77,191	280	280	280	211	247	276
			162	PETUKANGAN SELATAN	36,216	42,373	47,270	211	211	211	172	201	224
			163	ULUJAMI	53,051	59,079	64,612	206	206	206	258	287	314
			164	PESANGGRAHAN	35,327	39,341	43,025	196	196	196	180	201	219
			165	BINTARO	58,617	68,582	76,507	456	456	456	129	150	168
				Total	**242,352**	**278,570**	**308,605**	**1,349**	**1,349**	**1,349**	**180**	**207**	**229**
	South Jakarta - Total				**2,280,406**	**2,598,275**	**2,869,321**	**14,477**	**14,477**	**14,477**	**158**	**179**	**198**
East Jakarta	KC12	Matraman	201	KEBON MANGGIS	23,254	23,743	23,348	78	78	78	298	305	300
			202	PALMERIAM	25,565	24,832	24,420	65	65	65	393	382	376
			203	KAYU MANIS	31,572	33,876	36,076	55	55	55	578	621	661
			204	UTAN KAYU UTARA	34,613	63,111	91,868	99	99	99	348	634	923
			205	PISANGAN BARU	42,301	47,685	51,799	72	72	72	586	661	718
			206	UTAN KAYU SELATAN	31,126	30,234	29,732	117	117	117	267	259	255
				Total	**188,430**	**223,481**	**257,243**	**486**	**486**	**486**	**388**	**460**	**530**
	KC13	Pulo Gadung	207	KAYU PUTIH	48,777	47,380	46,593	384	384	384	127	124	121
			208	RAWAMANGUN	40,564	41,417	40,729	264	264	264	154	157	154
			209	PISANGAN TIMUR	51,872	55,657	59,272	180	180	180	289	310	330
			210	JATINEGARA KAUM	25,610	27,479	29,264	130	130	130	198	212	226
			211	PULO GADUNG	34,740	33,745	33,184	177	177	177	197	191	188
			212	CIPINANG	42,145	43,031	42,316	150	150	150	281	287	282
			213	JATI	34,470	38,858	42,210	207	207	207	166	188	204
				Total	**278,178**	**287,566**	**293,567**	**1,490**	**1,490**	**1,490**	**187**	**193**	**197**
	KC14	Cakung	214	RAWA TERATE	31,752	35,793	38,881	414	414	414	77	86	94
			215	JATINEGARA	84,019	85,785	84,360	653	653	653	129	131	129
			216	PENGGILINGAN	76,841	82,448	87,803	424	424	424	181	194	207
			217	CAKUNG BARAT	47,755	51,240	54,568	622	622	622	77	82	88
			218	UJUNG MENTENG	26,991	30,427	33,051	422	422	422	64	72	78
			219	PULO GEBANG	81,634	92,025	99,964	677	677	677	121	136	148
			220	CAKUNG TIMUR	50,353	56,763	61,660	936	936	936	54	61	66

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
				Total	**399,345**	**434,481**	**460,288**	**4,148**	**4,148**	**4,148**	**96**	**105**	**111**
	KC15	Jatinegara	221	KAMPUNG MELAYU	29,818	30,445	29,939	48	48	48	620	633	622
			222	BALI MESTER	12,135	13,021	13,866	67	67	67	180	193	206
			223	BIDARA CINA	42,939	41,709	41,016	124	124	124	345	335	330
			224	CIPINANG CEMPEDAK	37,228	36,161	35,561	166	166	166	225	218	215
			225	RAWA BUNGA	17,295	19,497	21,179	84	84	84	205	231	251
			226	CIPINANG BESAR SELATAN	33,178	35,599	37,911	170	170	170	195	209	223
			227	CIPINANG MUARA	62,259	63,568	62,512	266	266	266	234	239	235
			228	CIPINANG BESAR UTARA	51,025	52,097	51,232	113	113	113	450	460	452
				Total	**285,877**	**292,097**	**293,216**	**1,039**	**1,039**	**1,039**	**275**	**281**	**282**
East Jakarta (continued)	KC16	Kramat Jati	229	CAWANG	35,193	37,761	40,213	194	194	194	181	194	207
			230	CILILITAN	45,413	51,194	55,610	182	182	182	250	281	306
			231	KRAMAT JATI	37,891	38,688	38,045	144	144	144	264	270	265
			232	BATU AMPAR	34,816	43,290	51,894	254	254	254	137	171	205
			233	BALE KAMBANG	25,672	30,397	34,691	169	169	169	152	180	205
			234	DUKUH	23,334	26,304	28,574	173	173	173	135	152	165
			235	KAMPUNG TENGAH	36,866	39,556	42,125	197	197	197	187	201	214
				Total	**239,185**	**267,190**	**291,153**	**1,312**	**1,312**	**1,312**	**182**	**204**	**222**
	KC17	Pasr Rebo	236	GEDONG	36,697	43,452	49,590	258	258	258	142	168	192
			237	CIJANTUNG	40,106	45,211	49,111	246	246	246	163	184	200
			238	BARU	28,637	30,726	32,722	197	197	197	146	156	166
			239	KALI SARI	37,476	42,247	45,891	252	252	252	149	168	182
			240	PEKAYON	44,382	52,551	59,974	302	302	302	147	174	198
				Total	**187,297**	**214,186**	**237,288**	**1,255**	**1,255**	**1,255**	**149**	**171**	**189**
	KC18	Duren Sawit	241	PONDOK BAMBU	62,128	66,662	70,992	415	415	415	150	161	171
			242	KLENDER	74,346	79,771	84,953	297	297	297	251	269	286
			243	DUREN SAWIT	53,826	60,677	65,912	461	461	461	117	132	143
			244	MALAKA JAYA	40,696	43,666	46,502	104	104	104	391	420	447
			245	PONDOK KELAPA	61,812	69,681	75,692	572	572	572	108	122	132
			246	MALAKA SARI	37,337	38,122	37,489	133	133	133	281	287	282
			247	PONDOK KOPI	38,409	43,298	47,033	228	228	228	169	190	207
				Total	**368,555**	**401,877**	**428,572**	**2,209**	**2,209**	**2,209**	**167**	**182**	**194**
	KC19	Makasar	248	PINANG RANTI	21,956	27,301	32,726	216	216	216	102	127	152
			249	MAKASAR	39,085	46,279	52,817	145	145	145	269	318	363
			250	KEBON PALA	51,121	54,851	58,414	213	213	213	240	257	274
			251	HALIM PERDANA KUSUMA	41,269	46,522	50,535	1,299	1,299	1,299	32	36	39
			252	CIPINANG MELAYU	44,352	49,998	54,311	263	263	263	168	190	206

