JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF HOUSING AND CITY PLANNING
REPUBLIC OF COTE D'IVOIRE

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

FINAL REPORT
SUPPORTING REPORT

JANUARY 2000

PACIFIC CONSULTANTS INTERNATIONAL, TOKYO
TOKYO ENGINEERING CONSULTANTS, TOKYO

The cost estimate is made based on the average market rate between March and August, 1999. The rate of local currency, FCFA to Jp Yen is as follows:

1 FCFA = 0.195 Jp Yen

FCFA is fixed rate to French Franc, FF as follows:

100 FCFA = 1 FF

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ABREVIATION

ADB	African Development Bank (BAD en Français)
ANDE	National Agency for Environment Agence Nationale de l'Environnement
BAD	Banque Africaine de Développement (ADB in English)
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest
BIRD	Banque Internationale pour la Reconstruction et le Développement (IBRD in English)
BM	Banque Mondiale (WB in Englich)
BNETD	Bureau National d'Etudes Techniques et de Developpement
BOD_5	Biochemical Oxygen Demand (DBO_5 en Français)
BOT	Build-Operate-Transfer (COT en Français)
COT	Construire-Opérer-Transférer (BOT in English)
CARENA	Compagnie Abidjanaise de Réparation Navale et de Travaux
CEDEAO	Communauté Economique d'Etats de l'Afrique de l'Ouest Economic Community of the Western African Countries
CEE	Communauté Economique Européene (EEC in English)
CFA	Communauté Financière Africaine
CIAPOL	Centre Ivoirien d'Anti-Pollution
COD	Chemical Oxygen Demand (DCO en Français)
CRO	Centre de Recherches Océanologiques
DAUC	Département Aménagement Urbain et Construction
DBO_5	Demande en Oxygène Biochimique (BOD in English)

DCI	Ductile Cast-Iron Une Fonte Nodulaire
DCO	Demande en Oxygène Chimique (COD in English)
DDT	Dichlorodiphenyltrichlorocthane Dichloro-Diphényl Trichloroéthane
DSR	Debt Service Ratio Ratio de Service de la Dette
DTT	Département Transports et Télécommunications Transport and Telecommunication Department
EEC	European Economic Community (CEE en Français)
EIA	Environmental Impact Assessment Evaluation de l'Impact sur l'Environnement
EU	European Union (UE en Français)
F/S	Feasibility Study Etude de Faisabilité
FCD	Ferrum Casting Ductile Fonte Nodulaire Ferreuse
FIRR	Financial Internal Rate of Return Taux de Rentabilité Interne Financier
FMI	Fonds Mpnétaire International (IMF in English)
FNE	Fonds National de l'Eau
FOB	Free-on-Board Livré à Bord
GDP	Gross Domestic Product (PIB en Français)
HHWL	Higher High Water Level Niveau d'Eau plus Elevé
IBRD	International Bank for Reconstruction and Development - World Bank (BIRD en Français)

IMF	International Monetary Fund
	(FMI en Français)
INS	Institut National de Statistique
JICA	Japan International Cooperation Agency
	Agence Japonaise de Coopération Internationale
LANEMA	Laboratoire National d'Essais de Qualité, de Métrologie et d'Analyses
M/P	Master Plan
	(P/D en Français)
MACA	Maison d'Arrêt et de Correction d'Abidjan
M&E	Machine and Electric
	Machine et Electricité
MEF	Ministère de l'Environnement et de la Forêt
MES	Matières en suspension
	(SS in English)
MIE	Ministère des Infrastructures Economiques
MLU	Ministère du Logement et de l'Urbanisme
MOS	Mode d'Occupation de Sol
NPV	Net Present Value
	Valeur Actuelle Nette
OMS	Oraganisation Mondiale de la Santé
P/D	Plan Directeur
	(M/P in English)
PAA	Port Autonone d'Abidjan
PCB	Polychlorobiphenyl
	Polychlorobiphényle
PDA	Perspectives Décennales d'Abidjan
PIB	Produit Intérieur Brut
	(GDP in English)
PNUD	Programme des Nations Unie pour le Développement
PLAD	Pipe Line Arch-Drilling
	Perçage en arc pour la Canalisation
P/S	Pumping Station
	Station de Pompage

PVC	Polyvinyl Chloride
	Chlorure de Polyvinyle
RC	Reinforced Concrete
	Béton Armé
S/W	Scope of Work
	Etendue des Travaux
SETU	Société d'Equipement des Terrains Urbains
SIIC	Service de l'Inspection des Installations Classées
SODECI	Société de Distribution d'Eau de la Côte d'Ivoire
SODEXAM	Société d'Exploitation et de Développement Aeroportuaire Aéronautique et Météorologique
SPT	Standard Penetration Test
	Test de Pénétration Standard
SS	Suspended Solids
	(MES en Français)
SSPL	Supported Seabed Pipe-Laying
	Pose de Tuyaux Soutenus sur le Fond Marin
T/S	Trunk Sewer
	Collecteur Primaire
T-N	Total Nitrogen
	Azote Total
T.O.R.	Terms of References
	Termes de Référence
T-P	Total Phosphorus
	Phosphore Total
UEMOA	Union Economique et Monetaire de l'Afrique de l'Ouest
	West African Economic and Monetary Union
UE	Union Européenne
	(EU in English)
UNDP	United Nations Development Program
	(PNUD en Français)
UNIDO	United Nations Industrial Development Organization
	Organisation des Nations Unies pour le Développement Industriel

USEPA	United States Environmental Protection Agency Agence Américaine pour la Protection de l'Environnement
WB	World Bank (BM in French)
WHO	World Health Organization (OMS en Français)

UNIT

FCFA: Currency unit in Côte d'Ivoire

1 FCFA ≈ 0.195 Jpn Yen, average between March and August, 1999

100 FCFA = 1 FF (French Franc); Fix rate

APPENDIX A

TOPOGRAPHIC SURVEY

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1. Introduction

The topographic survey works were entrusted to a local contractor. The purpose of this survey is to identify the topographic condition for the construction of proposed interceptor and pumping stations. Survey area is shown in Fig. A.1.

2. Terms of Reference for the Works

The whole works are entrusted to a local contractor under the Terms of Reference as attached on the page A-3 to A-6.

3. Results of Topographic Survey

3.1 Bench Mark and Coordinates

Bench marks and coordinate system of the survey area was based on "Topographic Map ABIDJAN; Scale: 1:5000, Institut Géographic National, Paris 1988".

The following maps are referred in the survey works:

ABIDJAN 1:5000

BLOC :99-47, 98-46, 98-47, 98-48, 97-46, 97-47, 97-48.

3.2 Prepared Topographic Drawings

(1) Interceptor

Route survey with planimetric, cross section and longitudinal survey were conducted along the planned laying routes of interceptor. Whole survey area was divided into three areas, i.e., Niangon, Locodjoro and Plateau.

Scale of drawings was given as follows:

- Planimetric suvey: 1:1000
- Cross Section: Horizontal and Vertical 1:100
- Longitudinal profile: Horizontal 1:1000, Vertical 1:100

Number of drawings and quantities of survey are listed below:

Area	Planimetric	Longitudinal	Cross-Section
Niangon	11(3.55 ha)	13 (7.1 km)	36 (72 Sections, 3.6 km)
Locodjoro	5 (1.40 ha)	10 (5.6 km)	60 (120 sections, 3.0 km)
Plateau	-	3 (1.8 km)	10 (19 Sections, 0.5 km)

All the prepared drawings are to be compiled in a supplementary separate volume.

(2) Pumping Station

Planimetric survey was conducted concerning the points of the proposed ten (10) pumping stations. The total surveyed area was 10 hectare and number of drawings amounts to 10 sheets with a scale of 1:500.

All the prepared drawings are to be compiled in a supplementary separate volume.

TERMS OF REFERENCE
FOR
TOPOGRAPHIC SURVEY

1. PURPOSE

The work called for under this Contract (hereinafter referred to as the Work) will be conducted as part of the JICA Study on the Feasibility Study on Sewerage Facilities in Western District of Abidjan City in Côte d'Ivoire. The results of the survey will be used by the JICA Study Team for working out a plan for the projects.

2. SCOPE OF WORK

The Work comprises the following schedules:

Schedule 2.1:
Topographic Survey of the sites proposed for the Pumping Stations

Schedule 2.2:
Route Surveying along Planning Laying Routes of Intercepting Sewers

Locations of the sites for the Work shall be confirmed by the Contractor and shall be approved by the JICA Study Team before the commencement of the survey works in the field.

All measurements and results of the survey shall be in metric units.

2.1 Topographic Survey of the sites proposed for the Pumping Stations

2.1.1 Work Quality

(1) Preparation Works

Temporary bench marks (timber piles or concrete or others) shall be established at nearby appropriate locations at the proposed pumping station

sites. Elevation of each temporary bench marks shall be identified by direct leveling from existing permanent bench marks.

(2) Survey Works

Work quantities for the survey works for the proposed pumping station sites are as follows:

Planimetric Survey: about 1 ha x 10 sites

2.1.2 Scale of Survey Drawings

Scale: 1/500
Contour interval: 1 m

2.1.3 Accuracy

Allowable errors for the survey are as follows:

(1) Leveling of Temporary Bench Marks

Accuracy : $0.6\sqrt{S}$ cm; where S denotes distance in kilometer

(2) Planimetric Survey

Accuracy for distance : within ± 0.5 mm
(distance on the survey drawing)

Accuracy for level : altitude point within $\pm \Delta h/4$
contour line within $\pm \Delta h/2$
Δh : interval of principal contour lines

2.2 Route Survey along Planned Laying Routes of Interceptors

2.2.1 Work Quantity

(1) Preparation Works

Temporary bench marks (timber piles or concrete or others) shall be established at nearby appropriate locations along Planning Laying Routes of Intercepting sewers. Elevation of each temporary bench marks shall be surveyed by direct leveling from existing permanent bench marks.

(2) Survey Works

Work quantities for the survey works for the Route Surveying are as follows:

1)	Planimetric survey	:	10km x 50m
2)	Longitudinal survey	:	10km
3)	Cross sectional survey:		10km (100m Interval, B≒50m)
			Where, B is width for cross sectional survey.

The survey works shall also include the survey for above circumstances (pavement condition, facilities, structures, etc.) and underground structures (water supply, sewerage, etc.).

In addition, at the cross sections of storm-water sewer and drainage, the survey for sections of flow of bridges and box culverts shall be conducted.

2.2.2 Scale of Survey Drawings

1)	Planimetric survey:	Scale 1/1000	(Contour interval 1m)
2)	Cross sectional survey	Horizontal scale	1/100
		Vertical scale	1/100
3)	Longitudinal survey:	Horizontal scale	1/1000
		Vertical scale	1/100

2.2.3 Accuracy

Allowable errors for the survey are as follows :

(1) Leveling of Temporary Bench Marks

Accuracy : $0.6\sqrt{S}$ cm; where S denotes distance in kilometer

(2) Planimetric Survey

Accuracy for distance : within ±0.5 mm

(distance on the survey drawing)

Accuracy for level : altitude point within $\pm \Delta h/4$

contour line within $\pm \Delta h/2$

Δh : interval of principal contour lines

(3) Longitudinal Survey

Accuracy : $10 \text{ mm} \times \sqrt{S}$

Where, S : survey length [km]

(4) Cross Sectional Survey

Accuracy for distance : 1/500

Accuracy for level : $2\text{cm} + 5\text{cm}\sqrt{S/100}$

Where, S: survey length [m].

3. PERFORMANCE

All performances of the above-mentioned works shall be accomplished in accordance with the attached schedule as shown in attached sheet.

4. EQUIPMENT, MATERIALS AND LABOR

All equipment, materials and labor necessary for all the above-mentioned works shall be provided by the Contractor.

5. REPORTING OF THE RESULTS

The Contractor shall submit the survey reports in English to the JICA Study Team at the designated time:

Survey Report (in English, 2 copies):

The survey report shall include all of the survey results.

6. OTHER CONDITIONS

(1) The Contractor shall carefully follow the instructions given by the JICA Study Team and keep close contact with the JICA Study Team during the work. The Contractor shall be always ready to report to the JICA Study Team whenever requested.

(2) The Contractor shall acquire any formal permits, if necessary, and arrange all necessary equipment.

(3) The Contractor shall assume the responsibility for any damages on properties and equipment, which belong to the Contractor during the work period. Accordingly, the JICA Study Team shall accept no claims.

Any other issues besides the items described above shall be decided after due consideration between the JICA Study Team and the Contractor.

WORK SCHEDULE OF THE SURVEY WORK

WORK ITEM	1999	
	June	July
1. Preparation/Mobilization		
2. Topographic Survey		
-The site proposed for Pumping Station		
-Planning Laying Routes of Intercepting sewer		
3. Drawing and Reporting		

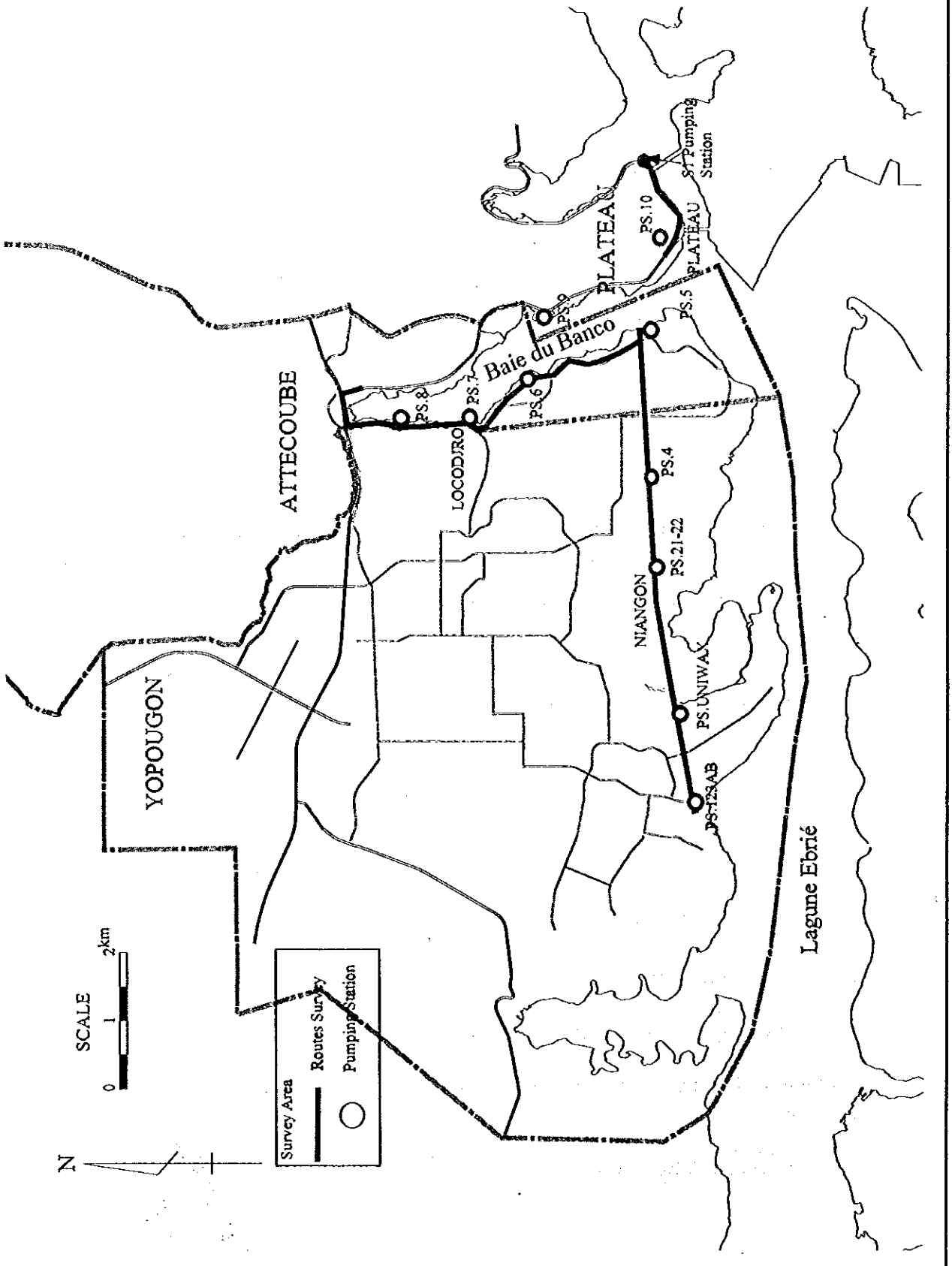

FIG. A.1 SURVEY AREA

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

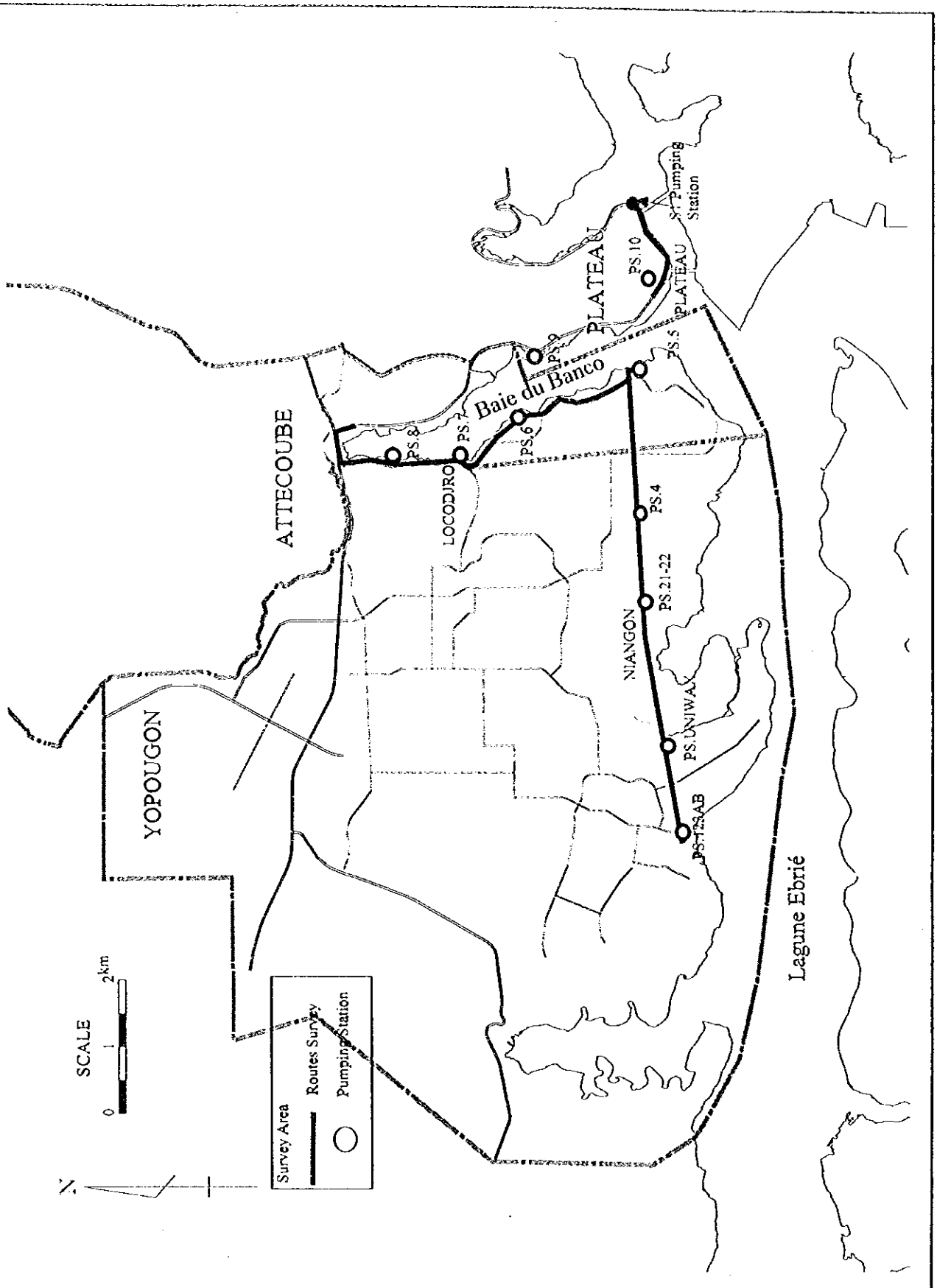

FIG. A.1 SURVEY AREA

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA

APPENDIX B

GEOLOGICAL SURVEY

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1. Introduction

The geological survey works were entrusted to a local contractor. The purpose of this survey is to identify the subsoil conditions at the sites of proposed pumping stations. A total of ten (10) locations were proposed for the geological survey. The locations of geological survey are shown in Fig. B.1.

2. Terms of Reference for the Works

The whole works are entrusted to a local contractor under the Terms of Reference as attached on the page B-4 to B-6.

3. Scope of Investigation

3.1 Field Tests

(1) Dynamic penetration tests (with 25 cm intervals) were performed at 10 locations up to 20m deep in accordance with the standard of NFP94-114 of December 1990.

(2) Borings by auger associated with the Dynamic penetration test were also performed at 10 locations up to 20m deep.

3.2 Laboratory Tests

A total of 42 samples were collected from the 10 borings for following tests;

Test Items	Standards
- Grain size analysis	: NFP 040 of October 1993
- Natural water content	: NFP 94-050 of October 1991
- Atterberg's Limit	: NFP 94-051 of March 1993
- Specific weight of Grains	: NFP 94-054 of October 1991

4. Results of Geological Survey

4.1 Laboratory Tests

The results of laboratory tests are shown in Table B.1.

Subsoil conditions of the 10 locations were mainly composed of sandy soil on the whole, and cohesive soils were not found in the surveyed locations. Components of the soil were classified as fine to coarse sand, clayey sand and gravelly sand. Grain size accumulation curves of the samples are shown in Fig. B.2.

The values of water content of the samples range between 10 % and 20 %. Though Atterberg's Limit was tested only for soil samples containing cohesive component, satisfactory results were not obtained. Specific weight of grains ranges between 2.60 and 2.66. In particular, the sample of No. PD 8 showed a very small value of 1.59. This soil is classified as organic clay.

4.2 Dynamic Penetration Test

Results from the dynamic penetration tests are shown by graphic pointing-out of the dynamic resistance (R_p) tested according to their depths. The obtained graphics (boring log) are shown in Fig. B.3. The apparatus used in the tests is a heavy dynamic penetrometer of BORRO type with a drop hammer of 50 kg of weight.

Evaluation of compaction of the soils by the scale of the dynamic resistance (R_p) is generally described as follows:

- R_p<20 bars : little compact soils
- 20<R_p<50 bars : fairly compact soils
- 50<R_p<100 bars : compact soils
- R_p>100 bars : very compact soils

Bearing capacity (q_a) of soil can be estimated using dynamic resistance (R_p) as follows:

Direct Foundation	:$q_a=R_p/20$ (bar)
Pile Foundation	:$q_a=R_p/6$ (bar)

The results of dynamic penetration test are shown in Table B.2.

TERMS OF REFERENCE
FOR
GEOLOGICAL SURVEY

1. Purpose

The work called for under this Contract (hereinafter referred to as the Work) will be conducted as part of the JICA Study on the Feasibility Study on Sewerage Facilities in Western District of Abidjan City in Côte d'Ivoire. The results of the survey will be used by The JICA Study Team for working out a plan for the projects.

2. Scope of Works

Machine boring will be conducted at following locations with specified number and depth. Two core samplings shall be taken for the whole depth of each boring log. Standard penetration test will be conducted in every one (1) meter with the boring. The JICA Study Team will direct the exact locations of the machine boring.

All measurements in the survey shall be recorded in metric units.

(1) Location: The sites proposed for the Pumping Stations (10 places)

(2) Quantity:

1) Machine boring:

Length:	20m x 10 places
Dynamic penetration test:	20m. x 10 places
Non-disturbed core sampling:	2nos. x 10 places

2) Physical test

Samples:	2 nos. x 10 places
Test item:	- Sieve analysis
	- Water content
	- Specific gravity (dry condition)
	- Liquid / Plastic limit

3) Mechanical test

Unconfined compression test : 20 nos.
Direct Shear test / Consolidation test: 10nos.

(3) Survey Results

1) Location map of machine boring sites
2) Boring log charts showing elevation, Rp-value, kind of geology, etc.
3) Explanation of geological and geo-technical characteristics
4) Photographs of core samplings

3. Performance

All performances of the above-mentioned works shall be accomplished in accordance with the attached schedule as shown in Table.

4. Equipment, materials and labor

All equipment, materials and labor necessary for all the above-mentioned works shall be provided by the Contractor.

5. Reporting of the Results

The Contractor shall submit the survey reports in English to The JICA Study Team at the designated time:

Survey Report (in English, 2 copies):

The survey report shall include all of the survey results.

6. Other Condition

(1) The Contractor shall carefully follow the instructions given by the JICA Study Team and keep close contact with the JICA Study during the work. The Contractor shall be always ready to report to the JICA Study Team whenever requested.

(2) The Contractor shall acquire any formal permits, if necessary, and arrange all necessary equipment.

(3) The Contractor shall assume the responsibility for any damages on

properties and equipment, which belong to the Contractor during the work period. Accordingly, the JICA Study Team shall accept no claims.

(4) Any other issues besides the items described above shall be decided after due consideration between The JICA Study Team and the Contractor.

7. Schedule

Table Work Schedule

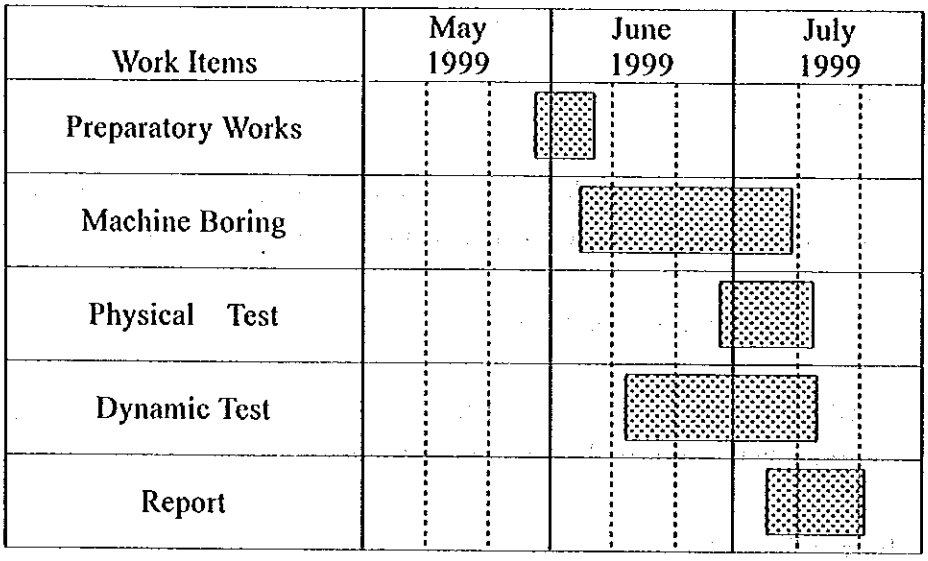


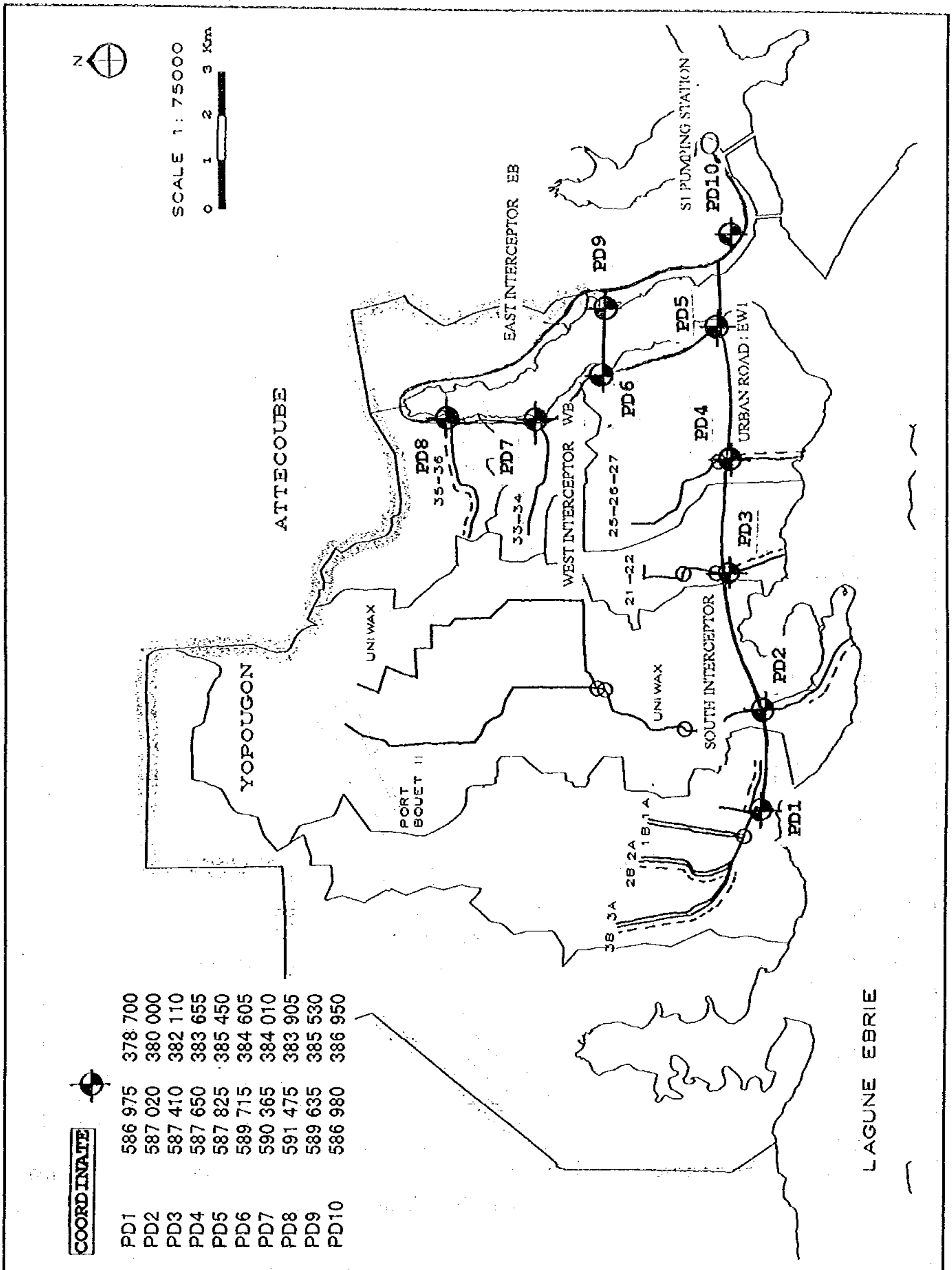
TABLE B.1 RESULTS OF LABORATORY TEST

No.	Depth (m)	Classification	Grain Size Analysis(%)			Water Content(%)	Liquid Limit LL(%)	Plastic Limit PL(%)	Plasticity Index IP (%)	Specific Gravity
			Fine	Sand	Gravel					
PD1	0.5-1.5	Medium Sand	6	93	1	10	N.A			2.64
	1.8-4.5	Clayey Sand	16	84	0	9	21	9	12	2.63
	5.1-8.0	Clayey Sand	14	81	5	15	22	9	11	2.63
	10.5-12.8	Clayey Fine Sand	9	87	4	12	N.A			2.65
	14.5-18.2	Medium -Coarse Sand	1	87	12	10	N.A			2.65
PD2	2.0-4.8	Clayey Sand	37	63	0	28	35	20	15	2.60
	6.0-9.2	Clayey Sand	35	60	5	12	28	14	14	2.64
	10.5-13.0	Gravelly Clayey Sand	16	74	10	26	27	13	14	2.63
	13.0-20.0	Clayey Sand	10	82	8	12	N.A			2.64
PD3	0.85-3.0	Clayey Sand	16	84	0	10	28	14	14	2.63
	3.0-5.6	Clayey Sand	29	71	0	9	34	14	20	2.64
	5.6-9.1	Clayey Sand	28	72	0	12	33	15	18	2.63
	9.1-20.0	Clayey Sand	27	73	0	15	32	20	12	2.65
PD4	1.4-8.6	Clayey Sand	25	75	0	15	30	16	14	2.64
	8.6-14.0	Clayey Sand	30	70	0	18	37	22	15	2.64
	14.2-15.4	Gravelly Clayey Sand	9	77	14	18	N.A			2.65
	17.3-20.0	Fine Sand	5	95	0	11	N.A			2.66
PD5	0.7-1.6	Clayey Sand	35	65	0	18	53	30	23	2.65
	1.6-2.8	Clayey Sand	28	70	2	20	38	24	14	2.64
	4.4-6.0	Medium Sand	6	88	6	14	N.A			2.64
	6.5-20.0	Fine Sand	2	92	6	12	N.A			2.64
PD6	1.95-3.0	Clayey Sand	19	81	0	17	20	12	8	2.65
	3.0-4.5	Medium Sand	4	90	6	10	N.A			2.66
	6.2-8.2	Clayey Medium Sand	10	84	6	10	N.A			2.65
	8.2-20.0	Clayey Sand	7	87	6	12	N.A			2.65
PD7	2.7-5.5	Medium Sand	1	88	11	8	N.A			2.65
	6.5-15.8	Clayey Sand	11	89	0	10	N.A			2.64
	15.8-20.0	Clayey Sand	10	90	0	9	N.A			2.64
PD8	0.4-2.5	Medium Sand	5	84	11	12	N.A			2.60
	3.1-4.2	Coarse Sand	1	93	6	10	N.A			2.64
	5.4-7.15	Organic Clay	80	20	0	140	94	50	46	1.59
	7.15-8.4	Medium Sand	4	95	1	10	N.A			2.65
	8.4-20.0	Clayey Sand	9	91	0	13	N.A			2.64
PD9	1.9-2.25	Medium Sand	1	99	0	8	N.A			2.65
	2.8-3.9	Coarse Sand	4	96	0	10	N.A			2.66
	3.9-6.8	Coarse Sand	0	95	5	6	N.A			2.66
	12.2-20.0	Medium Sand	2	71	27	12	N.A			2.65
PD10	0.3-2.3	Clayey Sand	10	90	0	14	N.A			2.63
	2.3-3.4	Medium Sand	5	95	0	11	N.A			2.63
	3.4-4.5	Medium Sand	1	84	15	13	N.A			2.66
	4.5-12.8	Coarse Sand	1	94	5	9	N.A			2.66
	12.8-20.0	Medium Sand	1	99	0	8	N.A			2.66

N.A; Non applicable

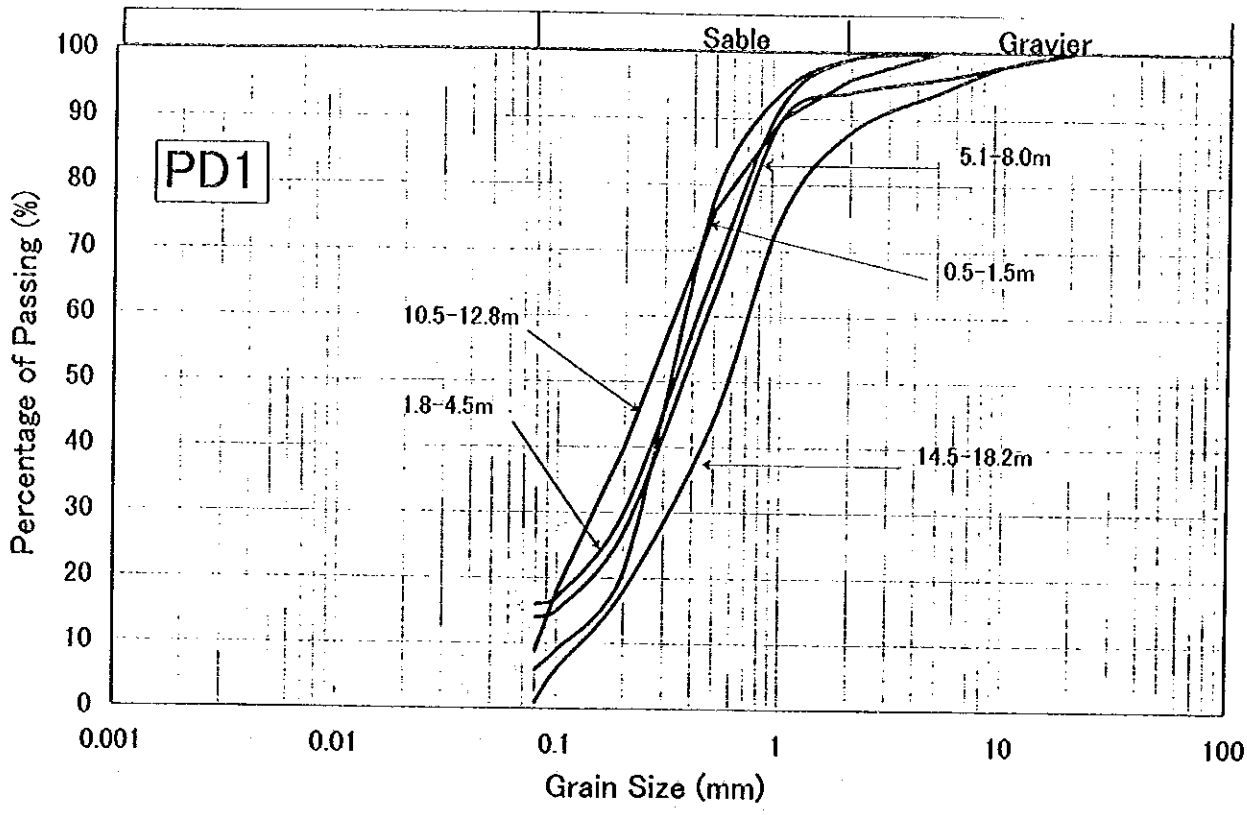
TABLE B.2 RESULTS OF DYNAMIC PENETRATION TEST

No.	Depth (GL-m)	Rp (bar)	Compaction Evaluation	Bearing Capacity qa (bar)	Groundwater Level(m)
PD 1	0-4	10>	little compact		
	4-14	20-50	faily compact	0.8 (GL-4 m)	GL-3.5m
	14-20	>100	compact		
PD 2	0-4	10>	little compact		
	4-12	20-50	faily compact	1.0 (GL-4 m)	GL-11.2m
	12-20	10-20	little compact		
PD 3	0-2	>10	little compact		
	2-4	10-20	little compact	0.8(GL-2m)	
	4-20	20-50	faily compact		GL-17.7m
PD 4	0-2	10-20	little compact		
	2-6	>50	compact	0.8(GL-2m)	GL-5.8m
	6-8	10-20	little compact		
	8-20	>50	compact		
PD 5	0-2	10-20	little compact	1.0 (GL-1 m)	
	2-6	>50	compact		GL-5.8m
	6-8	10-20	little compact		
	8-20	>50	compact		
PD 6	0-7	20-40	faily compact	1.5 (GL-1 m)	GL-3.8m
	7-20	40-80	compact		
PD 7	0-7	10>	little compact		GL 0 m
	7-11	10-30	faily compact	1.0 (GL-1m)	
	11-20	30-50	compact		
PD 8	0-7	10>	little compact		GL 0.5m
	7-20	20-30	faily compact	1.0(GL-1m)	
PD 9	0-1	50-100	compact		
	1-2	10-20	little compact		GL-1.5m
	2.5-20	20-30	faily compact	1.0 (GL-2 m)	
PD 10	0-1	50	compact		
	1-3	10-20	little compact		
	3-20	40-100	compact	2.0 (GL-3 m)	GL-2.3m



COORDINATE		
PD1	586 975	378 700
PD2	587 020	380 000
PD3	587 410	382 110
PD4	587 650	383 655
PD5	587 825	385 450
PD6	589 715	384 605
PD7	590 365	384 010
PD8	591 475	383 905
PD9	589 635	385 530
PD10	586 980	386 950

FIG. B.1 LOCATION OF GEOLOGICAL SURVEY



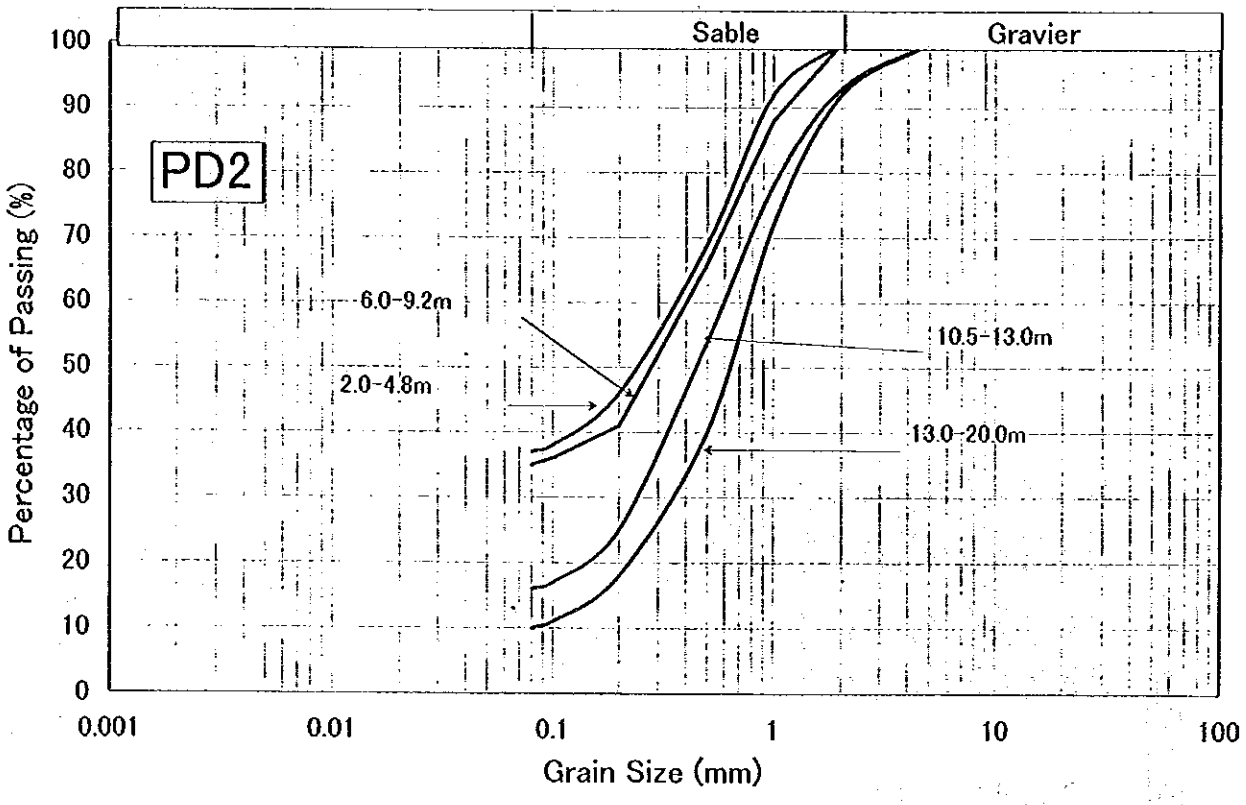
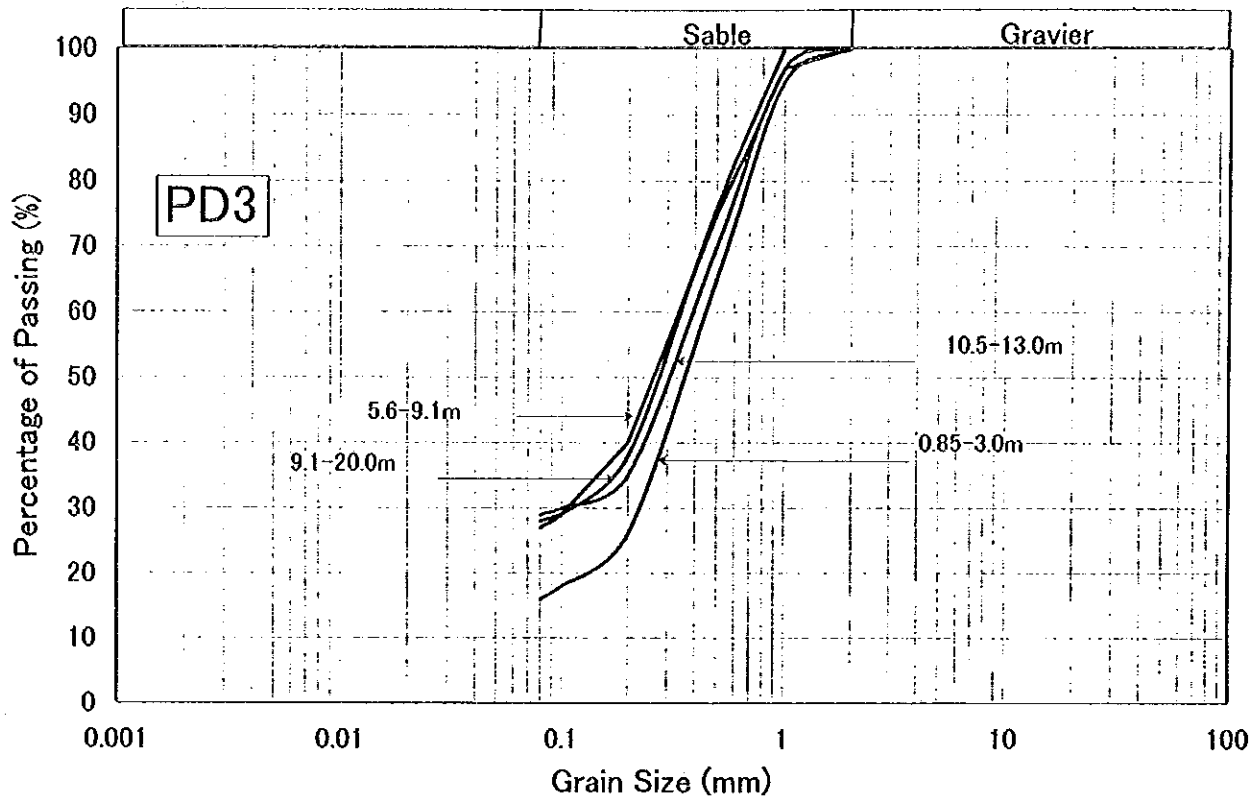