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
				Total	**197,783**	**224,950**	**248,803**	**2,136**	**2,136**	**2,136**	**93**	**105**	**116**
	KC20	Ciracas	253	CIBUBUR	63,327	67,948	72,361	496	496	496	128	137	146
			254	KELAPA DUA WETAN	42,921	46,053	49,045	336	336	336	128	137	146
			255	CIRACAS	66,820	75,325	81,823	397	397	397	168	190	206
			256	SUSUKAN	35,438	38,024	40,494	212	212	212	167	179	191
			257	RAMBUTAN	36,432	41,070	44,613	228	228	228	160	180	196
				Total	**244,938**	**268,420**	**288,336**	**1,669**	**1,669**	**1,669**	**147**	**161**	**173**
	KC21	Cipayung	258	PONDOK RANGON	21,753	28,397	35,746	472	472	472	46	60	76
			259	CILANGKAP	20,283	25,220	30,232	547	547	547	37	46	55
			260	MUNJUL	20,461	23,065	25,055	281	281	281	73	82	89
			261	CIPAYUNG	23,389	25,096	26,726	185	185	185	126	136	144
			262	SETU	16,062	18,106	19,668	281	281	281	57	64	70
			263	BAMBU APUS	24,680	27,821	30,221	331	331	331	75	84	91
			264	CEGER	12,260	14,516	16,567	326	326	326	38	44	51
			265	LUBANG BUAYA	57,154	67,674	77,234	362	362	362	158	187	214
				Total	**196,041**	**229,895**	**261,450**	**2,785**	**2,785**	**2,785**	**70**	**83**	**94**
	East Jakarta - Total				**2,585,628**	**2,844,145**	**3,059,916**	**18,529**	**18,529**	**18,529**	**140**	**153**	**165**
Central Jakarta	KC22	Gambir	301	CIDENG	19,076	20,540	22,757	125	125	125	152	164	182
			302	PETOJO UTARA	22,381	24,099	26,699	113	113	113	198	213	236
			303	KEBON KELAPA	9,498	10,227	11,330	79	79	79	121	130	144
			304	GAMBIR	2,930	3,155	3,496	250	250	250	12	13	14
			305	PETOJO SELATAN	18,504	20,932	23,655	114	114	114	163	184	208
			306	DURI PULO	24,629	26,519	29,381	68	68	68	362	390	432
				Total	**97,017**	**105,472**	**117,318**	**749**	**749**	**749**	**130**	**141**	**157**
	KC23	Sawah Besar	307	MANGGA DUA SELATAN	35,878	40,588	45,868	130	130	130	275	311	352
			308	KARANG ANYAR	31,989	34,444	38,161	50	50	50	645	695	770
			309	PASAR BARU	10,187	9,930	10,159	180	180	180	57	55	56
			310	GUNUNG SAHARI UTARA	18,681	20,115	22,285	127	127	127	147	159	176
			311	KARTINI	21,611	23,270	25,781	52	52	52	413	445	493
				Total	**118,347**	**128,346**	**142,255**	**539**	**539**	**539**	**220**	**238**	**264**
	KC24	Kemayoran	312	GUNUNG SAHARI SELATAN	22,321	24,034	26,628	150	150	150	148	160	177
			313	KEMAYORAN	23,173	24,952	27,645	59	59	59	392	422	467
			314	KEBON KOSONG	23,698	31,045	40,657	101	101	101	235	308	403
			315	SERDANG	31,875	36,059	40,751	82	82	82	391	442	499
			316	HARAPAN MULYA	19,097	20,562	22,782	53	53	53	362	389	431
			317	UTAN PANJANG	30,583	36,340	43,146	54	54	54	566	672	798
			318	CEMPAKA BARU	32,719	35,230	39,032	97	97	97	336	362	401
			319	SUMUR BATU	26,183	29,619	33,473	114	114	114	230	260	293

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
				Total	**209,650**	**237,841**	**274,112**	**710**	**710**	**710**	**295**	**335**	**386**
	KC25	Senen	320	SENEN	6,980	7,896	8,924	84	84	84	83	94	107
			321	KWITANG	16,644	17,921	19,855	44	44	44	375	404	447
			322	KENARI	12,591	12,901	13,198	90	90	90	139	143	146
			323	KRAMAT	31,341	33,747	37,389	71	71	71	439	473	524
			324	PASEBAN	24,521	26,403	29,252	82	82	82	299	322	357
			325	BUNGUR	16,489	16,073	16,444	63	63	63	261	255	261
				Total	**108,566**	**114,940**	**125,061**	**435**	**435**	**435**	**250**	**264**	**288**
	KC26	Cempaka Putih	326	CEMPAKA PUTIH BARAT	36,765	41,591	47,002	125	125	125	295	334	377
			327	RAWASARI	16,678	17,088	17,482	124	124	124	135	138	141
			328	CEMPAKA PUTIH TIMUR	26,230	28,244	31,292	217	217	217	121	130	144
				Total	**79,674**	**86,923**	**95,776**	**466**	**466**	**466**	**171**	**187**	**206**
	KC27	Menteng	329	KEBON SIRIH	13,608	13,265	13,571	83	83	83	164	159	163
			330	GONDANGDIA	6,383	6,872	7,614	146	146	146	44	47	52
			331	CIKINI	9,041	10,228	11,559	78	78	78	115	130	147
			332	MENTENG	26,230	28,244	31,292	242	242	242	108	117	129
			333	PEGANGSAAN	22,634	24,371	27,001	97	97	97	233	251	278
				Total	**77,897**	**82,980**	**91,036**	**647**	**647**	**647**	**120**	**128**	**141**
	KC28	Tanah Abang	334	KAMPUNG BALI	14,835	15,200	15,550	72	72	72	207	212	217
			335	KEBON KACANG	22,953	24,714	27,381	72	72	72	317	341	378
			336	KEBON MELATI	29,389	31,645	35,060	127	127	127	232	250	277
			337	PETAMBURAN	33,755	36,346	40,268	88	88	88	384	413	458
			338	KARET TENGSIN	17,495	22,919	30,015	152	152	152	115	150	197
			339	BENDUNGAN HILIR	26,960	27,623	28,260	158	158	158	170	174	178
			340	GELORA	3,991	4,089	4,183	334	334	334	12	12	13
				Total	**149,377**	**162,535**	**180,717**	**1,003**	**1,003**	**1,003**	**149**	**162**	**180**
	KC29	Johar Baru	341	JOHAR BARU	39,286	42,301	46,866	117	117	117	335	360	399
			342	KAMPUNG RAWA	15,492	16,681	18,481	30	30	30	517	556	617
			343	GALUR	17,373	20,643	24,510	27	27	27	646	768	911
			344	TANAH TINGGI	39,957	43,024	47,667	62	62	62	641	690	764
				Total	**112,108**	**122,649**	**137,524**	**237**	**237**	**237**	**474**	**518**	**581**
	Central Jakarta - Total				**952,635**	**1,041,686**	**1,163,800**	**4,786**	**4,786**	**4,786**	**199**	**218**	**243**
West Jakarta	KC30	Cengkareng	401	KAPUK	131,729	155,022	177,070	620	620	620	212	250	286
			402	CENGKARENG TIMUR	75,699	84,772	89,412	353	353	353	214	240	253
			403	KEDAUNG KALI ANGKE	38,536	45,350	51,800	293	293	293	132	155	177
			404	DURI KOSAMBI	76,662	94,786	110,434	535	535	535	143	177	207
			405	RAWA BUAYA	43,307	50,965	58,214	371	371	371	117	137	157
			406	CENGKARENG BARAT	70,460	82,919	94,712	393	393	393	179	211	241
				Total	**436,392**	**513,814**	**581,642**	**2,565**	**2,565**	**2,565**	**170**	**200**	**227**