FIG. B.2 (1)	GRAIN SIZE ACCUMULATION CURVE (1)



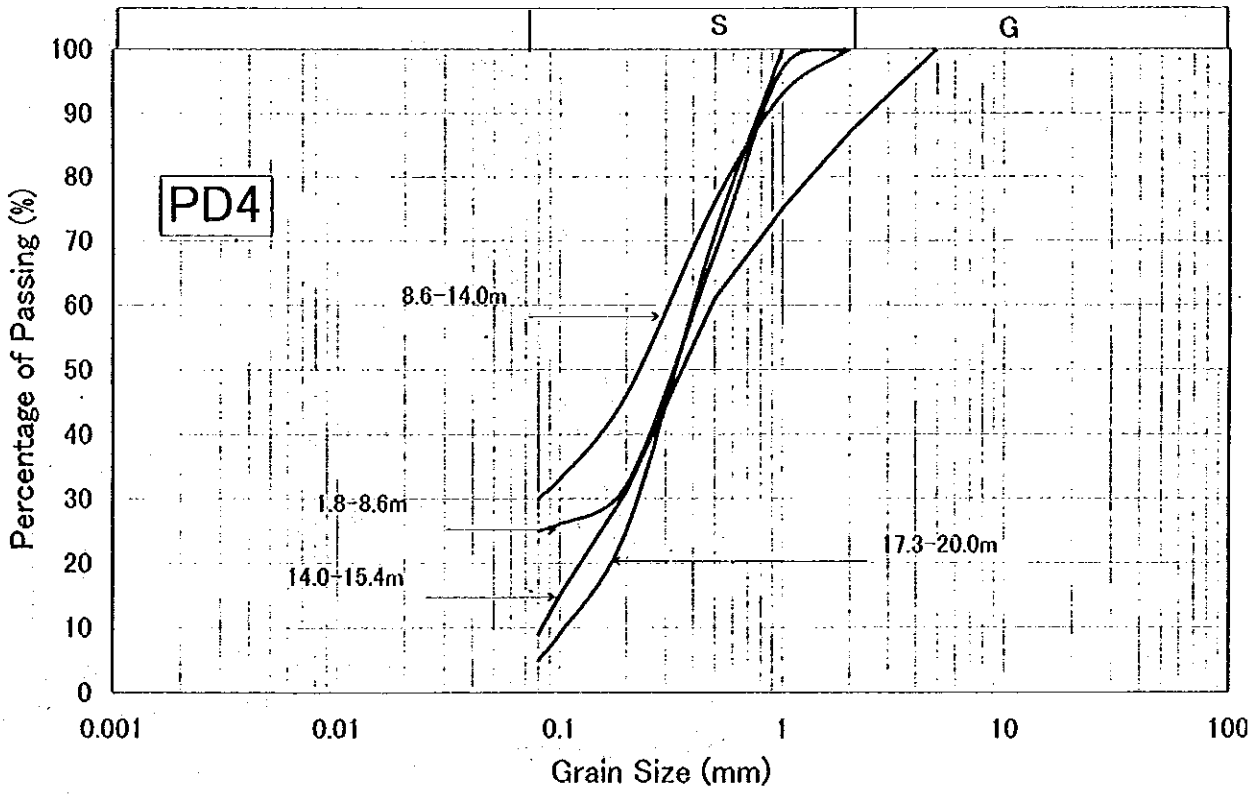
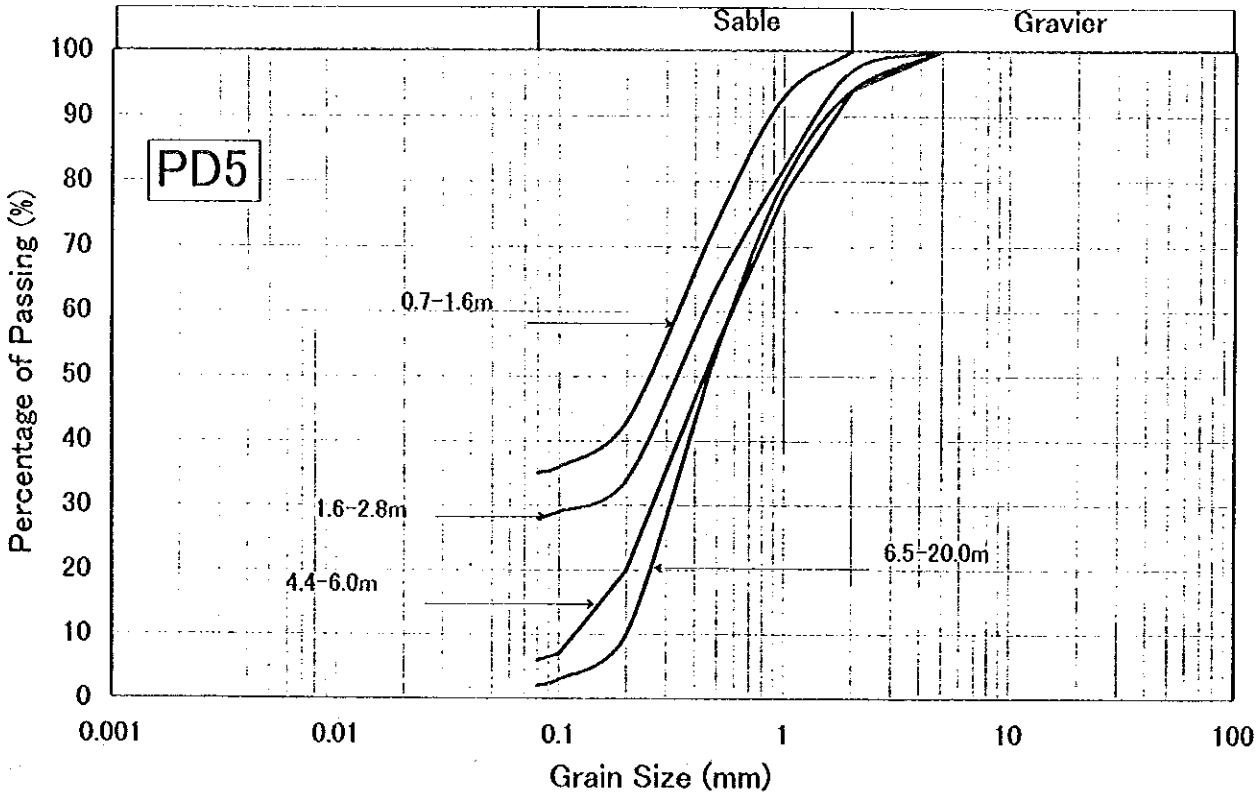


FIG. B.2 (2)	GRAIN SIZE ACCUMULATION CURVE (2)



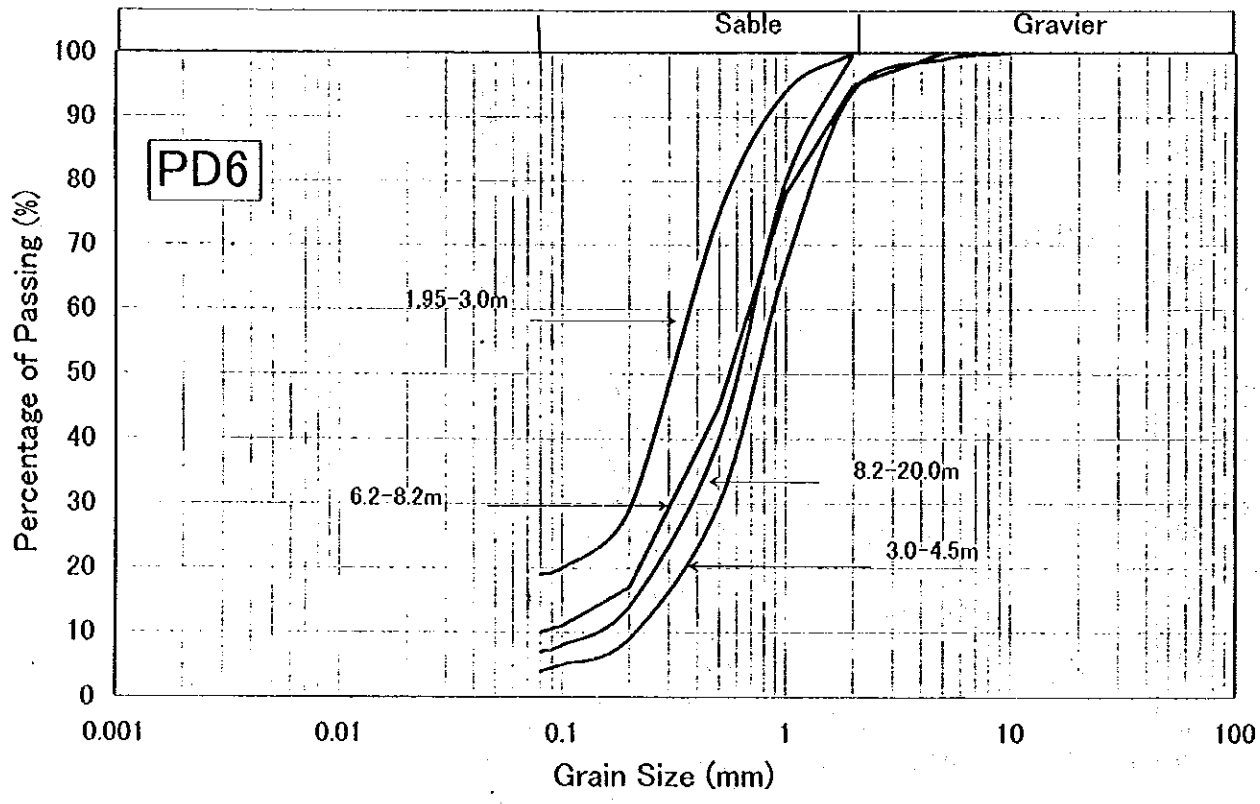
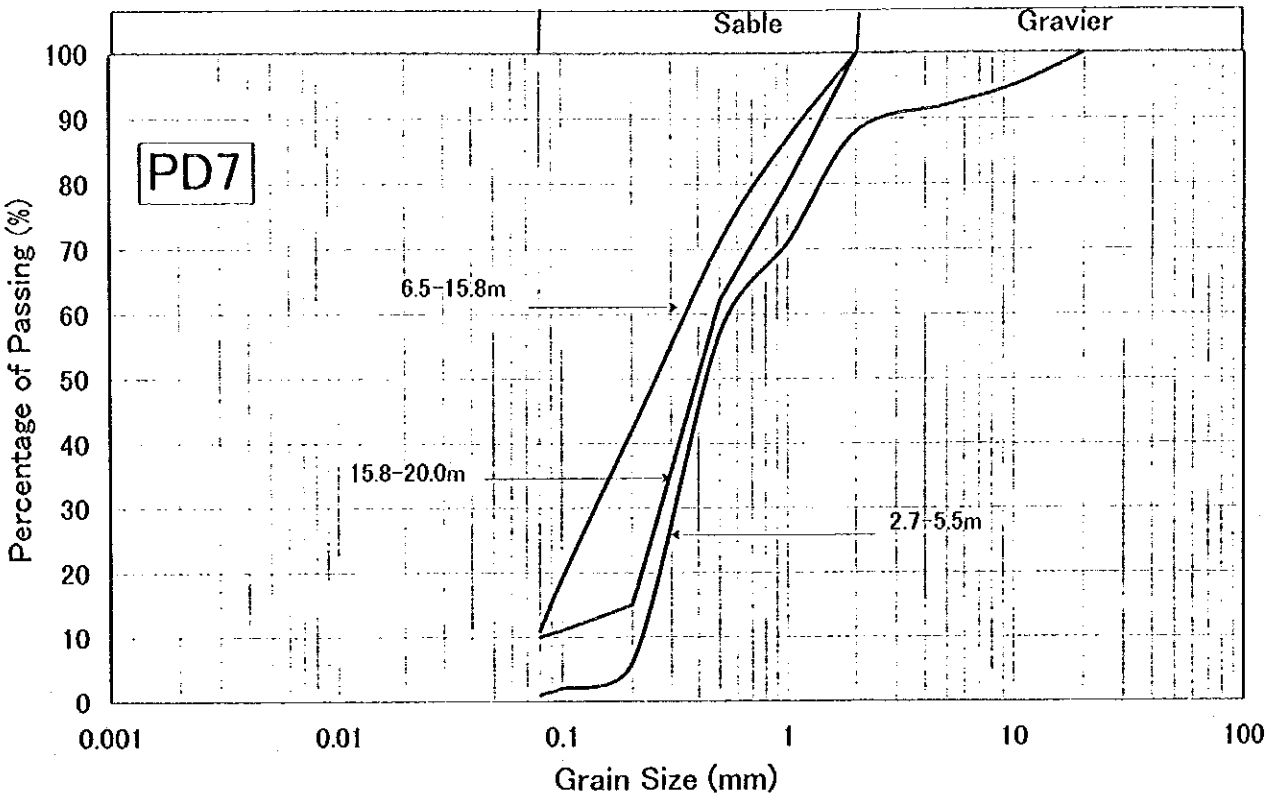


FIG. B. 2 (3) GRAIN SIZE ACCUMULATION CURVE (3)

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE



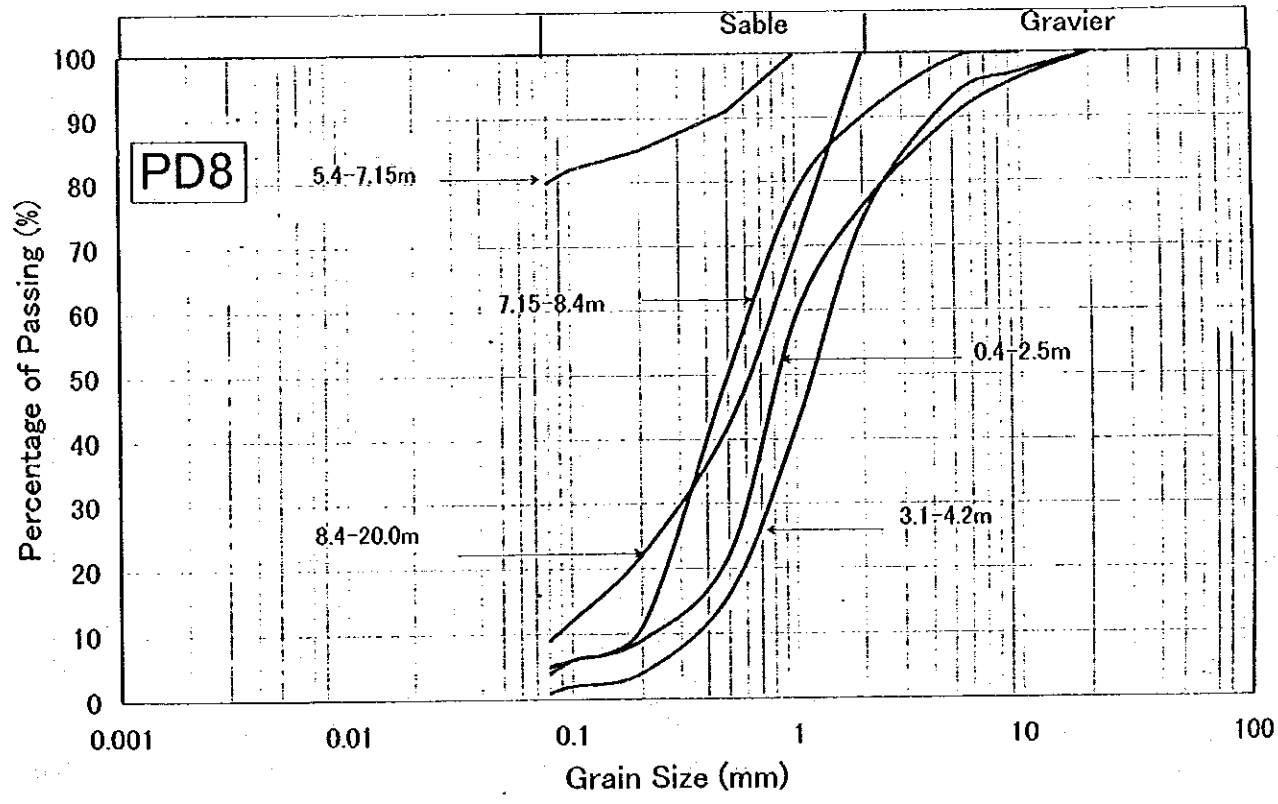
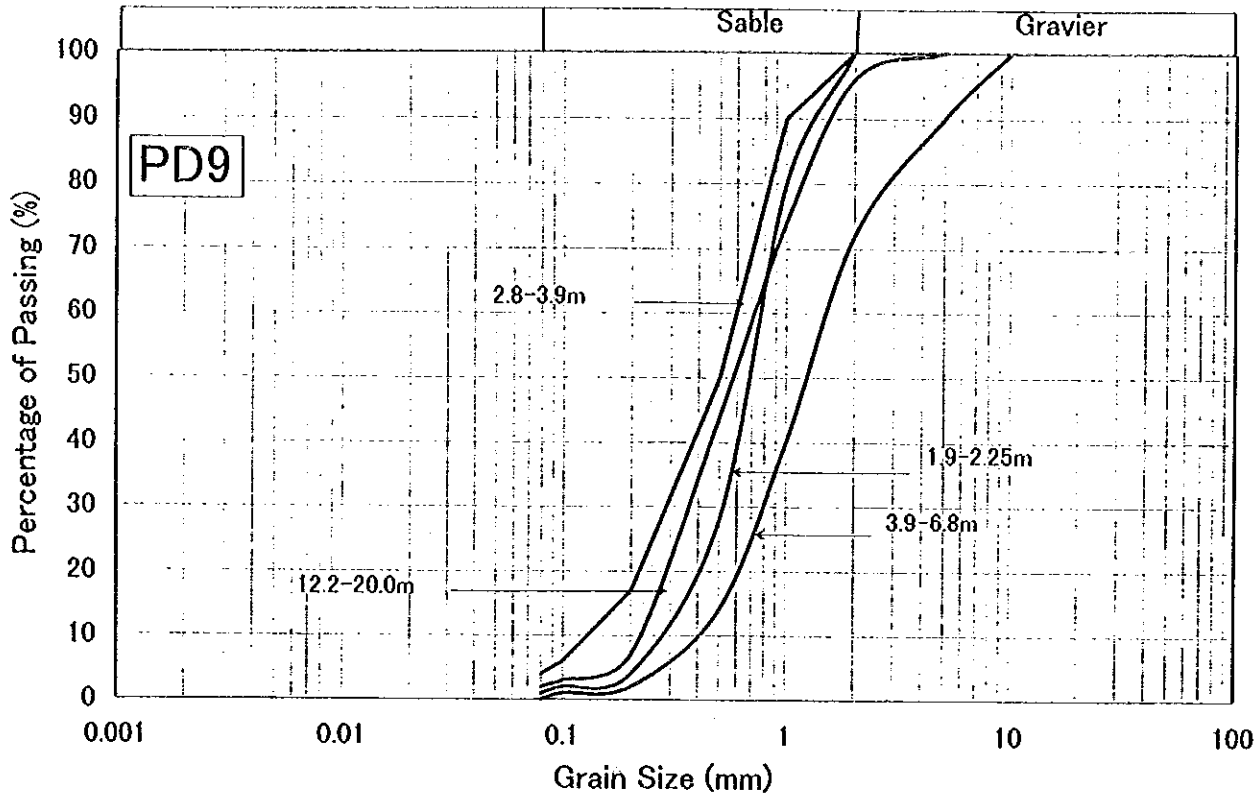