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
	KC31	Grogol Petamburan	407	GROGOL	24,994	29,414	33,598	101	101	101	248	292	333
			408	JELAMBAR	48,496	57,072	65,189	157	157	157	310	364	416
			409	TANJUNG DUREN UTARA	26,263	29,411	31,021	133	133	133	198	222	234
			410	TOMANG	41,217	46,157	48,683	179	179	179	230	257	272
			411	JELAMBAR BARU	42,784	47,912	50,535	150	150	150	285	319	337
			412	WIJAYA KUSUMA	41,363	48,677	55,600	228	228	228	182	214	244
			413	TANJUNG DUREN SELATAN	35,226	45,748	55,998	136	136	136	260	337	413
				Total	**260,344**	**304,391**	**340,625**	**1,083**	**1,083**	**1,083**	**240**	**281**	**315**
	KC32	Taman Sari	414	PINANGSIA	11,805	12,576	13,265	94	94	94	126	134	141
			415	GLODOK	12,081	13,529	14,270	37	37	37	328	367	387
			416	MANGGA BESAR	10,957	12,271	12,942	55	55	55	199	223	235
			417	TANGKI	17,943	20,093	21,193	38	38	38	468	524	553
			418	KEAGUNGAN	32,185	39,794	46,363	35	35	35	912	1,127	1,314
			419	KRUKUT	25,121	28,131	29,671	56	56	56	452	506	534
			420	TAMAN SARI	24,156	28,427	32,470	68	68	68	354	417	476
			421	MAPHAR	33,047	37,008	39,033	63	63	63	526	589	621
				Total	**167,295**	**191,830**	**209,209**	**446**	**446**	**446**	**375**	**430**	**469**
	KC33	Tambora	422	PEKOJAN	36,994	43,536	49,728	78	78	78	475	559	639
			423	ROA MALAKA	7,535	8,438	8,900	53	53	53	142	159	167
			424	KRENDANG	25,650	30,185	34,478	33	33	33	767	903	1,031
			425	TAMBORA	12,286	15,956	19,531	29	29	29	427	554	678
			426	JEMBATAN LIMA	29,446	32,976	34,781	47	47	47	622	697	735
			427	DURI UTARA	26,500	29,676	31,301	37	37	37	717	802	846
			428	TANAH SEREAL	37,869	46,821	54,551	63	63	63	605	748	871
			429	ANGKE	36,389	40,750	42,981	79	79	79	458	513	541
			430	JEMBATAN BESI	38,103	44,840	51,218	52	52	52	730	859	981
			431	KALI ANYAR	35,229	37,532	39,587	31	31	31	1,128	1,201	1,267
			432	DURI SELATAN	20,085	21,398	22,569	38	38	38	524	558	589
				Total	**306,086**	**352,109**	**389,625**	**542**	**542**	**542**	**565**	**650**	**719**
	KC34	Kebon Jeruk	433	KEDOYA UTARA	55,972	72,690	88,978	326	326	326	172	223	273
			434	DURI KEPA	73,372	82,166	86,663	366	366	366	201	225	237
			435	KEBON JERUK	57,855	68,085	77,769	369	369	369	157	185	211
			436	SUKABUMI UTARA	46,786	57,846	67,396	157	157	157	299	369	430
			437	KELAPA DUA	27,696	34,243	39,896	145	145	145	192	237	276
			438	SUKABUMI SELATAN	27,446	32,300	36,893	167	167	167	164	194	221
			439	KEDOYA SELATAN	37,982	57,080	77,067	219	219	219	174	261	352
				Total	**327,109**	**404,410**	**474,663**	**1,747**	**1,747**	**1,747**	**187**	**231**	**272**

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
	KC35	Kalideres	440	SEMANAN	84,462	104,430	121,670	528	528	528	160	198	231
			441	KAMAL	45,829	53,933	61,604	492	492	492	93	110	125
			442	TEGAL ALUR	94,634	117,006	136,323	560	560	560	169	209	243
			443	PEGADUNGAN	66,927	86,916	106,392	794	794	794	84	109	134
			444	KALI DERES	70,543	83,017	94,824	503	503	503	140	165	188
				Total	**362,395**	**445,302**	**520,813**	**2,877**	**2,877**	**2,877**	**126**	**155**	**181**
	KC36	Palmerah	445	JATIPULO	46,803	52,412	55,282	84	84	84	560	627	662
			446	KOTA BAMBU UTARA	33,463	39,380	44,981	67	67	67	503	592	676
			447	SLIPI	23,086	28,544	33,256	97	97	97	237	293	341
			448	PALMERAH	82,687	97,309	111,149	220	220	220	375	441	504
			449	KEMANGGISAN	42,368	47,446	50,043	210	210	210	202	226	238
			450	KOTA BAMBU SELATAN	22,105	24,755	26,110	58	58	58	378	424	447
				Total	**250,512**	**289,846**	**320,820**	**737**	**737**	**737**	**340**	**394**	**436**
	KC37	Kembangan	451	KEMBANGAN UTARA	51,231	73,350	99,035	418	418	418	122	175	237
			452	MERUYA UTARA	41,200	50,939	59,349	406	406	406	102	126	146
			453	MERUYA SELATAN	29,578	38,413	47,020	323	323	323	91	119	145
			454	JOGLO	39,093	50,770	62,146	447	447	447	87	114	139
			455	SRENGSENG	44,410	54,909	63,974	455	455	455	98	121	141
			456	KEMBANGAN SELATAN	29,878	36,941	43,040	473	473	473	63	78	91
				Total	**235,390**	**305,322**	**374,563**	**2,522**	**2,522**	**2,522**	**93**	**121**	**149**
	West Jakarta - Total				**2,345,524**	**2,807,023**	**3,211,959**	**12,518**	**12,518**	**12,518**	**187**	**224**	**257**
North Jakarta (Jakarta Utara)	KC38	Penjaringan	501	PENJARINGAN	86,550	103,277	111,943	452	457	462	191	226	242
			502	PEJAGALAN	76,292	86,607	93,874	368	368	368	207	235	255
			503	KAPUK MUARA	17,485	27,999	22,782	901	1,047	1,193	19	27	19
			504	KAMAL MUARA	9,739	17,169	12,690	1,135	1,402	1,669	9	12	8
			505	PLUIT	46,608	67,729	60,728	740	1,006	1,273	63	67	48
				Total	**236,673**	**302,782**	**302,017**	**3,596**	**4,281**	**4,965**	**66**	**71**	**61**
	KC39	Tanjung Priok	506	TANJUNG PRIOK	44,956	53,645	58,146	376	417	458	120	129	127
			507	PAPANGGO	48,540	63,949	76,567	304	304	304	160	210	252
			508	SUNGAI BAMBU	39,985	50,141	58,855	236	236	236	169	212	249
			509	KEBON BAWANG	70,815	84,502	91,592	173	173	173	409	488	529
			510	SUNTER AGUNG	87,157	109,293	128,289	525	525	525	166	208	244
			511	SUNTER JAYA	57,831	72,519	85,124	513	513	513	113	141	166
			512	WARAKAS	38,674	46,149	50,021	108	108	108	357	426	462
				Total	**387,959**	**480,197**	**548,593**	**2,236**	**2,277**	**2,318**	**174**	**211**	**237**
	KC40	Koja	513	RAWABADAK UTARA	47,160	62,131	74,390	127	127	127	371	489	585
			514	KOJA	41,756	55,011	65,866	257	258	260	162	213	254
			515	LAGOA	66,326	91,783	115,455	158	158	158	421	582	732

Table S/R-C1-1 Population Forecast of DKI Jakarta 2010 to 2030 (Registered + Non-Registered)

Municipality	Kec. No	Kecamatan	Kel. No	Kelurahan	Population (person)			Area (ha)			Density (person/ha)		
					2010	2020	2030	2010	2,020	2030	2010	2,020	2030
			516	TUGU SELATAN	32,155	42,363	50,722	186	186	186	173	228	273
			517	RAWABADAK SELATAN	40,891	51,277	60,189	179	179	179	228	286	336
			518	TUGU UTARA	74,089	92,906	109,054	239	239	239	310	389	456
				Total	**302,377**	**395,471**	**475,676**	**1,146**	**1,147**	**1,148**	**264**	**345**	**414**
	KC41	Cilincing	519	KALI BARU	79,653	99,883	103,785	250	845	1,439	318	118	72
			520	CILINCING	53,418	70,376	69,602	690	944	1,198	77	75	58
			521	SEMPER BARAT	79,284	99,420	116,700	318	318	318	249	312	367
			522	MARUNDA	22,012	35,249	28,682	856	1,030	1,204	26	34	24
			523	SUKAPURA	58,294	69,560	75,397	566	566	566	103	123	133
			524	ROROTAN	29,531	42,914	56,701	1,019	1,019	1,019	29	42	56
			525	SEMPER TIMUR	41,951	52,606	61,749	432	432	432	97	122	143
				Total	**364,143**	**470,008**	**512,615**	**4,131**	**5,153**	**6,176**	**88**	**91**	**83**
	KC42	Pademangan	526	ANCOL	19,625	24,610	25,571	754	1,645	2,537	26	15	10
			527	PADEMANGAN BARAT	75,251	89,795	97,329	151	151	151	497	593	643
			528	PADEMANGAN TIMUR	42,460	50,666	54,917	357	357	357	119	142	154
				Total	**137,336**	**165,071**	**177,817**	**1,262**	**2,154**	**3,045**	**109**	**77**	**58**
	KC43	Kelapa Gading	529	KELAPA GADING BARAT	35,426	51,479	68,019	744	744	744	48	69	91
			530	PEGANGSAAN DUA	48,398	70,330	92,926	555	555	555	87	127	168
			531	KELAPA GADING TIMUR	41,692	57,695	72,575	313	313	313	133	184	232
				Total	**125,516**	**179,504**	**233,519**	**1,612**	**1,612**	**1,612**	**78**	**111**	**145**
		Reclamation Area	601	**Reclamation Area**	0	0	110,049						
				Total	**0**	**0**	**110,049**						
	North Jakarta - Total				**1,554,003**	**1,993,032**	**2,360,286**	13,982	16,623	19,264	111	120	123
Total (Area and Population excluding Seribu)					**9,718,196**	**11,284,161**	**12,665,282**	64,292	66,933	69,573	151	169	182
Total (Area and Population)					**9,738,880**	**11,306,761**	**12,689,427**	---	---	---	---	---	---

Source : JICA expert team

C3 Construction Materials/Equipment and Construction

C3.2 Construction Method of Pipeline

C3.2.1 Open Cut Method

(1) Overview of the Open Cut Method

Open Cut Method is most commonly employed construction method and the characteristics are shown below;

1) Low Cost, short construction period and high credibility in construction
2) Suitable for shallow depth (less than 4 m) and technically easy to construct by adopting slop cutting and sheathing methods depending upon the geology and soil conditions
3) Easy to adjust the shape of cross section
4) Occasionally obstacles the traffic due to the works on road
5) Temporary works such as sheathing, road surface lining and protection of lining infrastructure are required

6) Supplementary works such as lowering groundwater and chemical grouting methods are required if the groundwater table is high

As sheathing methods in open cut method, wood sheet pile, light weight steel sheet pile, temporary sheathing and soldier piles and lagging method are the commonly utilized methods. The following describes the overviews of light weight steel sheet pile method and steel sheet pile method as representative sheathing methods.

1) Light Weight Steel Sheet Pile

Under normal circumstances, this method is applied for ordinal soil with the excavation depth of maximum 4m. Whereas the material is light, easy to handle, quality is uniform in comparison to wood sheet pile and iteration is available, this method is typically applied for small scale excavation with few water yield due to small section modulus and poor watertightness.

There are two types for the sheet joint namely piling method and steel sheet pile method.

In general, vibratory hammer and drop hammer are used for its placement. However, a special attention is required for bent, deflection and twist of the material.

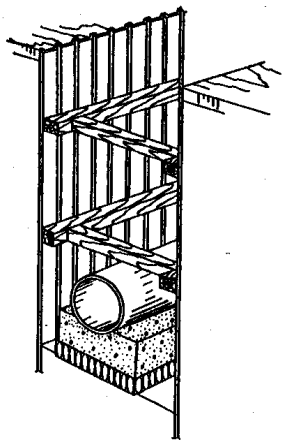


Figure S/R-C3-1 Light Weight Steel Sheet Pile

2) Steel Sheet Pile Method

This method is superior to wood sheet pile and light steel sheet pile method in respect to durability, watertightness and strength. Thus this method is frequently utilized under soft ground condition with high groundwater yield. Additionally, prevention of heaping and boiling is expected by increasing the depth of embedment.

Vibratory hammer is typically used for placement. Yet, recently low noise/vibration type pile driver is commonly employed due to noise and vibration issues especially in urban areas.