FIG. B.2 (4) GRAIN SIZE ACCUMULATION CURVE (4)



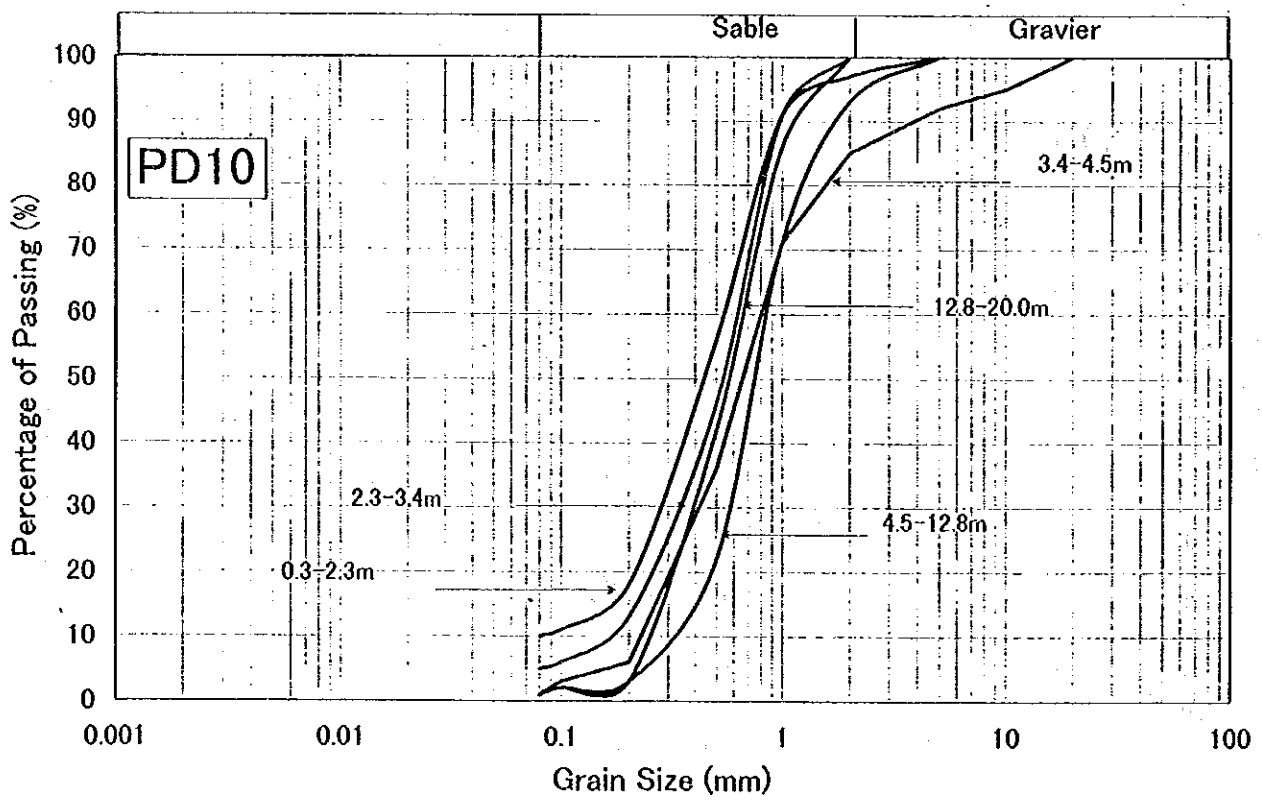


FIG. B, 2 (5)	GRAIN SIZE ACCUMULATION CURVE (5)

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N° 99/D/326

TYPE DE SONDAGE Tariere tubée
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 3.50 m
MISE EN STATION

ESSAI N° PD_1/T_1
(COLLECTEUR 1-2-3 AB)

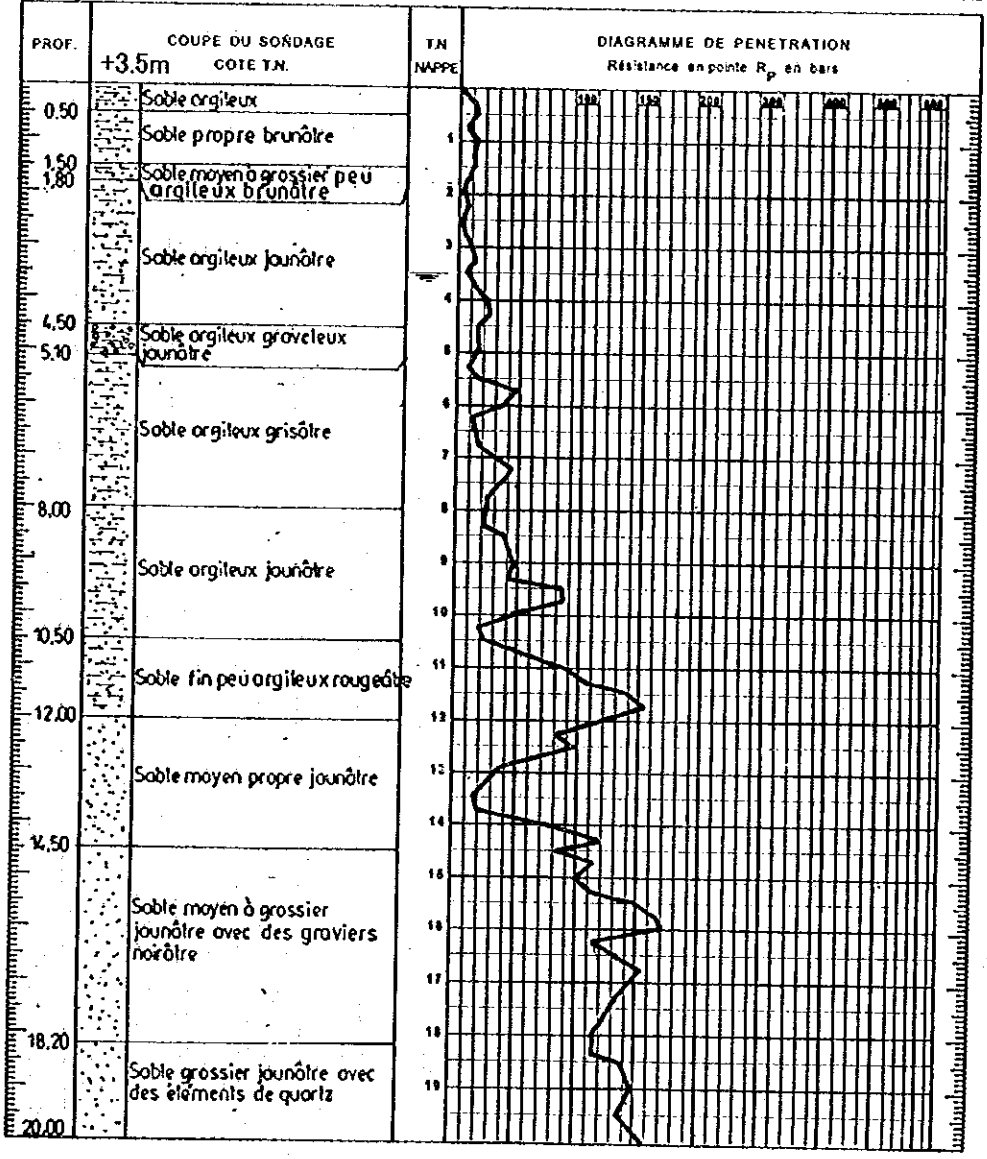


FIG. B. 3 (1) BORING LOG (PD1)

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N°99/D/326

TYPE DE SONDAGE Tarière à main
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 11,20 m
MISE EN STATION

ESSAI N°PD2/2
(UNIWAX)

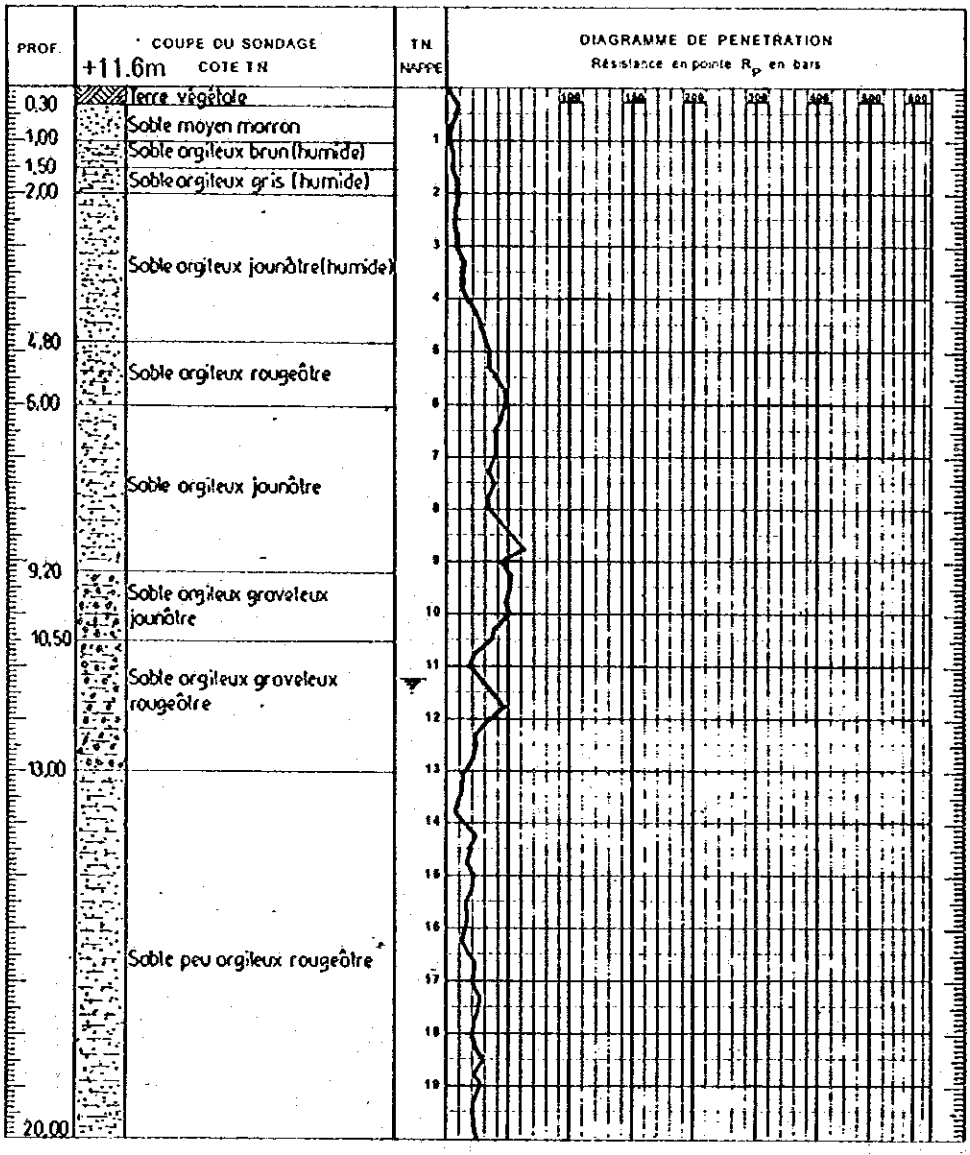


FIG. B.3 (2) BORING LOG (PD2)

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N°99/D/326

TYPE DE SONDAGE Tarière à main
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 16,70 m
MISE EN STATION

ESSAI N°PD_3/T_3

(COLLECTEUR 21-22)

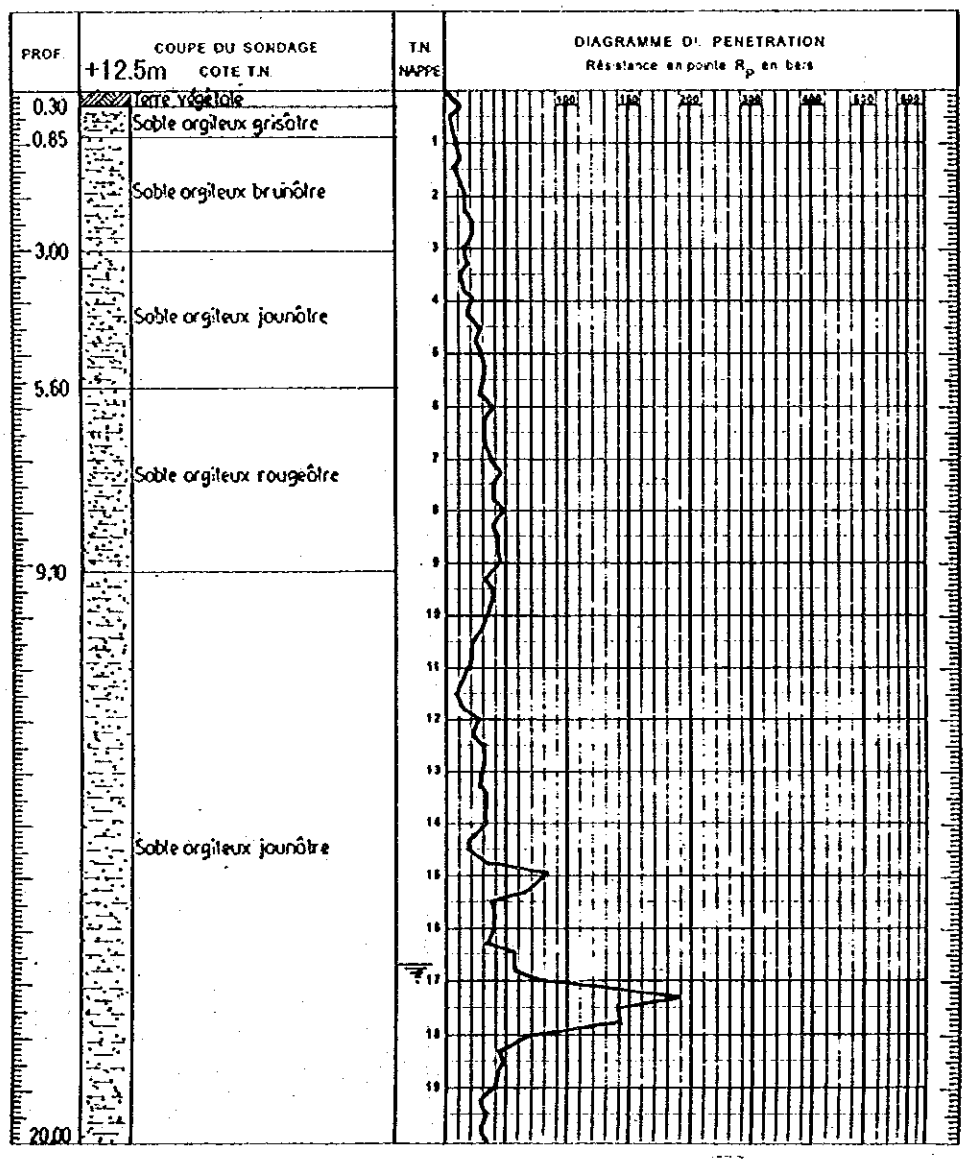


FIG. B.3 (3) BORING LOG (PD3)

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N° 99/D/326

TYPE DE SONDAGE Tarière à main
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 18.20m
MISE EN STATION

ESSAI N° PD_4 / T_4
(COLLECTEUR 25 - 26 - 27)

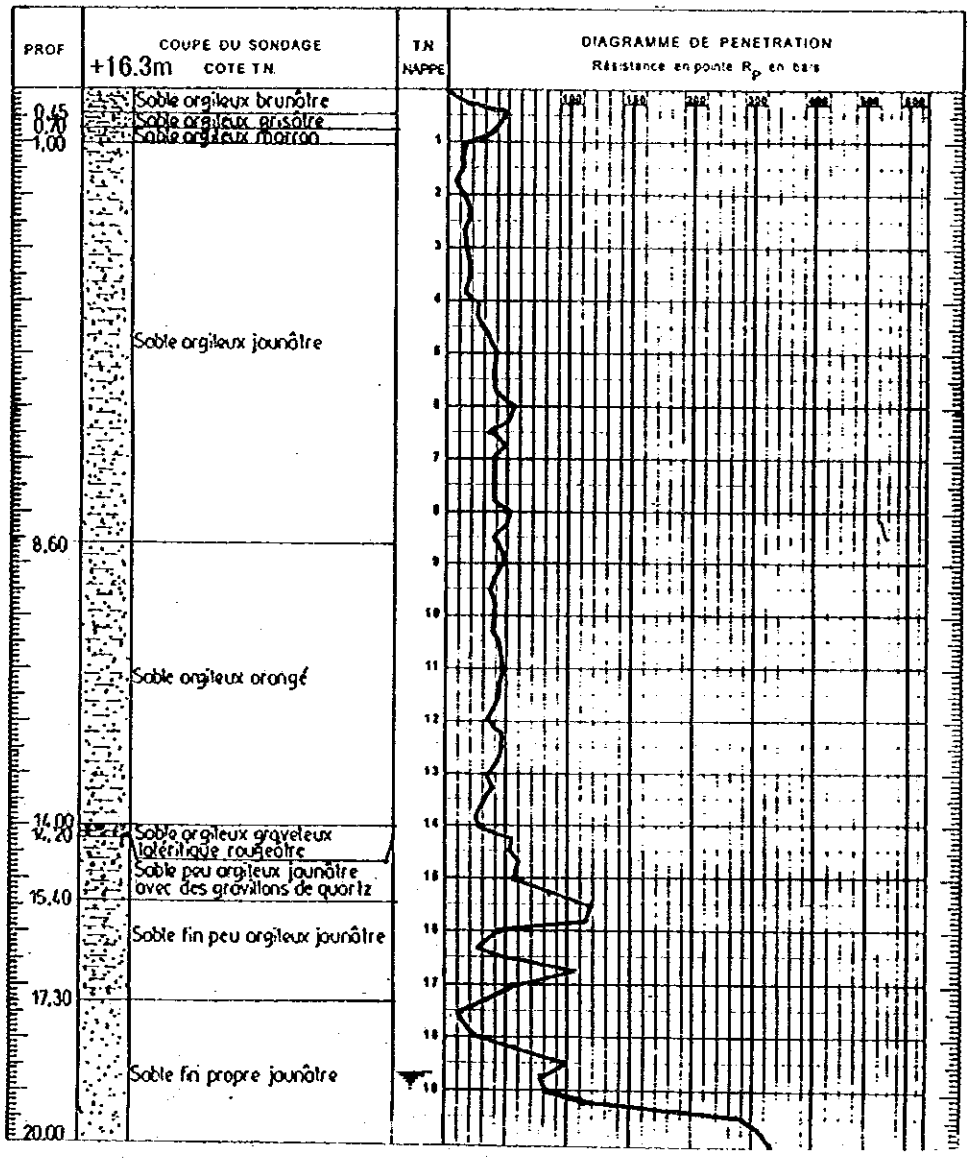


FIG. B. 3 (4) BORING LOG (PD4)

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N°99/D/326

TYPE DE SONDAGE Tarière tubée
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 5.80 m
MISE EN STATION

ESSAI N°PD5/T5
(LOCODJRO)

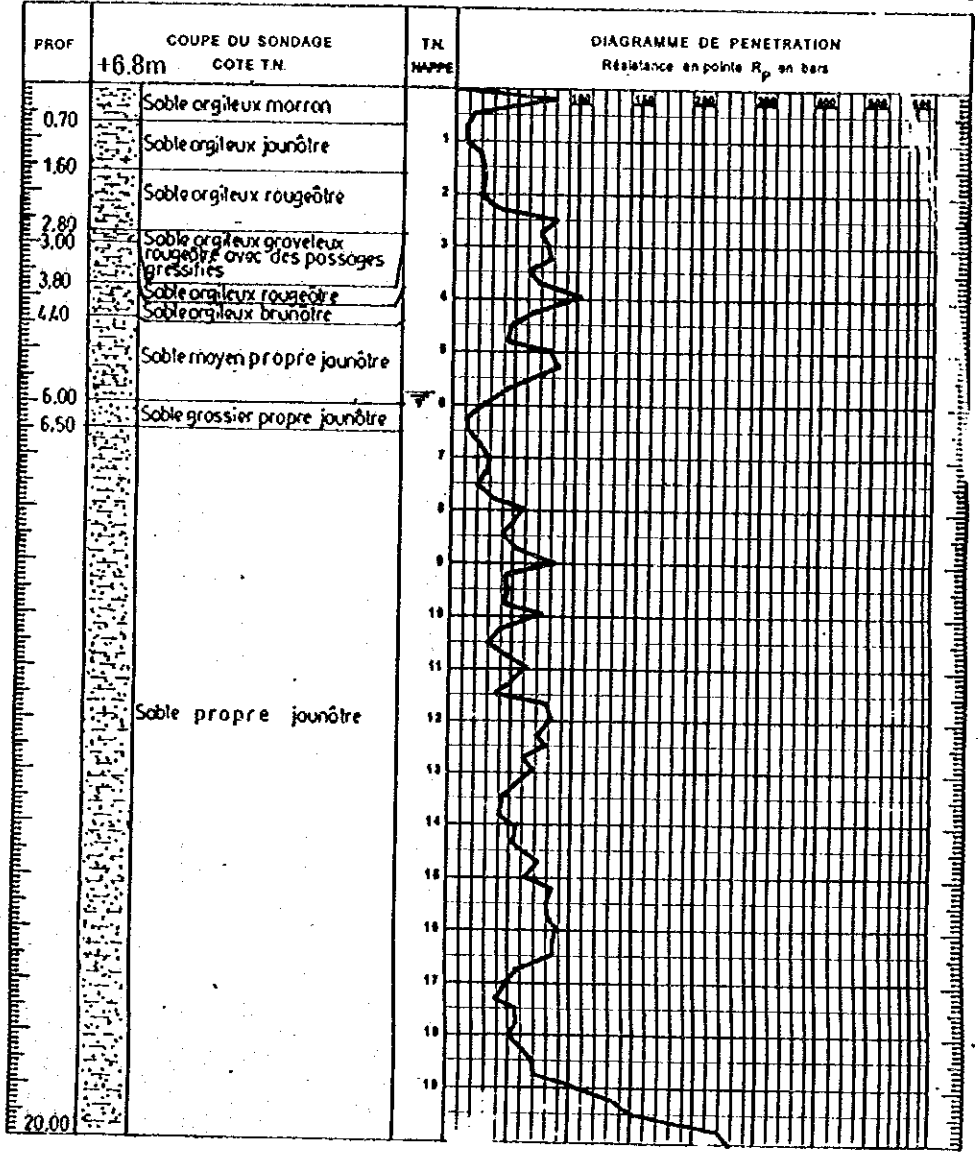


FIG. B.3 (5) BORING LOG (PD5)