A special attention is required while pulling from the ground since the back side of the sheet pile disturbs the soil composition and extracts soil together by attaching on the sheet. Thus, land subsidence may be triggered.

Steel sheet pile method is employed under the condition that N value is less than 50. Although it is widely believed this method is not suitable for hard ground condition, construction works are available by pre-drilling with earth auger, etc.

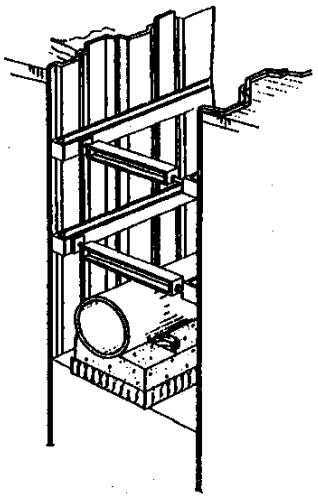


Figure S/R-C3-2 Steel Sheet Pile Method

(2) Applicability of Open Cut Method

Typically utilized open cut methods in sewerage projects are described in the previous sections. The geological and ground water conditions in up to 10 m below the ground level in DKI Jakarta are described as soft ground with N value of less than 10 and consisting of silt with a high groundwater table. Therefore, sheathing works are required for prevention of landslide in case the drilling and excavation depth exceeds more than 1.5m. Additionally in case the depth exceeds more than 4m, reliable sheathing methods such as steel sheet pile are highly recommended.

In general, the drilling and excavation depth in sewerage projects is less than 4m, therefore, small scale sheathing methods are typically applied. Among the methods, light steel sheet pile is frequently employed in respect to constraints of construction and economy.

Considering the above conditions, the basic policy for open cut is set as follows in consideration of impact on the surrounding environment, constraints of construction and safety.

- Excavation Depth $\leqq$ 4m $\Rightarrow$ light steel sheet pile
- Excavation Depth $>$ 4m $\Rightarrow$ steel sheet pile

In case of the depth exceeding 4m and, therefore, steel sheet pile is applied in construction, some negative impacts of piling works on traffic in wide area and long period may be considered. Additionally, negative impacts of irregular subsidence occurrence due to pulling works may be anticipated. If steel sheet pile is applied as measures for these negative impact, the cost for the construction works raises.

Therefore, further detailed survey is required for the excavation works deeper than 4m. If the impact of steel sheet pile is hardly ceased, application of pipe jacking method is strongly recommended. Pipe jacking method is commonly utilized method in Japan. Pipe jacking method enables to deploy the maximum pipe diameter of 150mm. The following section describes the details of the pipe jacking method.

C3.2.2 Pipe Jacking Method

(1) Overview of Pipe Jacking Method

Pipe jacking method is the construction method to construct pipelines by gradually pushing and jointing ready-made pipes such as steel concrete pipe or unplastticized polyvinyl chloride pipe (PVC Pipe) from a vertical shaft (work shaft) on a part of road toward another vertical shaft (arrival shaft).

In general, pipe jacking method has various types of construction method in stability of face, excavation method, transmission of thrust, conveyance of soil, etc., the method is normally classified

dependent on the diameter of jacking pipes.

- Nominal diameter 150mm～700mm Small Diameter Pipe Jacking
- Nominal diameter 800mm～3,000mm Middle- or Large Diameter Pipe Jacking

Figure S/R-C3-3 shows the classification of pipe jacking method except special technology.

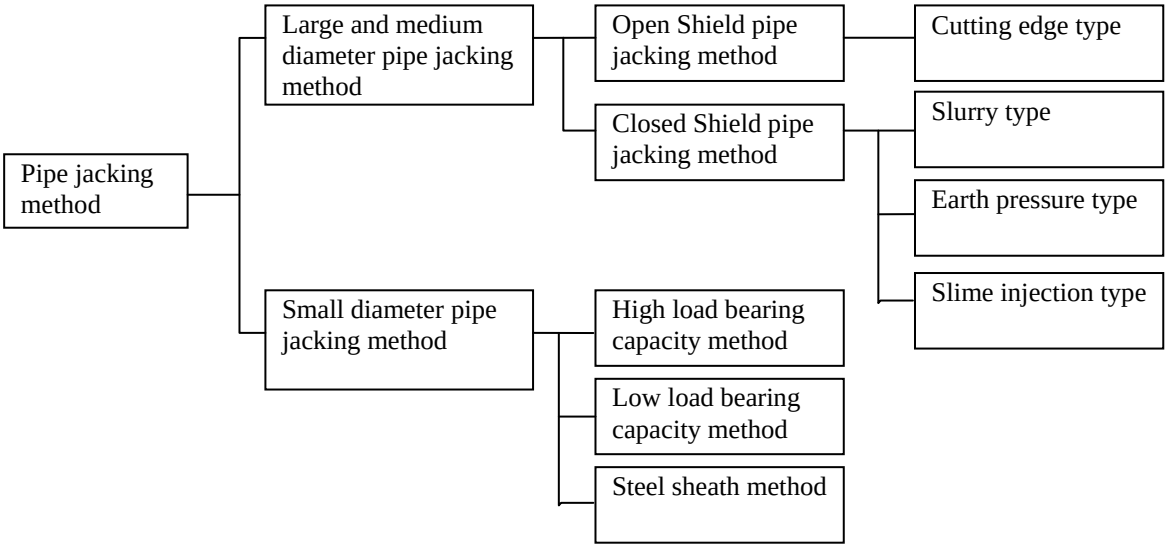


Figure S/R-C3-3 Classification of Pipe Jacking Method

1) Small Diameter Pipe Jacking

Small Diameter Pipe Jacking is a construction method to excavate, removing soil, thrusting and laying one (1) span of jacking pipe by remote control of small diameter jacking pipe or induction pipe with small diameter lead pipe that workers are not able to work in holes.

The main feature of small diameter pipe jacking method is as follows;

i) Steel concrete pipe, unplastticized polyvinyl chloride pipe (PVC Pipe), steel ductile pipe or steel pipe are available for pipe jacking method
ii) Applicable nominal diameter: 150 – 700 mm
iii) Extension of one span of jacking: 50 – 160 m
iv) Applicable soil type: Silt, sand, sandy gravel and gravel

Typical overview of the small diameter pipe jacking method is shown in Figure S/R-C3-4

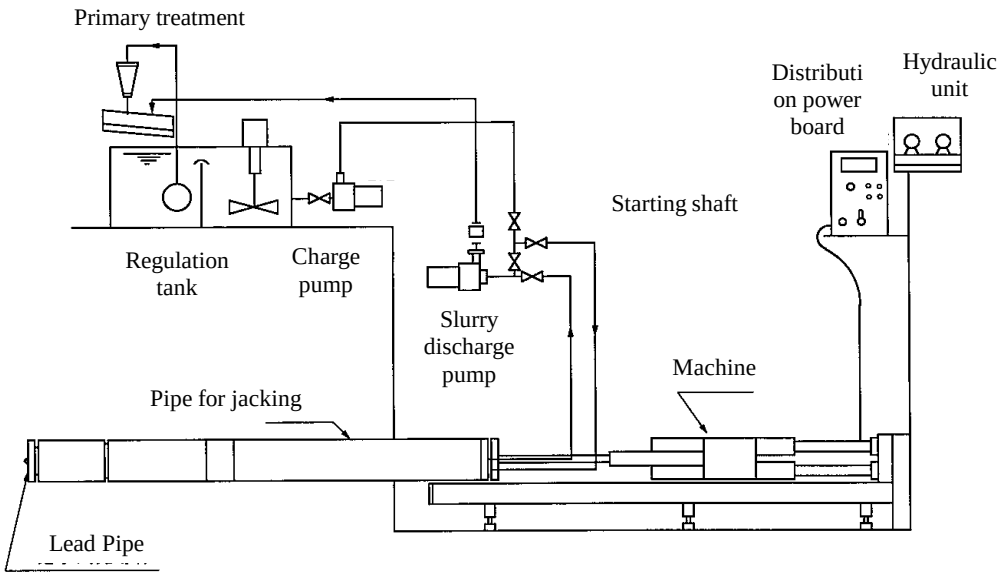


Figure S/R-C3-4 Overview of Small Diameter Pipe Jacking

2) Middle- or Large Diameter Pipe Jacking

Middle- or large diameter pipe jacking method is a construction method to drive ready-made pipes with a normal diameter of more than 800 mm. The method is subdivided into open type cutting edge pipe jacking method and close type semi-shield method.

(a) Cutting Edge Pipe Jacking Method (Man Power Excavation Method)

Cutting edge pipe jacking method is a pipe laying method to thrust the pipe by the force of main hydraulic jack, which is set at the end of barrel of starting shaft, to excavate the soil by man power with the cutting edge on the lead of the pipe and to lay the pipes. Due to the face is normally in open condition, the bank should be stable and water should be cut off. Therefore, cutting edge pipe jacking method frequently applied together with supplementary construction methods. In general, chemical grout is employed as a supplementary construction work. The cost is higher than other mechanical pipe jacking method and, therefore, cutting edge pipe jacking method is frequently not applied as an actual construction method.

Figure S/R-C3-5 shows the overview of cutting edge pipe jacking method.

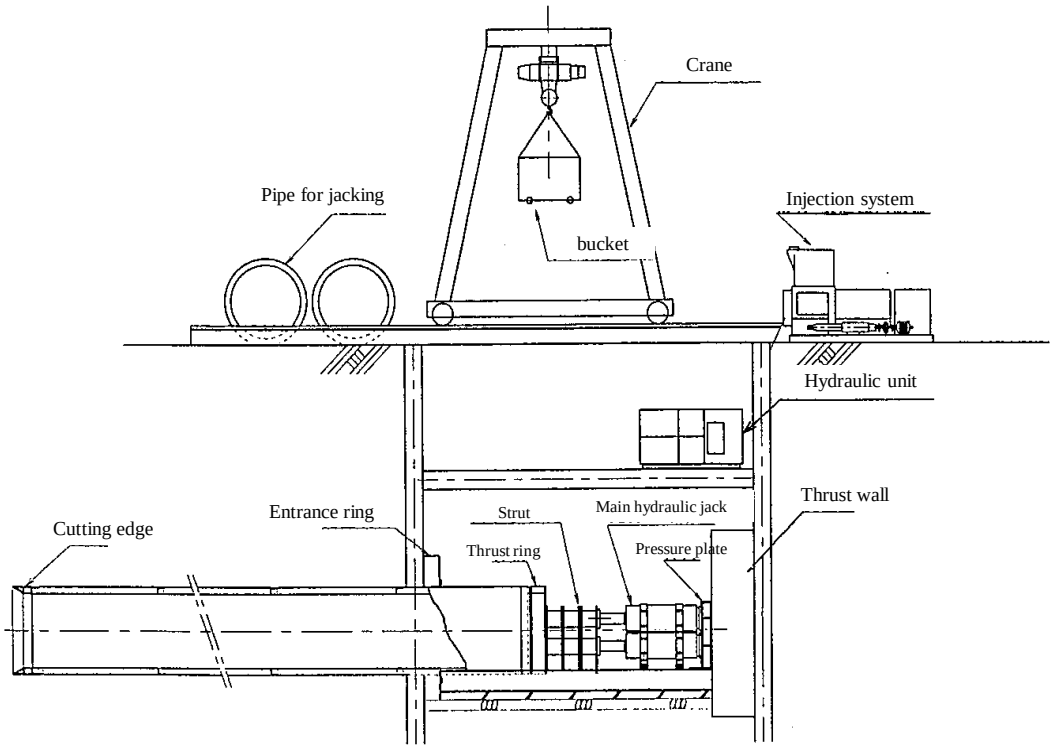


Figure S/R-C3-5 Overview of Cutting Edge Pipe Jacking Method

(b) Semi Shield Jacking Method (Machinery Excavation Method)

Semi shield method is a construction method to laying pipelines with closed mechanical excavation. Semi shield method has various types of jacking method such as slurry type, earth pressure type and mud density type. Such difference depends on the stability of cutting edge during excavation and conveyance of excavated soil. In comparison with cutting edge pipe jacking method, the size of the jacking facility is larger. Yet, semi shield method is superior in constraints of construction such as conveyance of excavated soil. Therefore, semi shield method is suitable for a long distance jacking.

Figure S/R-C3-6 shows the representative overview of semi shield jacking method.