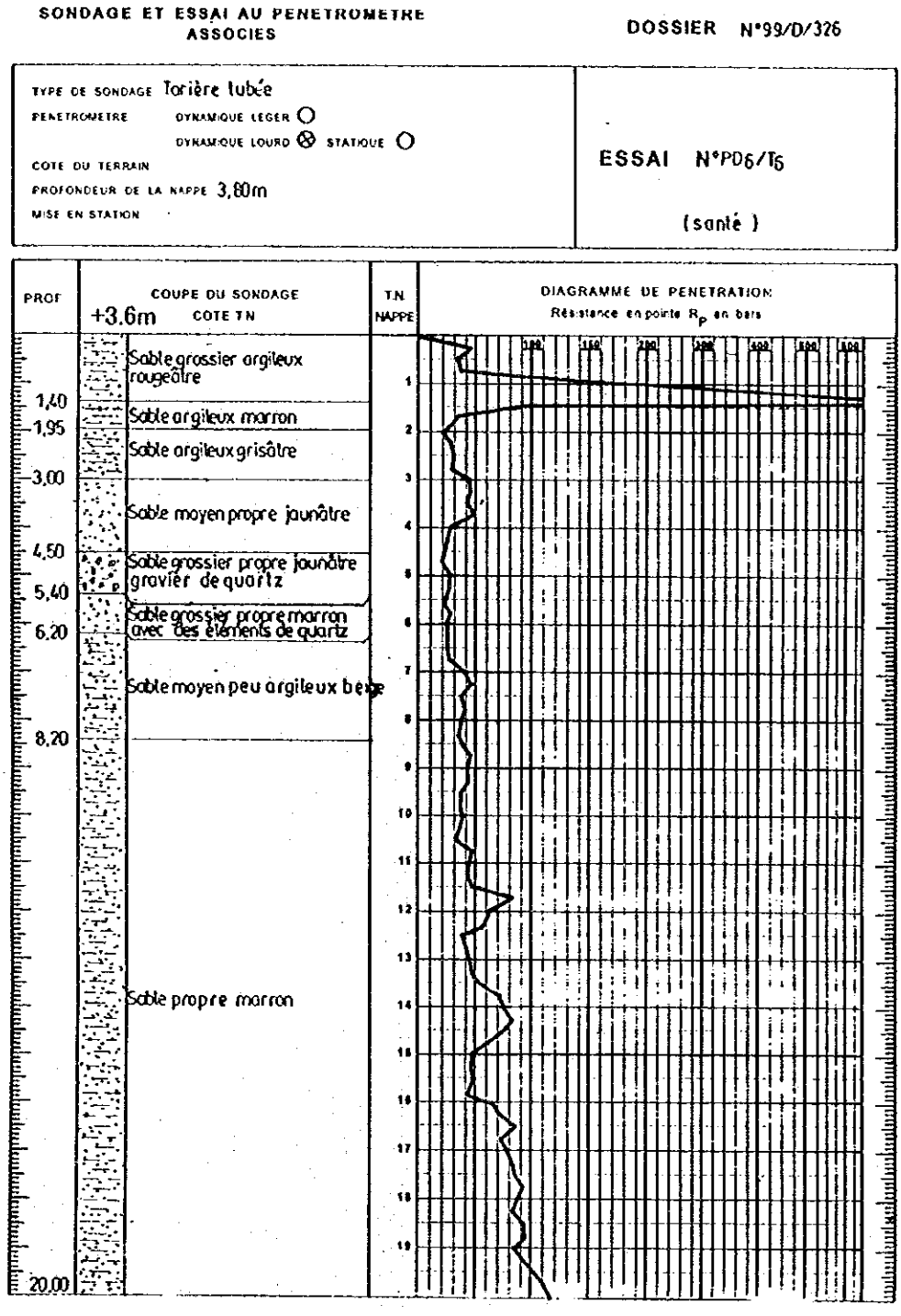


FIG. B.3 (6) BORING LOG (PD6)

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N°99/D/326

TYPE DE SONDAGE Tarière tubée
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 0,00m
MISE EN STATION

ESSAI N°PD7/T7

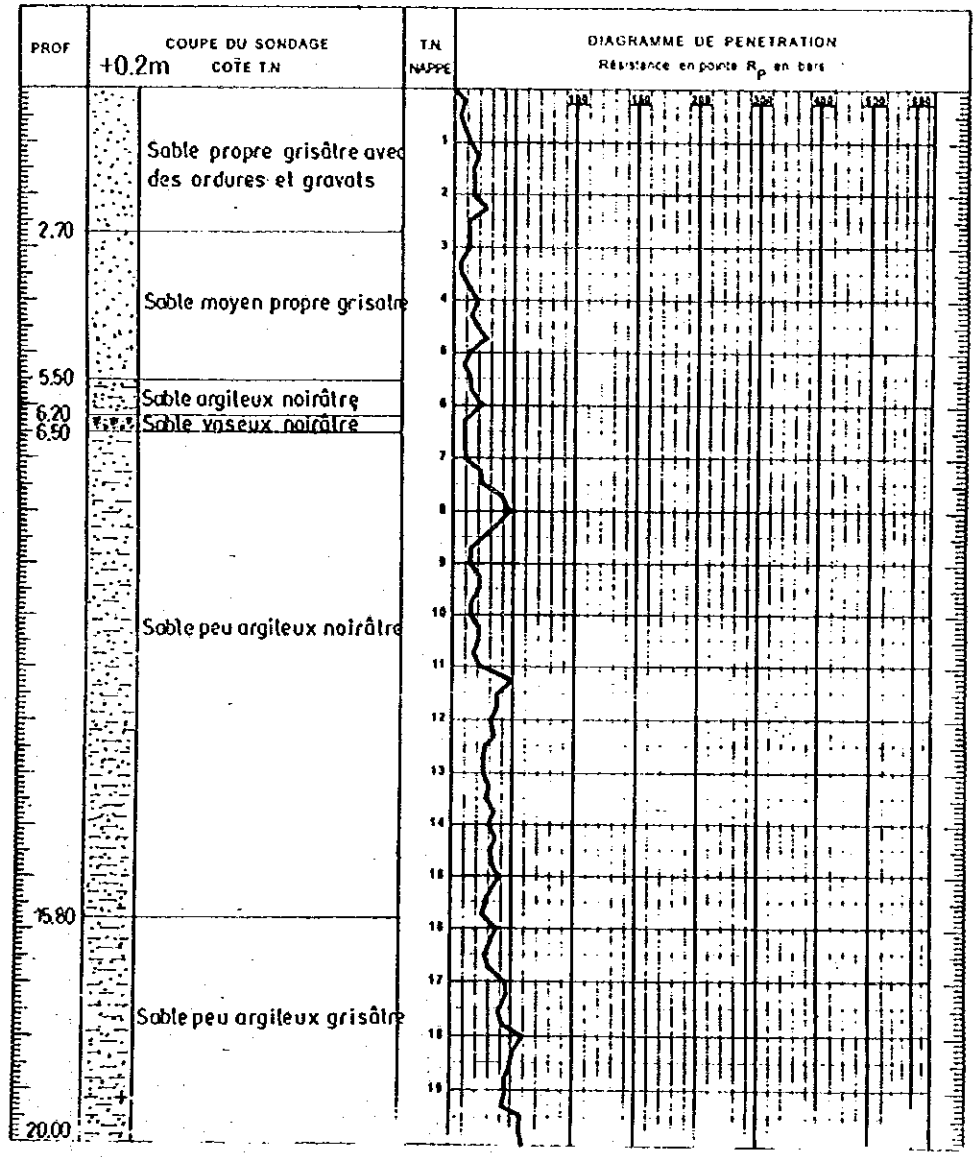


FIG. B.3 (7) BORING LOG (PD7)

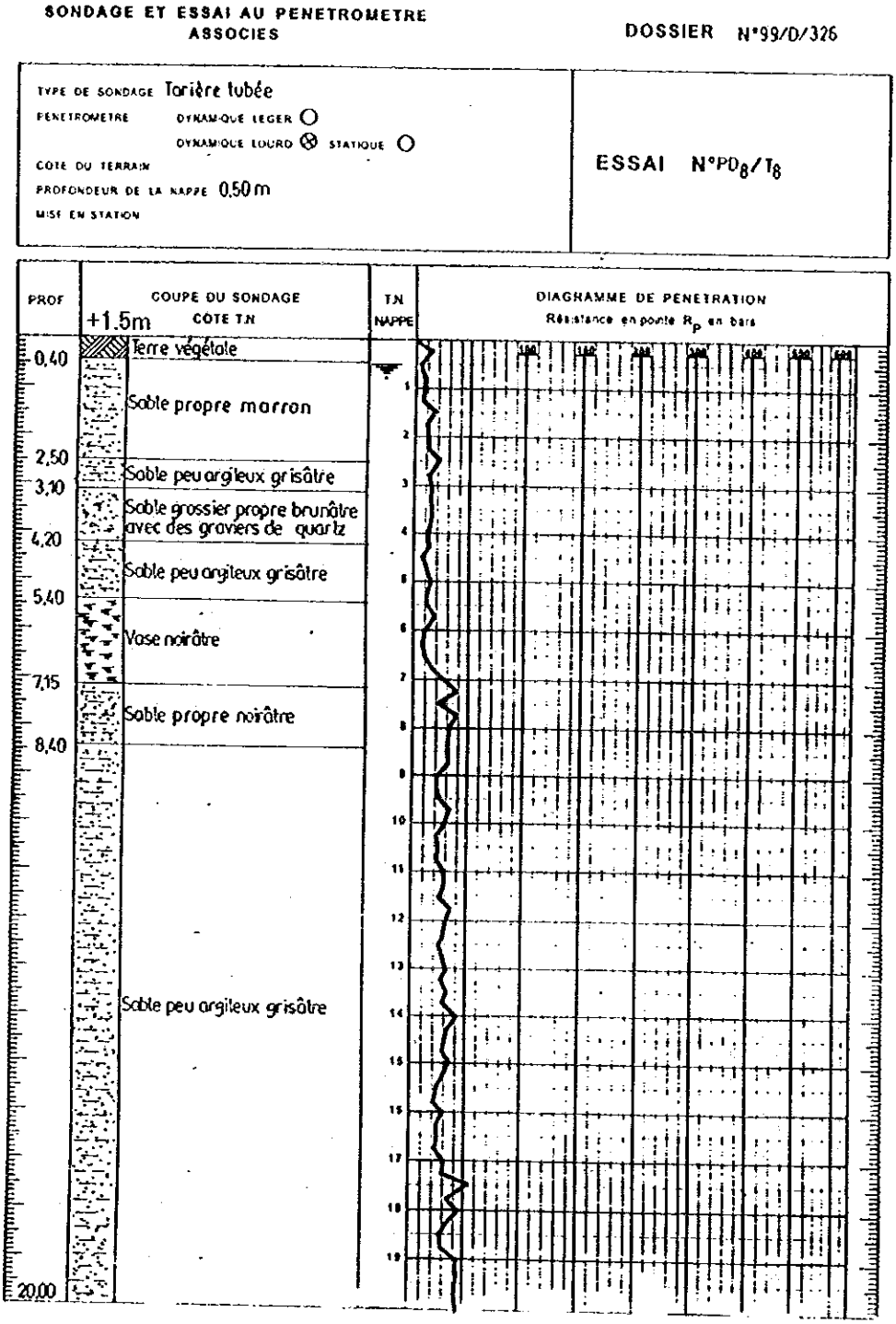


FIG. B.3 (8) BORING LOG (PD8)

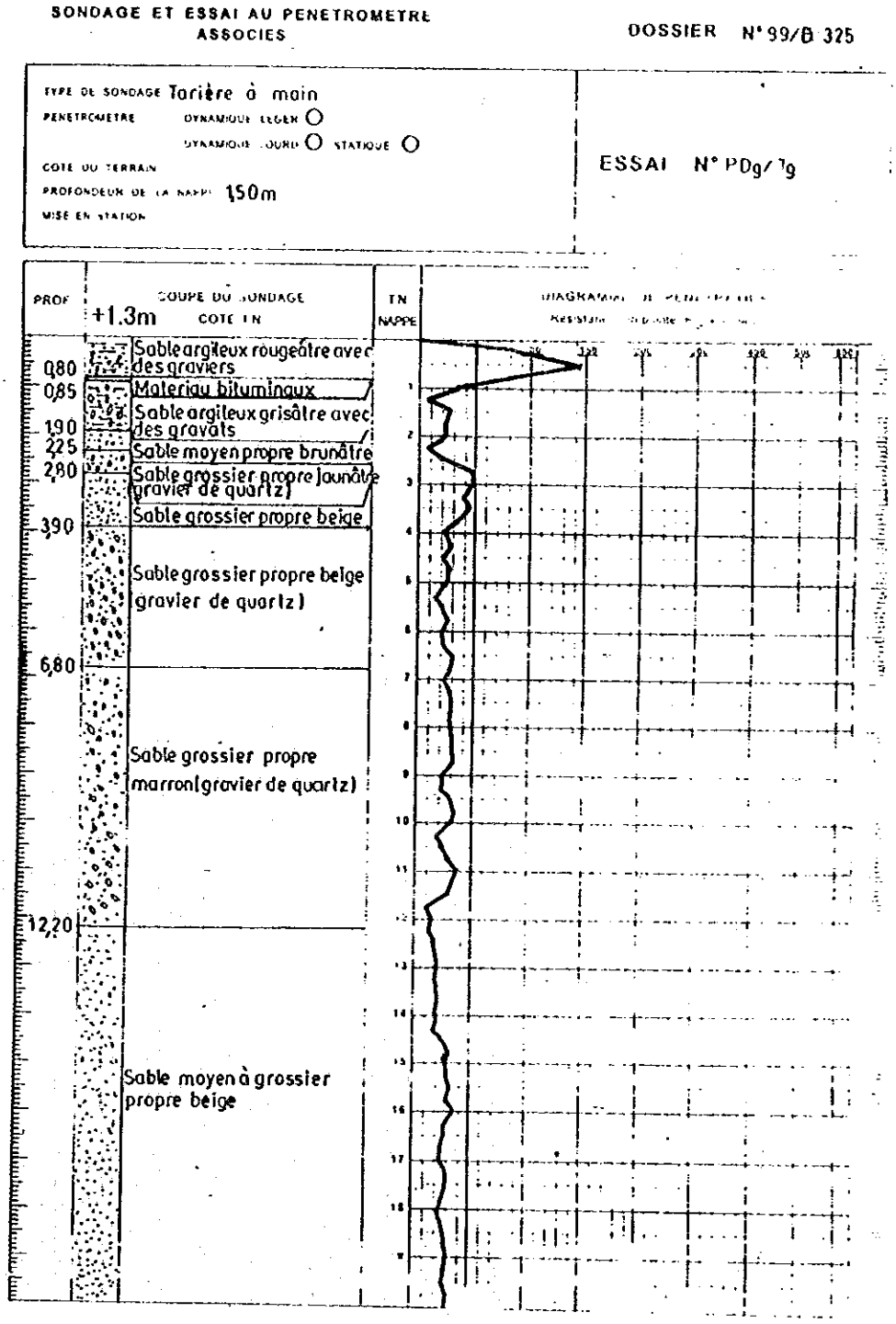


FIG. B.3 (9) BORING LOG (PD9)

SONDAGE ET ESSAI AU PENETROMETRE ASSOCIES

DOSSIER N°99/F/326

TYPE DE SONDAGE Tarière tubée
PENETROMETRE DYNAMIQUE LEGER ○
DYNAMIQUE LOURD ⊗ STATIQUE ○
COTE DU TERRAIN
PROFONDEUR DE LA NAPPE 2.30m
MISE EN STATION

ESSAI N°PD10/T10

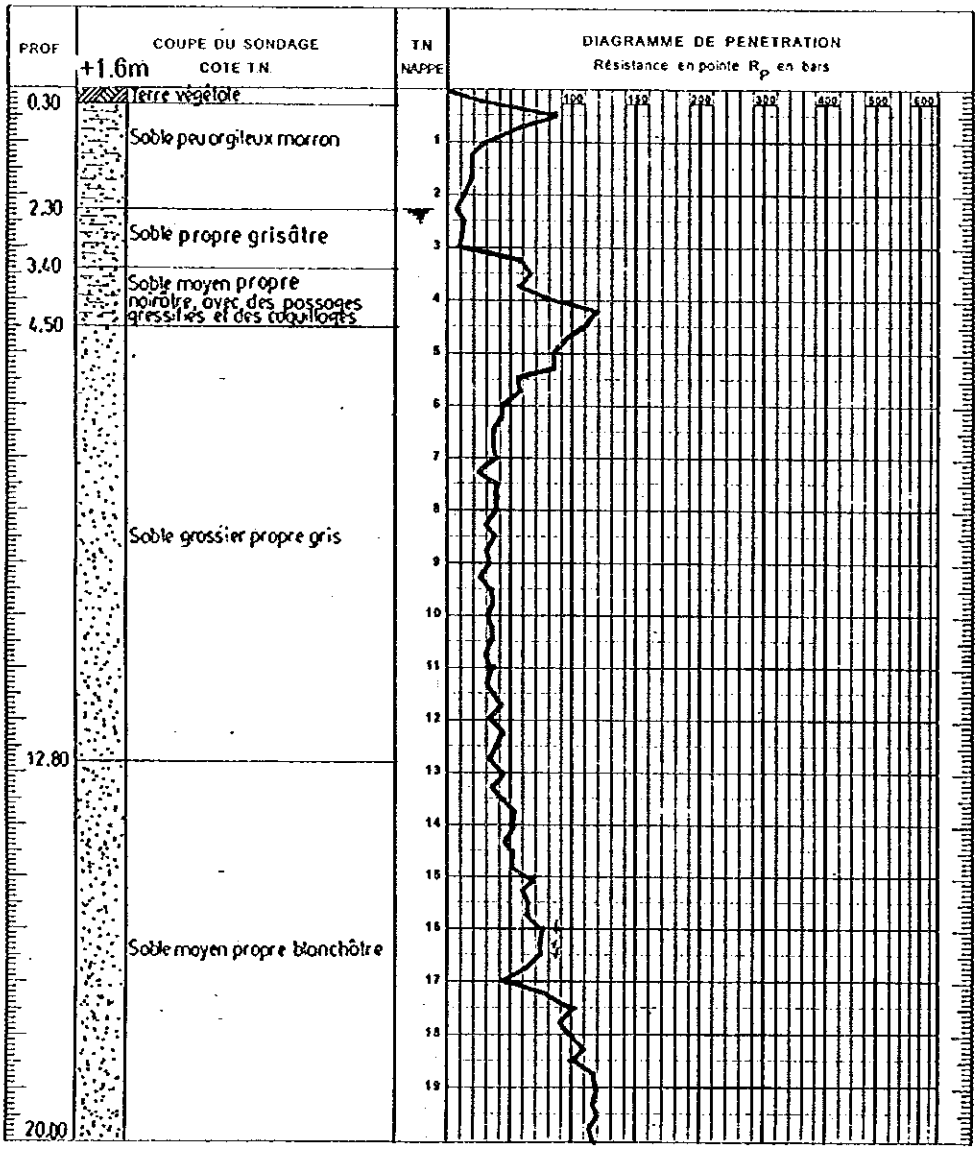


FIG. B.3 (10) BORING LOG (PD10)

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA

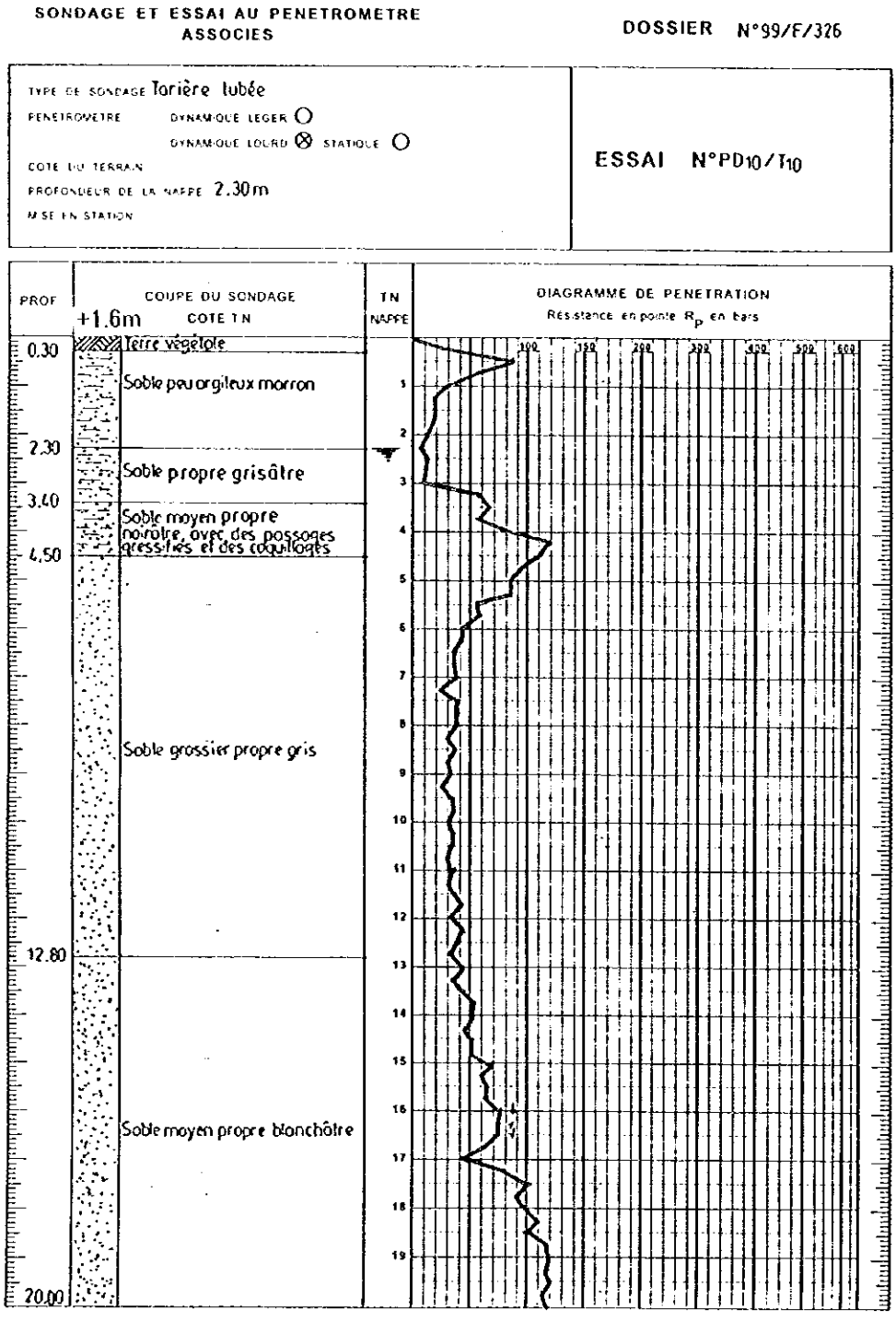


FIG. B.3 (10) BORING LOG (PD10)

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA

APPENDIX C

WATER QUALITY AND QUANTITY SURVEY

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1. Water Quality of Lagoon

The Study Team collected data concerning the Lagoon water quality at nine places where CIAPOL had investigated (Fig. C.1). Data were obtained from 1993 to 1998 concerning four items (NH_4, NO_3, NO_2, and PO_4). The data are shown in Table C.1 and Fig. C.2 to C.19.