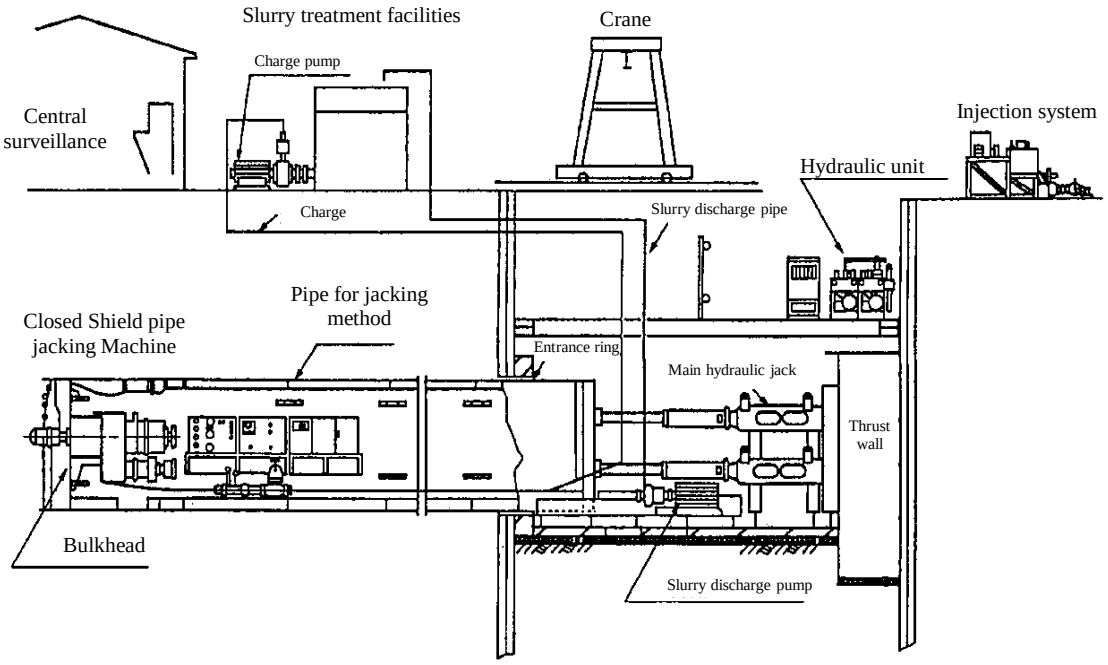


Figure S/R-C3-6 Overview of Semi Shield Jacking Method

(2) Applicability of Jacking Method

The following conditions shall be taken into considered for application of jacking method.

i) Road with large traffic and/or road with congested underground utility which makes difficult to excavate from the surface ground
ii) Those locations that excavate from the surface ground is hard due to cross of carline or rivers
iii) Those location that economically non feasible due to considerable depth if excavated from the surface ground

Traffic jam is an inveterate issue in DKI Jakarta. Therefore, open cut method shall be refrained as much as possible for those roads with heavy traffic. In case if there is a construction works for crossing road section under open cut method, road closure likely occurs. Additionally, there are a number of large scale rivers and canals in DKI Jakarta, application of jacking method is inevitable for crossing these obstacles. As have been mentioned in the section for open cut method, most likely construction method for those pipeline routes that their excavation depth with more than 4m is steel sheet pile method. The negative impacts on the surrounding environment are anticipated. Therefore, jacking method shall be progressively applied for construction of pipelines in DKI Jakarta.

Present technology of jacking method allows a pipe diameter of 150 – 3,000 mm. One span of jacking extension of reaches more than 300m in case of the pipe diameter with more than 800 mm is adopted. Special jacking technology enables to drive more than 700 m. A technical development for small diameter jacking method is remarkable and enables to drive even with unplastticized polyvinyl chloride pipe (PVC Pipe).

The record of application of jacking method in Indonesia is limited to the total extension of 5 km with pipe diameter of 800 mm under the Denpasar Sewerage Development Project in Bali Province between 2010 and 2011. At present day, cost may become a crucial factor due to import of machinery and acquisition of technology for Indonesia. However, jacking method is a definitely indispensable technology for the future expansion of sewerage in Indonesia.

C3.2.3 Shield Method

(1) Overview of Shield Method

Shield method is a construction method to drive a tunnel drilling machinery, called "shield", implement excavation works and lining works and construct a tunnel.

Shield method is applicable for diameter with more than 1,350 mm. Due to high construction cost in case of the total extension with less than 1.0 km, shield method is not generally adopted except specific conditions.

Figure S/R-C3-7 shows the representative overview of shield method.

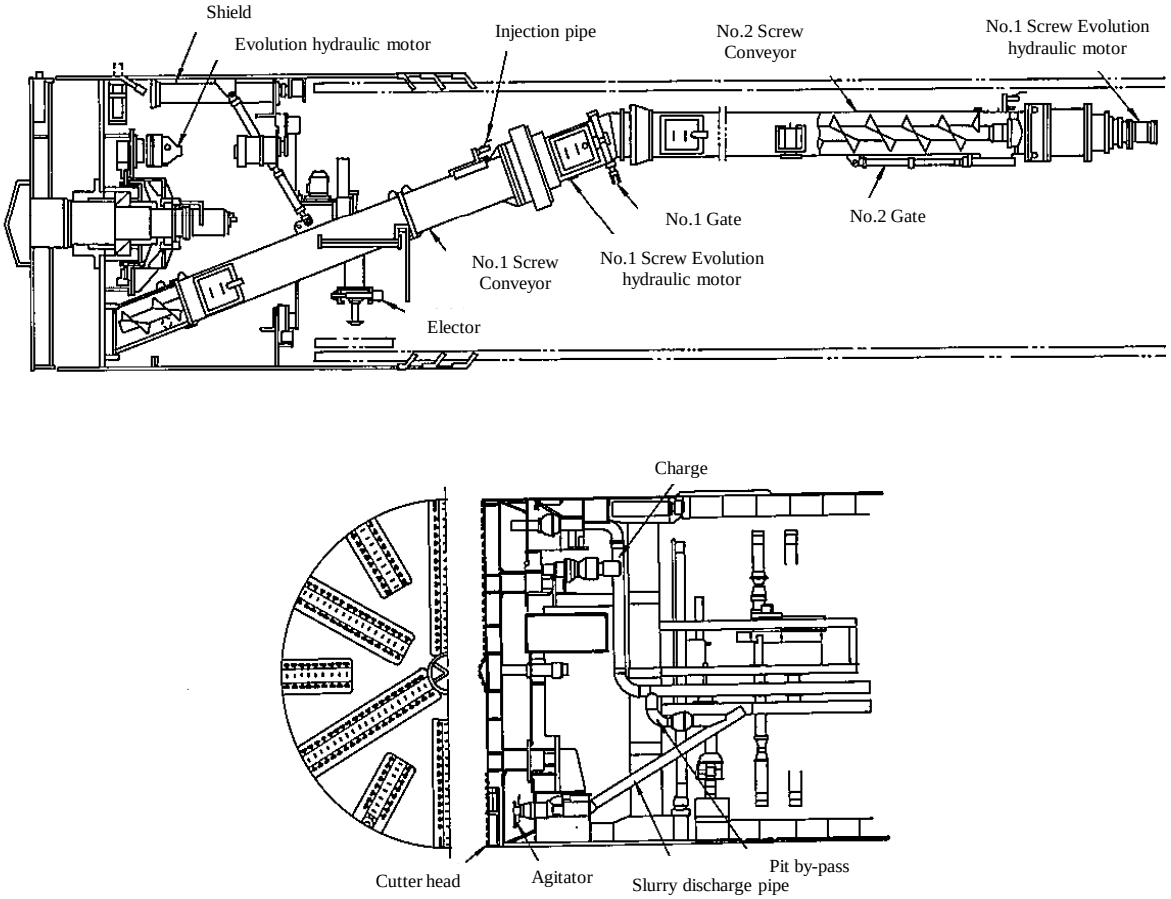


Figure S/R-C3-7 Overview of Shield Method

(2) Application of Shield Method

Shield method has advantage in its capability for construction of long distance. However, this method is economically unfeasible for those sections with a large number of affluxes and/or various pipe diameters are required. Under normal circumstances, secondary lining works are required. Thus, the construction schedule may become long term. Additionally, a considerable facility is required for construction of pipelines for more than 1 km with a long term construction period.

At present, concrete or steel segment as lining materials is not manufactured in Indonesia. Therefore, the cost for shield method is higher than the one of pipe jacking method due to import of materials.

However, shield method is potentially economically feasible than pipe jacking method for those sections that pipe duct with more than 1,350 mm in diameter is applied and the lining depth is more than 15.0m due to the following reasons;

i) Soil retaining works becomes a considerable scale and the cost for preparation of shaft becomes rather higher. Therefore, shield method, holding longer one span extension, may be advantageous in terms of cost.

ii) Utilization of specific pipes may be considered under jacking method for deep lining section due to a lack of strengthens of steel concrete pipes. However, procurement of specific pipes in Indonesia is difficult.

Considering the above conditions, application of shield method shall be carefully examined in comparison with pipe jacking method in respect to availability of materials, economic feasibility and constrains of construction.

C3.2.4 Other Construction Method

(1) Collecting Sewer Pipe Jacking Method

Collecting sewer pipe jacking method is a construction method to drive steel casing pipe to the main sewer, drain the soils and sediments inside the steel casing pipe, open a hole in main sewer with core pulling devices, insert unplastticized polyvinyl chloride pipe (PVC Pipe) with a special socket pipe for collecting jacking purpose, and fix the pipes by injecting filling grout materials between the steel casing pipe and PVC pipe. The method is applied for vertical and inclined directions from the road surface or household.

The applicable extension of collecting sewer pipe jacking method under general condition is less than 10m.

Figure S/R-C3-8 shows the representative overview of the collecting sewer pipe jacking method.

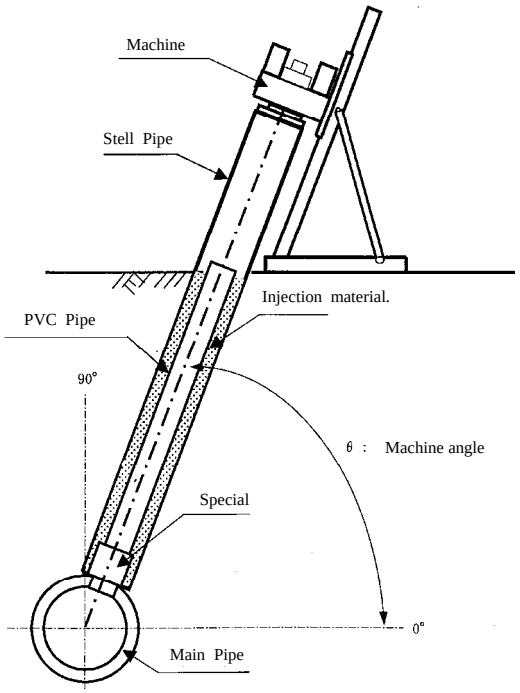


Figure S/R-C3-8 Overview of the Collecting Sewer Pipe Jacking Method

The following conditions shall be considered for application of collecting sewer pipe jacking method

i) Those sections that excavation from the ground surface is hard due to the connecting main sewer is considerably deep
ii) Lining of service sewer is costly
iii) Application of open cut method is difficult due to heavy traffic and collect sewer cannot be connected.

Collecting sewer is commonly constructed by open cut method. However, collecting sewer pipe jacking method is advantageous for the above conditions.

(2) Cross Cut Shaft

Preparation of a shaft (work shaft) is essential for implementation of pipe jacking method or tunnel works by shield method by occupying a part of road. A customary clear aperture is required for transportation of jacking machinery and materials such as jacking pipe and shield segments. Therefore, the shaft may become obstacles against traffic and traffic obstructions such as road closure or one-way traffic may occur. Therefore, the JICA Expert Team recommend application of cross cut shaft as a mitigation measure.

The clear aperture is set in the temporary leased land and the lining works are executed at this land under cross cut shaft. Thus, road is opens regardless day or night and the works will not cause traffic issues. Cross Cut Shaft is advantageous for those sections with narrow road width, no detouring routes and heavy traffic. Figure S/R-C3-9 shows the overview of cross cut shaft.

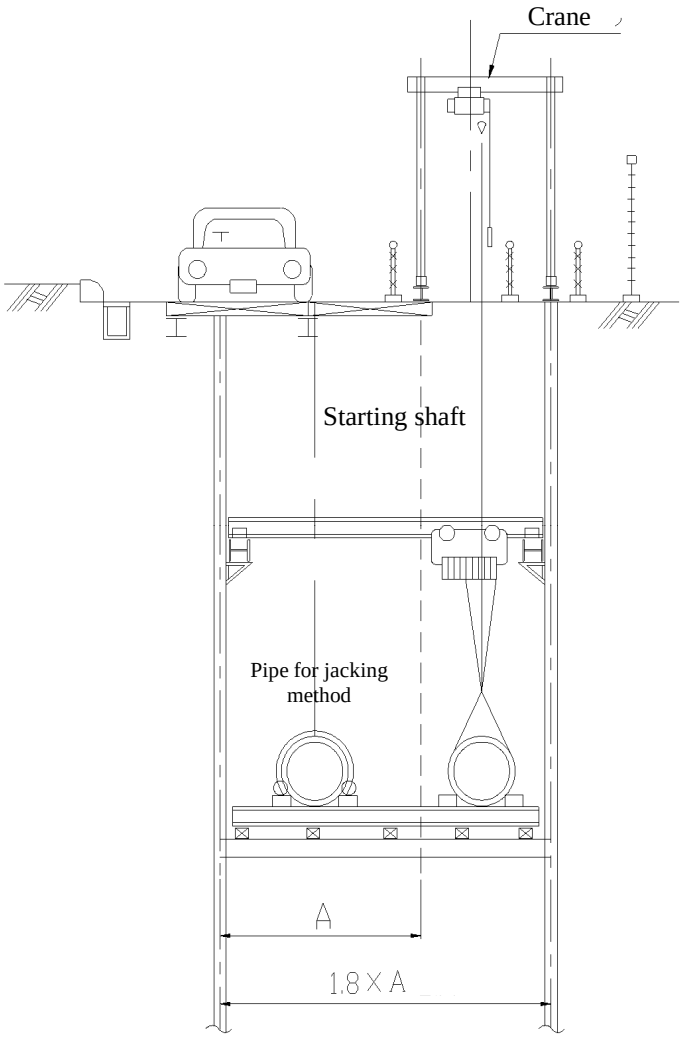


Figure S/R-C3-9 Cross Cut shaft