2. Sewage Quantity and Quality Survey

2.1 Introduction

In order to assess the existing sewage quality and quantity in the Study Area and at the major sewerage facility sites of the Central Trunk Sewer, the wastewater survey was conducted in June and July. Most of the Trunk Sewers in the Study Area are broken or lost in the downstream sections. Hence, the survey was carried out at the mid-stream of the sewer before the sewage flow enters the storm water drainage canal.

The surveys were conducted dividing to two times; in June and July, to assess the difference of seasonal effect due to rainy water inflow into the sewers. The survey was executed by contracting out to the local consultants.

The sampling locations are shown in Fig. C.20.

2.2 TOR

The execution of the survey was followed by TOR shown from Page C-3.

2.3 Results of Survey

The seasonal difference of sewage flow was not clearly identified between June and July because of small difference of rainy days in each month. The result is shown in Table C.2 to C.4, and Fig. C.21 to C.26.

1) Wastewater Quality

There are a lot of factories in the upstream of the UNIWAX Basin. Table C.2 and C.3 and Fig. C.21 to C.23 show the water quality data. As evident from data of Table C.2, the industrial wastewater of this basin seems not to be well treated. According to these data, the treatment efficiency in terms of BOD, COD and grease & oil removal at the Koumassi Pre-treatment Plant is minimal. The higher COD and BOD values at the Koumassi Pre-treatment Plant compared to S1 Pumping Station seem to be due to industrial effluent from the factories of Treichville.

2) Wastewater Quantity

The survey result is shown in Table C.4 and Fig. C.24 to C.26. As a result of this investigation, it is estimated that the population connected to the sewerage system in the upstream basin is comparatively high (about 60%), based on the upstream population and per-capita water discharged quantity. On the other hand, the wastewater flow in the S1 Pumping Station is only a few % of design wastewater flow. Moreover, no remarkable daily fluctuation of wastewater flow is observed except one peak in the morning in addition to 2 to 3 irregular peaks due to surface run-off inflow. The results of the survey were referred for sewerage facility planning.

3. Tap Water Quality

The physical, chemical and bacteriological parameters of tap water at different locations in the distribution network of Abidjan were obtained. The data is shown in Table C.5 and C.6.

TERMS OF REFERENCE
FOR
WASTEWATER FLOW MEASUREMENT AND WATER QUALITY SURVEY

1. PURPOSE

The work called for under this Contract (hereinafter referred to as the Work) will be conducted as part of the JICA Study on the Feasibility Study on Sewerage Facilities in Western District of Abidjan City in Côte d'Ivoire. The results of the survey will be used by the JICA Study Team for working out a plan for the projects.

2. SCOPE OF WORKS

The Work comprises the following schedules:

Schedule 2.1 : Existing Primary Wastewater Treatment Plant and Pumping Stations

Schedule 2.2 : Outfalls of Existing Sewers

Locations of the sites for the Work shall be confirmed by the Contractor and shall be approved by the JICA Study Team before the commencement of the survey works in the field.

All measurements and results of the survey shall be in metric units.

2.1 Existing Primary Wastewater Treatment Plant and Pumping Stations

The objective of the Work at the existing primary wastewater treatment plant and pumping stations is:

- to provide basic information on design fundamentals such as unit wastewater generation rate, design influent quality and pollutant loads

The Work consists of "Wastewater Flow Measurement", "Sampling" and "Water Quality Analysis".

1) The Contractor shall conduct wastewater flow measurements of influent, twenty-four (24) hours at interval of one hour at Koumassi primary wastewater treatment plant, S1 pumping station and 7J1 pumping station, as shown in Table A.1.

2) The Contractor shall take samples of influent (or influent and effluent), once a each surveying day at Koumassi primary wastewater treatment plant, S1 pumping station and 7J1 pumping station, as shown in Table A.1.

3) Ten (10) water quality parameters shall be analyzed as shown in Table A.2 per each sample.

2.2 Outfalls of Existing Sewers

The objective of the Work at the outfalls of existing sewers is:

- to provide basic information on design fundamentals such as unit wastewater generation rate, design influent quality and pollutant loads

The Work consists of "Wastewater Flow Measurement", "Sampling" and "Water Quality Analysis".

1) The Contractor shall conduct wastewater flow measurements of effluent, twenty-four (24) hours at interval of one hour at each point of the existing sewers as shown in Table A.1. Measuring point is the end of downstream to be measured of each sewer.

2) The Contractor shall take samples of effluent, once a each surveying day at each point of the existing sewers, as shown in Table A.1. Sampling point shall be instructed by the JICA Study Team to be measured of each sewer.

3) Ten (10) water quality parameters shall be analyzed as shown in Table A.2 per each sample.

3. PERFORMANCE

All performances of the above-mentioned works shall be accomplished in accordance with the attached schedule as shown in Appendix D.

4. EQUIPMENT, MATERIALS AND LABOR

All equipment, materials and labor necessary for all the above-mentioned works shall be provided by the Contractor.

5. REPORTING OF THE RESULTS

The Contractor shall submit the survey reports in English to the JICA Study Team at the designated time:

Survey Report (in English, 2 copies):

The survey report shall include all of the survey results.

6. OTHER CONDITION

(1) The Contractor shall carefully follow the instructions given by the JICA Study Team and keep close contact with the JICA Study Team during the work. The Contractor shall be always ready to report to the JICA Study Team whenever requested.

(2) The Contractor shall acquire any formal permits, if necessary, and arrange all necessary equipment.

(3) The Contractor shall assume the responsibility for any damages on properties and equipment, which belong to the Contractor during the work period. Accordingly, the JICA Study Team shall accept no claims.

(4) Any other issues besides the items described above shall be decided after due consideration between the JICA Study Team and the Consultant.

Table A.1 Locations and Number of Wastewater Flow Measurement, Sampling and Water Quality Analysis

Survey Item	Locations	Day and Sampling Frequency	Total Number of Survey or Sampling
Wastewater flow measurement	1. Koumassi Primary Wastewater Treatment Plant a. Influent	June Rainy day × 1 day Fine day × 1 day July	 3 3
	2. S1 Pumping Station a. Influent	Rainy day × 1 day Fine day × 1 day	3 3
	3. 7J1 Pumping Station a. Influent		
Sampling	1. Koumassi Primary Wastewater Treatment Plant a. Influent b. Effluent	June Fine day 1 time × 1 day July Fine day	 4
	2. S1 Pumping Station a. Influent	1 time × 1 day	4
	3. 7J1 Pumping Station a. Influent		
Wastewater flow measurement	1. Trunk main of Port-Bouet	June	
	2. Trunk main of Uniwax	Rainy day × 1 day	6
	3. Trunk main of 21-22	July	
	4. Trunk main of 25-26-27	Fine day × 1 day	6
	5. Trunk main of 33-34		
	6. Trunk main of 35-36		
Sampling	1. Trunk main of Port-Bouet	June	
	2. Trunk main of Uniwax	Fine day	
	3. Trunk main of 21-22	1 time × 1 day	6
	4. Trunk main of 25-26-27	July	
	5. Trunk main of 33-34	Fine day	
	6. Trunk main of 35-36	1 time × 1 day	6

Table A.2 List of Water Quality Analysis

Parameter		Existing Primary Wastewater Treatment Plant and Pumping Stations	Outfalls of Existing Sewers	Total
A. Water Quality Analysis				
1	Ambient Temperature, ℃	4	6	10
2	Water Temp., ℃	4	6	10
3	pH	4	6	10
4	BOD_5	4	6	10
5	COD	4	6	10
6	SS	4	6	10
7	Cl^-	4	6	10
8	T-N	4	6	10
9	T-P	4	6	10
10	Oil	4	6	10

WORK SCHEDULE (TENTATIVE)

Works \ Date	June - July, 1999							
	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8
Flow Measurement	■				■			
Sampling	■				■			
Water Quality Analysis		- -	- -	- -		- -	- -	- -
Drawing and Reporting							■	■

TABLE C.1 WATER QUALITY OF LAGOON

Canal de Vridi (R_1)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.021	0.025	0.027	0.024	0.025	0.015	0.037	0.026	0.010	0.048	0.018	0.025
	94	0.057	0.083	0.123	0.009	0.006	0.050	0.017	0.051	0.039	0.078	0.010	0.023
	95	0.049	0.010	0.006	0.003	0.018	0.015	0.015	0.042	0.044	0.096	0.003	0.055
	96	0.150	0.170	0.166	0.009	0.014	0.054	0.002	0.005	0.007	-	0.047	-
	97	0.000	0.041	0.030	0.030	0.029	-	-	-	-	-	-	-
	98	-	-	-	0.420	-	0.261	-	-	0.124	-	0.250	0.116

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.050	0.029	-	-	-	0.211	0.122	-	0.121	0.013	0.012	-
	94	0.017	0.016	0.046	0.025	0.033	0.024	0.138	0.018	0.032	0.015	0.115	0.017
	95	0.067	0.025	0.094	0.088	0.143	0.043	0.069	0.232	0.120	0.023	0.016	0.026
	96	0.012	-	0.032	0.001	0.003	0.086	0.051	0.091	0.141	-	0.021	-
	97	0.036	0.001	0.089	0.003	0.023	-	-	-	-	-	-	-
	98	-	-	-	0.035	-	0.028	-	0.149	0.093	-	0.081	0.023

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.057	0.035	-	-	-	0.016	0.028	-	0.013	0.003	0.003	-
	94	0.008	0.007	0.001	0.000	0.019	0.032	0.027	0.291	0.005	0.000	0.038	0.007
	95	0.000	0.000	0.027	0.008	0.015	0.000	0.008	0.008	0.022	0.003	0.037	0.008
	96	0.001	-	0.002	0.002	0.005	0.039	0.042	0.003	0.023	-	0.034	-
	97	0.000	0.000	0.000	0.020	0.005	-	0.002	-	0.000	0.060	0.000	0.021
	98	-	-	-	0.006	-	0.001	-	0.022	0.001	-	0.032	0.035

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.025	0.011	0.009	0.025	0.034	0.052	0.026	0.037	0.008	0.000	0.039	0.024
	94	0.025	0.017	0.042	0.021	0.030	0.000	0.005	0.039	0.000	0.015	0.044	0.011
	95	0.006	0.060	0.034	0.041	0.021	0.002	0.087	0.006	0.095	0.157	0.046	0.028
	96	0.046	0.023	0.063	0.192	0.033	0.080	0.039	0.084	0.013	-	0.040	-
	97	0.000	0.006	0.000	0.023	0.041	-	-	-	-	-	-	-
	98	-	-	-	0.077	-	0.071	-	0.080	0.076	-	0.123	0.148

Baie de Bietri (R_2)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.179	0.177	0.420	0.497	0.037	0.010	0.261	0.002	0.002	0.066	0.014	0.001
	94	0.003	0.133	0.007	0.029	0.012	0.025	0.062	0.176	0.253	0.064	0.107	0.003
	95	0.326	0.101	0.007	0.063	0.256	0.166	0.056	0.224	0.084	0.289	0.044	0.142
	96	0.075	0.157	0.025	0.382	0.025	0.213	0.016	0.152	0.074	-	0.011	-
	97	0.058	0.072	0.072	-	0.082	-	0.003	-	-	0.077	0.172	0.134
	98	-	0.195	0.179	0.851	-	0.257	-	-	0.283	-	0.598	1.119

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.298	0.019	0.034	0.001	0.011	0.015	0.081	0.111	0.054	0.032	0.004	-
	94	0.006	0.007	0.094	0.009	0.008	0.037	0.030	0.201	0.079	0.038	0.091	0.000
	95	0.036	0.052	0.092	0.090	0.034	0.057	0.055	0.207	0.064	0.062	0.000	0.011
	96	0.008	-	0.026	0.260	0.011	0.033	-	0.084	0.047	-	0.073	-
	97	0.016	0.044	0.036	0.009	0.013	-	0.054	-	-	0.048	0.199	0.077
	98	-	0.075	-	0.022	-	0.032	0.002	0.025	0.030	-	0.021	0.025

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.097	0.027	0.001	0.000	0.008	0.278	0.095	0.012	0.021	0.027	0.005	-
	94	0.006	0.005	0.000	0.000	0.011	0.107	0.270	0.062	0.022	0.018	0.121	0.088
	95	0.022	0.000	0.009	0.010	0.011	0.007	0.057	0.033	0.102	0.019	0.006	0.005
	96	0.011	-	0.000	0.005	0.015	0.064	-	0.015	0.009	-	0.018	-
	97	0.000	0.011	0.001	0.029	0.007	-	0.000	-	-	0.097	0.022	0.028
	98	-	0.022	-	0.006	-	0.009	0.006	0.003	0.002	-	0.001	0.011

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.037	0.038	0.023	0.249	0.018	0.065	0.054	0.015	0.023	0.005	0.082	0.037
	94	0.085	0.050	0.054	0.052	0.164	0.070	0.158	0.186	0.071	0.053	0.102	0.061
	95	0.022	0.129	0.046	0.077	0.092	0.015	0.142	0.021	0.143	0.339	0.074	0.121
	96	0.207	0.080	0.094	0.260	0.053	0.115	0.172	0.159	0.019	-	-	-
	97	0.063	0.024	0.017	0.030	0.064	-	0.509	-	-	0.066	0.030	0.234
	98	-	0.091	0.094	0.118	-	0.076	0.264	0.060	0.457	-	0.168	0.254

Azito:(R_3)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.060	0.020	0.019	0.176	0.023	0.038	0.019	0.049	0.010	0.006	0.043	0.020
	94	0.045	0.047	0.033	0.041	0.004	0.022	0.061	0.105	0.134	0.051	0.063	0.004
	95	0.127	0.043	0.054	0.132	0.005	0.040	0.020	0.011	0.077	0.270	0.031	0.019
	96	0.027	0.119	0.016	0.147	0.024	0.050	0.004	0.028	0.049	-	0.043	0.358
	97	0.078	0.039	0.058	0.049	0.006	-	0.002	-	0.004	0.082	0.130	0.183
	98	-	0.167	0.164	0.217	-	0.299	-	-	0.481	-	0.356	-

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.000	0.009	0.009	0.002	0.015	0.140	0.175	0.074	0.143	0.033	0.059	-
	94	0.045	0.025	0.074	0.010	0.002	0.021	0.139	0.174	0.035	0.031	0.137	0.017
	95	0.032	0.025	0.094	0.099	0.440	0.111	0.085	0.187	0.137	0.012	0.002	0.025
	96	0.003	-	0.014	0.002	0.000	0.075	0.004	0.157	0.057	-	0.090	0.000
	97	0.022	0.003	0.043	0.015	0.019	-	0.025	-	0.003	0.107	0.149	0.075
	98	-	0.097	-	0.012	-	0.159	0.176	0.090	0.030	-	0.012	-

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.036	0.002	0.000	0.001	0.007	0.164	0.085	0.026	0.033	0.044	0.031	0.036
	94	0.009	0.006	0.000	0.002	0.000	0.231	0.168	0.132	0.003	0.010	0.067	0.097
	95	0.012	0.000	0.012	0.011	0.073	0.024	0.023	0.052	0.011	0.000	0.000	0.025
	96	0.006	-	0.002	0.025	0.025	0.090	0.033	0.091	0.012	-	0.045	0.000
	97	0.000	0.000	0.023	0.029	0.007	-	0.002	-	0.000	0.060	0.000	0.021
	98	-	0.004	-	0.005	-	0.001	0.097	0.048	0.042	-	0.057	-

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.029	0.003	0.019	0.036	0.014	0.062	0.032	0.050	0.013	0.002	0.061	0.022
	94	0.032	0.038	0.053	0.025	0.078	0.021	0.065	0.104	0.010	0.037	0.070	0.035
	95	0.015	0.089	0.041	0.076	0.049	0.054	0.130	0.020	0.208	0.332	0.042	0.061
	96	0.104	0.051	0.083	0.230	0.052	0.115	0.072	0.161	0.027	-	-	0.010
	97	0.085	0.001	0.010	0.076	0.057	-	0.732	-	0.415	0.045	0.074	0.223
	98	-	0.074	0.092	-	-	0.073	0.098	0.094	0.074	-	0.119	-

Yopougon:(R_4)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.107	0.027	0.009	0.222	0.008	0.066	0.043	0.006	0.007	0.008	0.026	0.014
	94	0.024	0.056	0.026	0.004	0.032	0.009	0.077	0.131	0.084	0.041	0.022	0.010
	95	0.319	0.009	0.062	0.119	0.189	0.186	0.074	0.027	0.060	0.188	0.025	0.011
	96	0.025	0.200	0.102	0.002	0.015	0.221	0.004	0.099	0.118	0.019	0.009	0.252
	97	0.098	0.039	0.009	0.045	0.018	-	0.002	-	0.000	0.091	0.193	0.115
	98	-	0.149	0.221	0.242	-	0.085	-	-	0.538	-	0.226	0.382

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.029	0.025	0.040	0.009	0.013	0.018	0.134	0.067	0.205	0.065	0.035	-
	94	0.012	0.008	0.107	0.002	0.010	0.017	0.123	0.158	0.148	0.056	0.173	0.100
	95	0.044	0.022	0.103	0.084	0.088	0.171	0.143	0.167	0.046	0.061	0.006	0.017
	96	0.012	-	0.004	0.003	0.006	0.076	0.035	0.072	0.002	0.183	0.047	0.010
	97	0.016	0.016	0.078	0.002	0.014	-	0.055	-	0.006	0.084	0.205	0.103
	98	-	0.068	-	0.212	-	0.000	0.162	0.130	0.047	-	0.008	0.044

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.044	0.000	0.010	0.002	0.007	0.276	0.145	0.010	0.046	0.033	0.190	0.090
	94	0.014	0.010	0.001	0.000	0.019	0.234	0.212	0.148	0.015	0.015	0.057	0.061
	95	0.018	0.000	0.010	0.010	0.075	0.067	0.044	0.023	0.017	0.011	0.039	0.002
	96	0.010	-	0.012	0.006	0.000	0.005	0.046	0.020	0.017	0.033	0.109	0.241
	97	0.000	0.008	0.011	0.041	0.009	-	0.001	-	0.002	0.077	0.000	0.035
	98	-	0.023	-	0.012	-	0.153	0.106	0.041	0.031	-	0.033	0.075

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.023	0.025	0.035	0.062	0.012	0.061	0.034	0.006	0.006	0.008	0.074	0.021
	94	0.034	0.035	0.064	0.021	0.112	0.038	0.049	0.136	0.039	0.056	0.094	0.024
	95	0.021	0.126	0.028	0.078	0.065	0.072	0.150	0.028	0.129	0.336	0.198	0.073
	96	0.204	0.055	0.104	0.278	0.059	0.195	0.114	0.218	0.021	0.008	-	0.007
	97	0.033	0.003	0.014	0.044	0.083	-	0.797	-	0.472	0.066	0.071	0.294
	98	-	0.082	0.109	0.073	-	0.085	0.112	0.093	0.074	-	0.125	0.181

Baie du Banco:(R_5)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.055	0.051	0.294	0.223	0.011	0.104	0.157	0.087	0.004	0.038	0.050	0.014
	94	0.012	0.003	0.048	0.005	0.060	0.026	0.059	0.065	0.061	0.028	0.063	0.002
	95	0.152	0.090	0.131	0.081	0.175	0.106	0.030	0.142	0.182	0.068	0.021	0.075
	96	0.008	0.262	0.149	-	-	0.152	0.004	0.130	0.153	0.006	0.007	0.014
	97	0.082	0.041	-	0.047	0.038	-	0.008	-	0.000	0.031	0.096	0.106
	98	-	0.125	0.050	0.243	-	0.394	-	-	0.188	-	1.538	0.185

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.112	0.017	0.030	0.013	0.005	0.171	0.141	0.210	0.124	0.121	0.029	-
	94	0.003	0.015	0.077	0.015	0.026	0.022	0.135	0.176	0.017	0.105	0.195	0.000
	95	0.054	0.020	0.087	0.079	0.078	0.177	0.134	0.209	0.040	0.092	0.019	0.006
	96	0.021	-	0.005	-	-	0.038	0.129	0.065	0.002	0.110	0.124	0.053
	97	0.014	0.014	-	0.004	0.021	-	0.056	-	0.036	0.153	0.074	0.098
	98	-	0.024	-	0.082	-	-	0.078	0.119	0.058	-	0.097	0.044

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.089	0.024	0.041	0.006	0.013	0.135	0.142	0.022	0.017	0.060	0.097	0.058
	94	0.110	0.012	0.000	0.002	0.028	0.230	0.171	0.042	0.008	0.135	0.121	0.107
	95	0.014	0.027	0.024	0.019	0.056	0.033	0.106	0.030	0.013	0.011	0.020	0.000
	96	0.023	-	0.004	-	-	0.080	0.373	0.014	0.007	0.011	0.085	0.017
	97	0.000	0.003	-	0.037	0.012	-	0.005	-	0.010	0.096	0.000	0.033
	98	-	0.006	-	0.027	-	-	0.034	0.063	0.023	-	0.099	0.049

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.011	0.034	0.018	0.087	0.015	0.064	0.055	0.023	0.014	0.017	0.071	0.033
	94	0.060	0.107	0.061	0.041	0.111	0.048	0.115	0.092	0.028	0.048	0.091	0.046
	95	0.020	0.171	0.072	0.117	0.111	0.055	0.120	0.027	0.120	0.399	0.062	0.079
	96	0.116	0.053	0.090	-	-	0.124	0.104	0.172	0.019	0.012	-	0.006
	97	0.000	0.003	-	0.029	0.078	-	0.717	-	0.590	0.077	0.007	0.297
	98	-	0.110	0.082	0.110	-	-	0.080	0.155	0.097	-	0.185	0.304

Baie de Cocody:(R_6)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.194	0.014	0.482	0.490	0.205	0.371	0.262	0.010	0.009	0.111	0.006	0.024
	94	0.055	0.106	0.030	0.005	0.014	0.051	0.148	0.111	0.228	0.045	0.077	0.002
	95	0.159	0.019	0.082	0.167	0.170	0.014	0.158	0.097	0.056	0.256	0.035	0.011
	96	0.006	-	0.175	0.096	0.001	0.135	0.050	0.001	0.054	0.042	0.003	0.267
	97	0.030	0.034	0.060	-	0.063	-	-	-	0.008	0.067	0.104	0.087
	98	-	0.116	0.052	0.220	-	0.263	-	-	1.133	-	1.621	1.258

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.044	0.024	0.026	0.016	0.053	0.189	0.153	0.052	0.231	0.133	0.031	-
	94	0.009	0.019	0.041	0.164	0.069	0.119	0.243	0.156	0.123	0.095	0.109	0.132
	95	0.012	0.024	0.095	0.084	0.105	0.195	0.081	0.174	0.108	0.097	0.130	0.229
	96	0.028	0.106	0.019	0.005	0.005	0.036	0.002	0.122	0.090	0.074	0.044	0.107
	97	0.011	0.014	0.060	-	0.010	-	-	-	-	1.760	0.081	0.092
	98	-	0.096	-	0.074	-	0.067	0.090	0.124	0.052	-	0.055	0.026

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.029	0.003	0.000	0.002	0.044	0.065	0.130	0.009	0.060	0.015	0.026	0.034
	94	0.028	0.008	0.007	0.083	0.038	0.131	0.068	0.151	0.003	0.015	0.025	0.013
	95	0.000	0.000	0.022	0.019	0.027	0.025	0.027	0.014	0.010	0.017	0.035	0.032
	96	0.024	-	0.009	0.035	0.036	0.024	0.009	0.013	0.012	0.007	0.035	0.000
	97	0.003	0.005	0.010	-	0.012	-	-	-	-	0.107	0.043	0.011
	98	-	0.013	-	0.032	-	0.041	0.063	0.066	0.021	-	0.022	0.043

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.032	0.113	0.054	0.036	0.051	0.076	0.066	0.006	0.018	0.039	0.084	0.052
	94	0.063	0.063	0.079	0.091	0.109	0.067	0.063	0.160	0.113	0.092	0.192	0.034
	95	0.027	0.135	0.065	0.114	0.106	0.060	0.152	0.035	0.152	0.447	0.085	0.065
	96	0.131	-	0.103	0.258	0.069	0.160	0.193	0.211	0.025	0.016	-	0.007
	97	0.004	0.013	0.045	-	0.078	-	-	-	0.617	0.012	0.084	0.177
	98	-	0.095	0.090	0.055	-	0.098	0.111	0.181	0.031	-	0.159	0.204

Baie die Marcory:(R_7)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.123	0.043	0.180	0.496	0.099	0.014	0.337	0.166	0.005	0.055	0.044	0.051
	94	0.024	0.011	0.061	0.004	0.004	0.051	0.031	0.096	0.227	0.022	0.124	0.003
	95	0.192	0.076	0.008	0.120	0.346	0.010	0.475	0.228	0.075	0.080	0.011	0.028
	96	0.078	0.091	0.023	-	0.087	0.106	0.039	0.081	0.077	0.012	0.004	0.223
	97	0.048	0.023	0.061	0.094	0.038	-	-	-	0.003	0.063	0.098	0.101
	98	-	0.239	0.066	0.222	-	0.228	-	-	1.198	-	1.711	0.242

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.095	0.034	0.017	0.011	0.064	0.143	0.187	0.084	0.198	0.125	0.026	-
	94	0.015	0.017	0.115	0.026	0.043	0.128	0.099	0.189	0.203	0.042	0.157	0.041
	95	0.056	0.019	0.098	0.084	0.099	0.150	0.147	0.191	0.101	0.159	0.050	0.032
	96	0.032	-	0.015	-	0.003	0.095	0.150	0.119	0.046	0.096	0.019	0.178
	97	0.033	0.021	0.070	0.005	0.038	-	-	-	0.023	0.199	0.055	0.062
	98	-	0.049	-	0.000	-	0.084	0.112	0.113	0.048	-	0.070	0.044

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.044	0.028	0.000	0.001	0.051	0.161	0.097	0.014	0.039	0.017	0.012	0.023
	94	0.026	0.010	0.011	0.008	0.087	0.122	0.010	0.118	0.005	0.010	0.015	0.137
	95	0.029	0.000	0.016	0.027	0.029	0.015	0.057	0.015	0.012	0.005	0.015	0.025
	96	0.025	-	0.023	-	0.031	0.035	0.045	0.010	0.010	0.003	0.075	0.011
	97	0.011	0.009	0.019	0.056	0.005	-	-	-	0.009	0.109	0.026	0.026
	98	-	0.006	-	0.066	-	0.050	0.062	0.072	0.014	-	0.015	0.041

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.029	0.026	0.037	0.051	0.028	0.099	0.065	0.008	0.017	0.050	0.070	0.078
	94	0.088	0.055	0.079	0.039	0.150	0.028	0.051	0.128	0.065	0.036	0.125	0.059
	95	0.023	0.128	0.072	0.116	0.120	0.061	0.160	0.032	0.186	0.460	0.124	0.081
	96	0.137	0.067	0.096	-	0.101	0.161	0.148	0.270	0.028	0.017	-	0.004
	97	0.008	0.000	0.008	0.065	0.084	-	-	-	0.660	0.026	0.015	0.354
	98	-	0.099	0.119	0.037	-	0.090	0.098	0.190	0.038	-	0.233	0.201

Canal Est:(R_8)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.042	0.031	0.116	0.238	0.066	0.119	0.078	0.167	0.028	0.007	0.030	0.024
	94	0.047	0.028	0.054	0.002	0.017	0.032	0.203	0.084	0.038	0.064	0.061	0.018
	95	0.107	0.046	0.095	0.075	0.126	0.015	0.020	0.060	0.021	0.011	0.008	0.032
	96	0.039	0.056	0.178	0.012	0.022	0.051	0.031	0.001	0.140	0.041	0.007	0.061
	97	0.010	0.095	0.080	0.070	0.008	-	-	-	0.001	0.000	0.160	0.107
	98	-	0.063	0.100	0.190	-	0.202	-	-	0.917	-	0.507	0.094

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.051	0.063	0.014	0.014	0.194	0.099	0.196	0.117	0.240	0.163	0.046	-
	94	0.015	0.013	0.096	0.018	0.079	0.142	0.217	0.238	0.079	0.108	0.029	0.035
	95	0.080	0.023	0.009	0.082	0.219	0.206	0.092	0.200	0.090	0.114	0.024	0.033
	96	0.032	-	0.024	0.006	0.006	0.144	0.057	0.174	0.162	0.095	0.016	0.016
	97	0.026	0.015	0.008	0.019	0.035	-	-	-	0.030	0.183	0.059	0.031
	98	-	0.127	-	0.067	-	0.124	0.123	0.110	0.063	-	0.132	0.059

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.011	0.027	0.002	0.002	0.115	0.095	0.089	0.015	0.046	0.010	0.008	-
	94	0.028	0.009	0.011	0.007	0.044	0.107	0.019	0.061	0.001	0.008	0.016	0.029
	95	0.022	0.001	0.000	0.015	0.041	0.016	0.021	0.041	0.012	0.017	0.010	0.016
	96	0.034	-	0.039	0.088	0.017	0.034	0.029	0.017	0.048	0.005	0.140	0.000
	97	0.007	0.010	0.002	0.042	0.005	-	-	-	0.013	0.113	0.043	0.037
	98	-	0.049	-	0.060	-	0.033	0.073	0.070	0.021	-	0.027	0.048

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.010	0.014	0.037	0.016	0.087	0.070	0.058	0.013	0.018	0.046	0.071	0.028
	94	0.010	0.054	0.077	0.032	0.136	0.040	0.043	0.083	0.057	0.058	0.115	0.039
	95	0.025	0.129	0.055	0.067	0.101	0.088	0.151	0.030	0.184	0.515	0.063	0.032
	96	0.125	0.072	0.106	0.247	0.066	0.170	0.136	0.227	0.024	0.022	0.007	0.007
	97	0.022	0.008	0.000	0.053	0.062	-	-	-	0.666	0.027	0.067	0.246
	98	-	0.110	0.097	0.114	-	0.085	0.103	0.138	0.082	-	0.159	0.153

Baie de Koumassi:(R_9)

		1	2	3	4	5	6	7	8	9	10	11	12
NH_4	93	0.010	0.024	0.017	0.136	0.013	0.127	0.019	0.028	0.005	0.034	0.070	0.017
	94	0.010	0.039	0.077	0.050	0.022	0.040	0.080	0.046	0.015	0.015	0.015	0.019
	95	0.006	0.004	0.167	0.013	0.282	0.088	0.009	0.085	0.009	0.940	0.022	0.000
	96	0.001	0.030	0.105	0.002	-	0.036	0.003	0.004	0.110	-	0.022	0.055
	97	0.037	0.035	0.039	0.073	0.033	-	0.000	-	0.035	0.079	0.144	0.178
	98	-	0.499	0.062	0.184	-	0.259	-	-	0.206	-	0.122	-

		1	2	3	4	5	6	7	8	9	10	11	12
NO_3	93	0.033	0.041	0.156	0.009	0.011	0.132	0.182	0.095	0.211	0.157	0.190	-
	94	0.065	0.063	0.073	0.022	0.131	0.236	0.254	0.241	0.038	0.121	0.150	0.099
	95	0.111	0.140	0.121	0.000	0.162	0.089	0.125	0.172	0.105	0.067	0.073	0.018
	96	0.006	0.007	0.002	0.107	-	0.131	-	0.158	0.096	-	0.017	0.003
	97	0.077	0.024	0.033	0.098	0.031	-	0.037	-	0.047	0.125	0.035	0.054
	98	-	0.000	-	0.033	-	0.038	0.050	0.025	0.034	-	0.111	-

		1	2	3	4	5	6	7	8	9	10	11	12
NO_2	93	0.021	0.031	0.022	0.003	0.011	0.054	0.103	0.004	0.113	0.009	0.000	0.041
	94	0.018	0.025	0.026	0.014	0.079	0.013	0.032	0.064	0.000	0.009	0.013	0.007
	95	0.037	0.000	0.053	0.000	0.085	0.013	0.016	0.010	0.016	0.007	0.012	0.000
	96	0.000	0.000	0.000	0.034	-	0.018	-	0.021	0.050	-	0.035	0.000
	97	0.017	0.000	0.017	0.056	0.001	-	0.005	-	0.009	0.030	0.000	0.044
	98	-	0.000	-	0.028	-	0.094	0.104	0.007	0.019	-	0.039	-

		1	2	3	4	5	6	7	8	9	10	11	12
PO_4	93	0.078	0.024	0.089	0.031	0.033	0.081	0.081	0.016	0.027	0.053	0.074	0.051
	94	0.065	0.076	0.093	0.031	0.170	0.065	0.045	0.125	0.026	0.067	0.102	0.030
	95	0.023	0.079	0.106	0.090	0.125	0.095	0.104	0.013	0.052	0.107	0.022	0.000
	96	0.007	0.078	0.259	0.363	-	0.137	0.099	0.020	0.046	-	0.016	-
	97	0.037	0.021	0.053	0.037	0.083	-	0.877	-	0.101	0.067	0.196	0.232
	98	-	0.095	0.323	0.124	-	0.076	0.153	0.064	0.073	-	0.206	-

TABLE C.2 WATER QUALITY OF EACH SAMPLING POINTS

	1-2-3AB	Port-Bouet II	Uni Wax	21-22	33-34	S_1 P.S	$7J_1$ P.S	Koumassi(IN)	Koumassi(OUT)
pH	7.6	7.6	9.7	7.6	7.5	7.5	7.0	4.5	5.5
SS(mg/l)	250.00	500.00	250.00	250.00	260.00	250.00	250.00	250.00	250.00
COD(mg/l)	1,100.00	1,100.00	1,400.00	900.00	220.00	140.00	180.00	390.00	320.00
BOD(mg/l)	700.00	750.00	840.00	550.00	140.00	90.00	110.00	240.00	180.00
T-P(mg/l)	52.80	54.80	44.70	42.30	12.10	22.10	29.60	23.00	30.95
T-N(mg/l)	114.80	167.20	87.00	91.00	47.60	54.50	59.30	100.50	91.60
Cl-(mg/l)	68.90	79.90	71.00	61.40	10.30	36.20	48.30	100.50	91.60
Grease(mg/l)	176.00	188.00	280.00	220.00	128.00	80.00	160.00	140.00	110.00

TABLE C.3 ACTUAL SEWAGE pH DATA

1) 1-2-3 AB Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	22/6-23/6	7.3	7.4	7.3	7.6	7.5	7.5	7.5	7.4	7.5	7.5	7.7	7.9	7.3	7.6	7.6	7.7	7.9	8.3	7.9	7.9	7.4	8.0	7.5	7.1	7.6
pH	04/7-05/7	7.3	7.2	7.3	7.4	7.4	7.5	7.5	7.6	7.5	7.4	7.7	7.7	7.5	7.6	7.5	7.6	8.0	8.1	8.1	7.9	7.5	6.3	7.5	7.4	7.5

2) Port-Bouet II Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	23/6-24/6	7.2	7.2	7.3	7.5	7.5	7.5	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.7	7.6	7.7	7.8	7.8	7.6	8.1	7.9	7.7	7.6	7.1	7.6
pH	05/7-06/7	7.5	7.2	7.4	7.4	7.2	7.2	7.2	7.2	7.4	7.6	7.4	7.2	7.9	7.1	7.3	7.5	7.7	7.9	8.2	8.3	8.1	8.2	7.4	7.6	7.5

3) UNI WAX Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	24/6-25/6	9.7	9.3	9.9	9.8	9.4	10.7	11.4	10.2	10.9	9.3	10.4	9.5	9.5	10.1	11.2	11.3	10.7	10.0	9.3	11.2	10.2	9.8	9.6	9.5	10.1
pH	14/7-15/7	9.5	8.3	8.3	7.6	9.0	8.5	9.9	10.0	8.3	10.1	9.8	9.2	9.8	9.6	9.5	9.2	9.7	9.5	9.3	9.6	9.7	10.5	9.3	9.3	9.3

4) 21-22 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	21/6-22/6	7.5	7.5	7.5	7.6	7.5	7.5	7.5	7.5	7.6	7.6	7.7	7.7	7.7	7.6	7.4	7.6	7.9	8.1	8.2	7.9	7.7	7.6	7.4	7.4	7.6
pH	03/7-04/7	7.1	7.3	7.4	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.7	7.6	7.7	7.3	7.6	7.7	7.9	8.3	8.2	8.0	7.7	7.5	7.3	7.6

5) 25-26-27 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	20/6-21/6	7.4	7.4	7.5	7.5	7.4	7.5	7.4	7.2	7.5	7.5	7.5	7.3	7.7	7.6	7.6	7.7	7.5	7.9	8.2	7.6	7.8	7.7	7.5	7.3	7.6
pH	02/7-03/7	6.8	7.1	7.4	7.4	7.5	7.3	7.4	7.4	7.5	7.4	7.4	7.5	7.4	7.4	7.2	7.2	7.5	7.7	8.2	8.0	7.7	7.5	7.4	7.1	7.4

6) 33-34 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	19/6-20/6	7.6	7.5	7.4	7.7	7.1	7.8	7.9	7.8	7.9	7.9	7.2	7.5	7.6	7.8	7.7	7.8	7.8	7.7	7.9	7.9	7.7	7.6	7.8	7.4	7.7
pH	01/7-02/7	7.2	7.4	7.4	7.1	8.8	7.2	6.2	6.7	7.1	7.5	7.7	7.4	7.6	7.5	7.7	7.5	6.9	8.1	8.2	8.0	7.8	7.8	6.6	6.3	7.4

7) S_1 Pumping Station

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	28/6-29/6	7.1	7.3	6.9	7.1	6.9	6.6	7.1	6.9	6.9	7.0	6.8	7.2	6.9	5.9	5.8	6.7	6.2	6.8	6.9	6.2	6.1	6.8	7.0	6.9	6.8
pH	12/7-13/7	7.1	7.2	7.2	7.1	7.3	7.4	7.5	7.5	7.3	7.4	7.1	7.2	7.3	7.3	7.2	7.2	7.1	7.1	7.0	7.2	7.2	7.1	7.3	7.4	7.2

8) 7J, Pumping Station

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	26/6-27/6	2.3	1.2	1.2	4.4	2.2	1.2	1.1	1.2	2.2	3.1	2.4	2.0	2.0	1.7	3.5	2.7	1.3	1.9	1.8	4.5	2.1	4.4	1.2	1.3	2.2
pH	11/7-12/7	6.6	6.8	6.9	6.7	6.9	6.6	6.5	6.9	6.9	7.0	6.9	6.8	6.8	6.9	6.7	6.8	7.0	6.9	7.2	7.0	7.0	7.0	7.1	7.0	6.9

9) Koumassi Pre-Treatment Plant

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Average
pH	27/6-28/6	3.6	2.1	1.8	1.9	1.5	1.2	2.4	4.9	5.0	3.6	3.1	2.8	2.8	2.9	5.0	4.8	5.2	6.3	6.2	6.2	6.4	6.5	6.2	6.1	4.1
pH	10/7-11/7	6.7	6.8	7.1	7.1	7.2	7.2	7.1	7.0	6.8	7.0	7.0	6.9	6.8	6.8	6.8	6.9	6.9	6.8	6.8	6.7	6.8	6.8	6.9	6.9	6.9

TABLE C.4 ACTUAL SEWAGE FLOW DATA

1) 1-2-3 AB Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	22/6-23/6	50.40	50.40	36.00	43.20	43.20	43.20	46.80	39.60	43.20	46.80	46.80	36.00	50.40	36.00	21.60	28.80	39.60	46.80	50.40	39.60	43.20	32.40	39.60	25.20	979	1,469
Q (l/s)		14.00	14.00	10.00	12.00	12.00	12.00	13.00	11.00	12.00	13.00	13.00	10.00	14.00	10.00	6.00	8.00	11.00	13.00	14.00	11.00	12.00	9.00	11.00	7.00		
Q (m³/h)	04/7-05/7	54.00	50.40	46.80	57.60	43.20	46.80	39.60	50.40	39.60	32.40	43.20	39.60	32.40	32.40	14.40	25.20	50.40	46.80	64.80	21.60	39.60	36.00	39.60	25.20	972	1,458
Q (l/s)		15.00	14.00	13.00	16.00	12.00	13.00	11.00	14.00	11.00	9.00	12.00	11.00	9.00	9.00	4.00	7.00	14.00	13.00	18.00	6.00	11.00	10.00	11.00	7.00		

2) Port-Bouet II Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	23/6-24/6	961.20	745.20	928.80	853.20	709.20	781.20	781.20	892.80	961.20	781.20	745.20	781.20	745.20	565.20	673.20	496.80	637.20	565.20	781.20	781.20	817.20	745.20	745.20	928.80	18,403	27,605
Q (l/s)		267.00	207.00	258.00	237.00	197.00	217.00	217.00	248.00	267.00	217.00	207.00	217.00	207.00	157.00	187.00	138.00	177.00	157.00	217.00	217.00	227.00	207.00	207.00	258.00		
Q (m³/h)	05/7-06/7	61.20	75.60	46.80	61.20	93.60	18.00	46.80	75.60	75.60	111.60	111.60	25.20	36.00	36.00	36.00	25.20	25.20	93.60	111.60	111.60	111.60	151.20	61.20	61.20	1,663	2,495
Q (l/s)		17.00	21.00	13.00	17.00	26.00	5.00	13.00	21.00	21.00	31.00	31.00	7.00	10.00	10.00	10.00	7.00	7.00	26.00	31.00	31.00	31.00	42.00	17.00	17.00		

3) UNI WAX Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	24/6-25/6	777.60	363.60	205.20	655.20	453.60	273.60	428.40	619.20	763.20	619.20	637.20	1094.40	792.00	759.60	594.00	763.20	428.40	428.40	777.60	637.20	428.40	493.20	619.20	363.60	13,975	20,963
Q (l/s)		216.00	101.00	57.00	182.00	126.00	76.00	119.00	172.00	212.00	172.00	177.00	304.00	220.00	211.00	165.00	212.00	119.00	119.00	216.00	177.00	119.00	137.00	172.00	101.00		
Q (m³/h)	14/7-15/7	363.60	453.60	453.60	619.20	493.20	637.20	619.20	759.60	655.20	540.00	619.20	453.60	540.00	1094.40	428.40	493.20	428.40	453.60	619.20	493.20	540.00	493.20	428.40	619.20	13,298	19,948
Q (l/s)		101.00	126.00	126.00	172.00	137.00	177.00	172.00	211.00	182.00	150.00	172.00	126.00	150.00	304.00	119.00	137.00	119.00	126.00	172.00	137.00	150.00	137.00	119.00	172.00		

4) 21-22 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	21/6-22/6	608.40	705.60	734.40	608.40	673.20	644.40	608.40	608.40	673.20	644.40	608.40	608.40	540.00	507.60	608.40	540.00	540.00	576.00	763.20	788.40	734.40	734.40	644.40	644.40	15,347	23,020
Q (l/s)		169.00	196.00	204.00	169.00	187.00	179.00	169.00	169.00	187.00	179.00	169.00	169.00	150.00	141.00	169.00	150.00	150.00	160.00	212.00	219.00	204.00	204.00	179.00	179.00		
Q (m³/h)	03/7-04/7	367.20	367.20	334.80	334.80	334.80	302.40	334.80	334.80	270.00	302.40	403.20	302.40	270.00	241.20	212.40	241.20	212.40	302.40	403.20	471.60	435.60	403.20	367.20	334.80	7,004	11,826
Q (l/s)		102.00	102.00	93.00	93.00	93.00	84.00	93.00	93.00	75.00	84.00	112.00	84.00	75.00	67.00	59.00	67.00	59.00	84.00	112.00	131.00	121.00	112.00	102.00	93.00		

5) 25-26-27 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	20/6-21/6	410.40	410.40	385.20	363.60	363.60	342.00	410.40	432.00	385.20	342.00	342.00	295.20	205.20	162.00	144.00	205.20	558.00	363.60	385.20	432.00	295.20	295.20	316.80	316.80	8,161	12,242
Q (l/s)		114.00	114.00	107.00	101.00	101.00	95.00	114.00	120.00	107.00	95.00	95.00	82.00	57.00	45.00	40.00	57.00	155.00	101.00	107.00	120.00	82.00	82.00	88.00	88.00		
Q (m³/h)	02/7-03/7	540.00	540.00	511.20	558.00	493.20	511.20	511.20	493.20	493.20	432.00	453.60	475.20	410.40	475.20	583.20	295.20	432.00	410.40	432.00	529.20	511.20	493.20	432.00	432.00	11,448	17,172
Q (l/s)		150.00	150.00	142.00	155.00	137.00	142.00	142.00	137.00	137.00	120.00	126.00	132.00	114.00	132.00	162.00	82.00	120.00	114.00	120.00	147.00	142.00	137.00	120.00	120.00		

6) 33-34 Trunk Sewer

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	19/6-20/6	36.00	151.20	147.60	93.60	57.60	57.60	57.60	50.40	151.20	151.20	151.20	133.20	68.40	50.40	68.40	43.20	50.40	147.60	133.20	162.00	82.80	57.60	43.20	36.00	2,182	3,272
Q (l/s)		10.00	42.00	41.00	26.00	16.00	16.00	16.00	14.00	42.00	42.00	42.00	37.00	19.00	14.00	19.00	12.00	14.00	41.00	37.00	45.00	23.00	16.00	12.00	10.00		
Q (m³/h)	01/7-02/7	50.40	43.20	57.60	64.80	68.40	57.60	68.40	57.60	68.40	68.40	57.60	50.40	43.20	43.20	43.20	50.40	50.40	43.20	50.40	50.40	43.20	50.40	43.20	50.40	1,274	1,912
Q (l/s)		14.00	12.00	16.00	18.00	19.00	16.00	19.00	16.00	19.00	19.00	16.00	14.00	12.00	12.00	12.00	14.00	14.00	12.00	14.00	14.00	12.00	14.00	12.00	14.00		

7) S_i Pumping Station

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	28/6-29/6	23.47	55.80	72.54	60.59	116.78	65.77	88.13	16.81	71.93	73.76	76.18	84.67	103.61	52.06	41.18	119.16	58.46	59.87	75.46	82.91	71.75	40.28	26.93	90.07	1,628	2,442
Q (l/s)		6.52	15.50	20.15	16.83	32.44	18.27	24.48	4.67	19.98	20.49	21.16	23.52	28.78	14.46	11.44	33.10	16.24	16.63	20.96	23.03	19.93	11.19	7.48	25.02		
Q (m³/h)	12/7-13/7	125.24	93.49	107.93	71.28	87.37	98.14	59.94	61.78	84.02	39.31	52.78	88.56	92.23	51.19	55.87	43.24	47.59	43.92	54.36	72.94	118.94	192.89	104.40	55.04	1,902	2,854
Q (l/s)		34.79	25.97	29.98	19.80	24.27	27.26	16.65	17.16	23.34	10.92	14.66	24.60	25.62	14.22	15.52	12.01	13.22	12.20	15.10	20.26	33.04	53.58	29.00	15.29		

8) 7J, Pumping Station

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	26/6-27/6	447.73	415.51	554.76	416.74	467.82	365.22	318.64	558.00	495.76	302.65	470.12	399.13	382.72	345.17	303.16	396.22	302.65	292.03	351.79	324.50	414.94	430.24	446.40	894.92	10,897	15,145
Q (l/s)		124.37	115.42	154.10	115.76	129.95	101.45	88.51	155.00	137.71	84.07	130.59	110.87	106.31	95.88	84.21	110.06	84.07	81.12	97.72	90.14	115.26	119.51	124.00	248.59		
Q (m³/h)	11/7-12/7	128.27	128.27	149.51	393.08	304.49	856.51	914.80	499.46	451.69	385.13	363.49	285.44	180.04	246.24	134.89	458.24	486.90	507.28	285.98	470.20	427.72	476.14	328.93	467.28	9,330	13,995
Q (l/s)		35.63	35.63	41.53	109.19	84.58	237.92	254.11	138.74	125.47	106.98	100.97	79.29	50.01	68.40	37.47	127.29	135.25	140.91	79.44	130.61	118.81	132.26	91.37	129.80		

9) Koumassi Pre-Treatment Plant

Time		13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	Daily Average (m³/day)	Hourly Maximum(m³/day)
Q (m³/h)	27/6-28/6	590.90	585.29	543.53	454.14	632.27	750.28	803.09	890.82	1139.18	1160.24	1313.06	1268.28	1140.30	1111.75	1219.36	1167.12	1272.92	1322.93	1484.42	1224.18	644.18	785.59	1141.78	1340.10	23,986	35,979
Q (l/s)		164.14	162.58	150.98	126.15	175.63	208.41	223.08	247.45	316.44	322.29	364.74	352.30	316.75	308.82	338.71	324.20	353.59	367.48	412.34	340.05	178.94	218.22	317.16	372.25		
Q (m³/h)	10/7-11/7	1768.54	1901.16	1827.07	1666.66	1612.37	1831.18	1790.02	1222.24	1119.38	1105.34	686.02	686.02	742.90	718.31	738.79	1112.76	295.34	324.11	1096.13	832.36	752.76	783.11	796.61	837.04	26,246	39,369
Q (l/s)		491.26	528.10	507.52	462.96	447.88	508.66	497.23	339.51	310.94	307.04	190.56	190.56	206.36	199.53	205.22	309.10	82.04	90.03	304.48	231.21	209.10	217.53	221.28	232.51		

TABLE C.5 PHYSICAL AND CHEMICAL PARAMETERS OF TAP WATER

(1/2)

	ADJAME			ADJAME 220			ZONE 4			RMERA			KOUMASSI			ABOBO		
DATE	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.
01. June. 99	6.89	0.58	1.64	7.04	0.06	0.88	7.07	0.04	1.22	8.23	0.06	1.02	7.96	0.36	26.50	6.69	0.02	3.58
02. June. 99				6.08	0.03	0.75	6.93	0.09	0.81	7.16	0.10	2.72	7.86	0.30	7.71	7.89	0.08	5.02
03. June. 99	6.62	0.21	1.65				7.22	0.10	1.18	8.04	0.02	1.06	7.84	0.28	9.43	5.90	0.03	4.62
04. June. 99	6.81	0.20	1.98										6.93	0.255	5.40	6.10	0.03	3.05
07. June. 99	6.45	0.42	1.97				6.62	0.20	0.71	7.89	0.04	1.83	8.06	0.11	15.70	6.18	0.02	5.39
08. June. 99										7.07	0.02	0.71	8.04	0.20	15.80	6.18	0.01	0.81
09. June. 99				7.00	0.07	0.88	7.16	0.07	0.73	6.13	0.03	0.65	7.59	0.22	5.17	6.69	0.01	0.62
10. June. 99				6.65	0.08	0.92	6.77	0.14	0.60	7.10	0.27	1.04	7.05	0.42	1.21	6.42	0.01	3.99
11. June. 99				6.63	0.04	0.75	6.70	0.11	0.68	8.02	0.02	0.93	7.18	0.22	1.27	6.72	0.02	2.81
13. June. 99																		
14. June. 99										7.76	0.20	0.31	7.32	0.24	1.58	6.82	0.06	1.31
15. June. 99				7.07	0.03	0.88	7.19	0.07	1.48	7.04	0.02	0.94	7.40	0.24	2.34	6.77	0.02	5.38
16. June. 99				6.66	0.03	0.84	6.56	0.07	0.39				7.55	0.26	0.98	6.57	0.03	0.32
17. June. 99	6.67	0.16	1.12	6.35	0.01	0.73	6.59	0.06	0.72	7.81	0.01	0.51	7.61	0.20	2.88	6.72	0.01	7.59
18. June. 99							6.75	0.10	0.47	7.80	0.06	0.92						
21. June. 99	6.25	0.17	0.67	6.64	0.02	0.71				7.84	0.02	0.69	7.52	0.25	1.79	6.20	0.02	0.39
22. June. 99	6.76	0.19	0.59	6.38	0.03	1.79				7.87	0.05	1.19				6.27	0.01	0.42
23. June. 99	6.60	0.50	0.50	6.91	0.00	0.69				8.08	0.02	1.17				6.13	0.02	0.61
24. June. 99	6.29	0.31	0.68	6.92	0.01	0.57	6.82	0.16	0.67	7.65	0.10	1.87				6.94	0.02	0.53
25. June. 99	6.48	0.23	0.49							7.97	0.00	0.41				7.01	0.10	0.43
28. June. 99	7.05	0.20	6.33							8.01	0.06	0.87						
29. June. 99				6.34	0.20	0.69	7.20	0.12	0.65	8.16	0.33	0.98				6.92	0.04	1.33
30. June. 99				6.40	0.04	1.75	6.84	0.12	0.45	7.48	0.08	0.50				6.29	0.01	3.88

(2/2)

	TREICH			NIANGON			2 PLATEAUX			YOPOUGON			PLATEAU			TREI ARRAS		
DATE	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.	pH	CL_2	Turb.
01. June. 99	6.69	0.02	3.58	7.61	0.04	0.69	7.20	0.02	1.08	7.32	0.02	3.22	6.36	0.12	4.03	7.08	6.31	1.09
02. June. 99	6.09	0.08	1.42	7.83	0.11	0.54	7.75	0.02	0.64	7.81	0.18	4.98	6.60	0.29	13.80	6.99	0.09	6.99
03. June. 99				7.68	0.02	0.99	6.94	0.06	0.70	7.12	0.01	0.61				6.95	0.06	2.71
04. June. 99	6.70	0.05	0.70	6.93	0.28	0.62				6.70	0.08	0.56				6.89	0.08	0.90
07. June. 99	6.58	0.05	0.87	8.1	0.02	1.68	6.96	0.07	0.60				5.18	0.17	1.17	6.71	0.14	1.68
08. June. 99	6.67	0.09	0.83	7.92	0.06	0.85	7.29	0.12	0.98	6.80	0.05	4.84				6.78	0.15	0.78
09. June. 99	6.74	0.13	0.63	7.60	0.06	0.61	7.78	0.13	1.06				6.74	0.180	0.64	7.15	0.13	0.70
10. June. 99	6.71	0.06	0.88	7.85	0.27	0.6							5.01	0.08	0.66	6.73	0.25	0.92
11. June. 99		0.07	0.70	7.15	0.26	0.75				7.91	0.01	0.83	5.02	0.24	0.65	6.76	0.11	0.78
13. June. 99																		
14. June. 99	6.81	0.06	0.79	7.49	0.12	0.59	6.71	0.15	1.16							6.72	0.16	0.66
15. June. 99	6.82	0.08	0.99	7.94	0.08	1.26							5.27	0.04	0.48	7.28	0.05	2.38
16. June. 99	6.56	0.03	0.47	7.87	0.06	0.40				7.74	0.23	1.89	5.17	0.01	0.41	6.73	0.09	0.77
17. June. 99	6.64	0.03	0.93	7.20	0.07	0.60	7.79	0.01	0.81	7.14	0.01	1.02	4.92	0.01	0.52	6.70	0.08	0.64
18. June. 99	6.48	0.07	1.17	7.84	0.08	0.48	7.17	0.05	0.56							6.70	0.04	0.66
21. June. 99				7.93	0.01	0.75	7.01	0.10	2.59				5.47	0.01	0.42	6.78	0.07	0.78
22. June. 99				7.89	0.02	0.88	7.23	0.12	0.82	7.74	0.00	2.77	5.09	0.00	0.44	6.63	0.12	0.58
23. June. 99	6.44	0.06	0.73	7.30	0.05	0.40	7.83	0.00	2.02	6.84	0.01	0.81	6.44	0.12	0.69	6.66	0.10	0.48
24. June. 99	6.60	0.10	0.44	7.76	0.21	0.42				7.54	0.05	1.11	5.47	0.02	0.34	6.95	0.11	0.78
25. June. 99	6.54	0.06	0.56	7.89	0.01	0.42	7.93	0.02	0.50	7.84	0.14	1.07				6.67	0.09	0.51
28. June. 99	6.96	0.05	0.48	7.67	0.10	0.31	7.20	0.02	0.51							6.73	0.11	0.46
29. June. 99	6.81	0.07	0.39				7.99	0.01	0.60	7.86	0.08	2.25	10	0.11	9.91	7.14	0.13	1.07
30. June. 99				7.59	0.11	0.78	6.55	0.33	0.81							6.9	0.16	0.68

TABLE C.6 BACTERIOLOGICAL PARAMETER OF TAP WATER

	Coliformes E. Coli / 100ml	Streptocoques Fecaux / 100ml	Staphylocoques Pathogenes	Clostridium Perfringens / ml	Autres germes
ABOBO	< 1	< 1	< 1	< 1	< 1
ADJAME	< 1	< 1	< 1	< 1	< 1
COCODY	< 1	< 1	< 1	< 1	< 1
LOKODJORO	< 1	< 1	< 1	< 1	< 1
MARCORY	< 1	< 1	< 1	< 1	< 1
PLATEAU	< 1	< 1	< 1	< 1	< 1
TREICHVILLE	< 1	< 1	< 1	< 1	< 1
VRIDI	< 1	< 1	< 1	< 1	< 1
ZONE 4	< 1	< 1	< 1	< 1	< 1

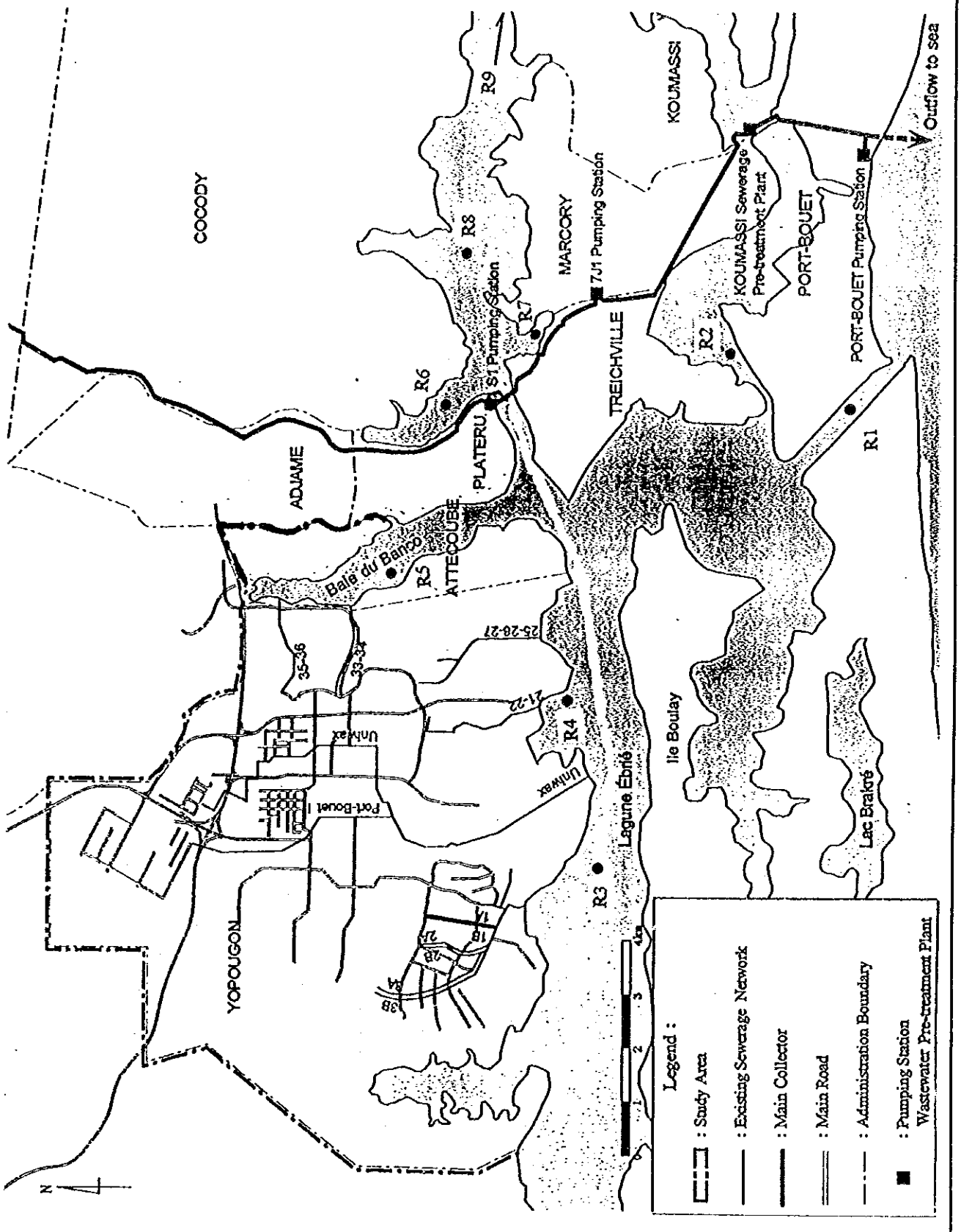
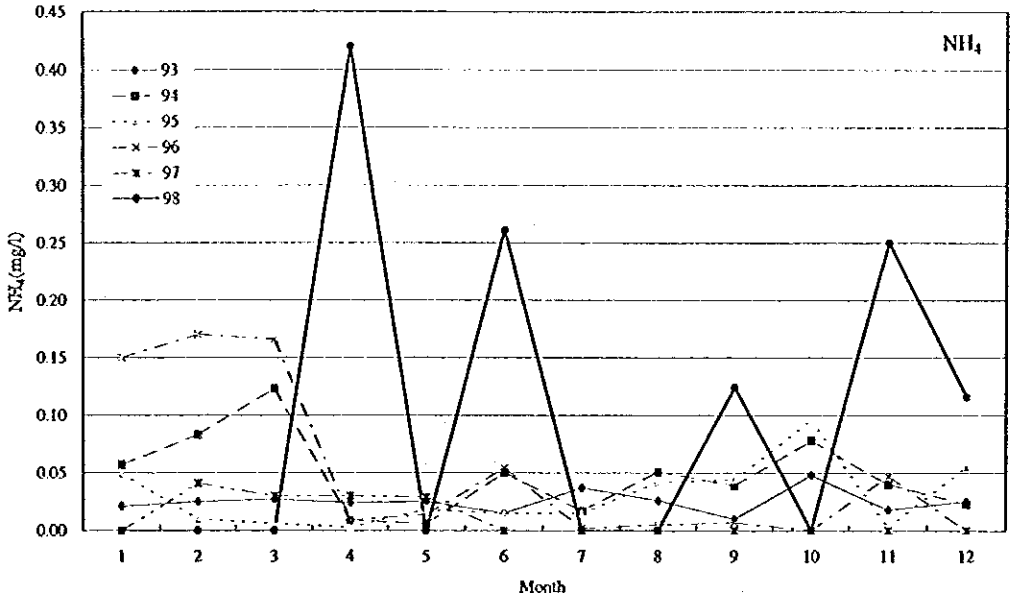


FIG. C.1 SAMPLING LOCATION OF EXISTING WATER QUALITY DATA IN LAGOON

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE

JICA



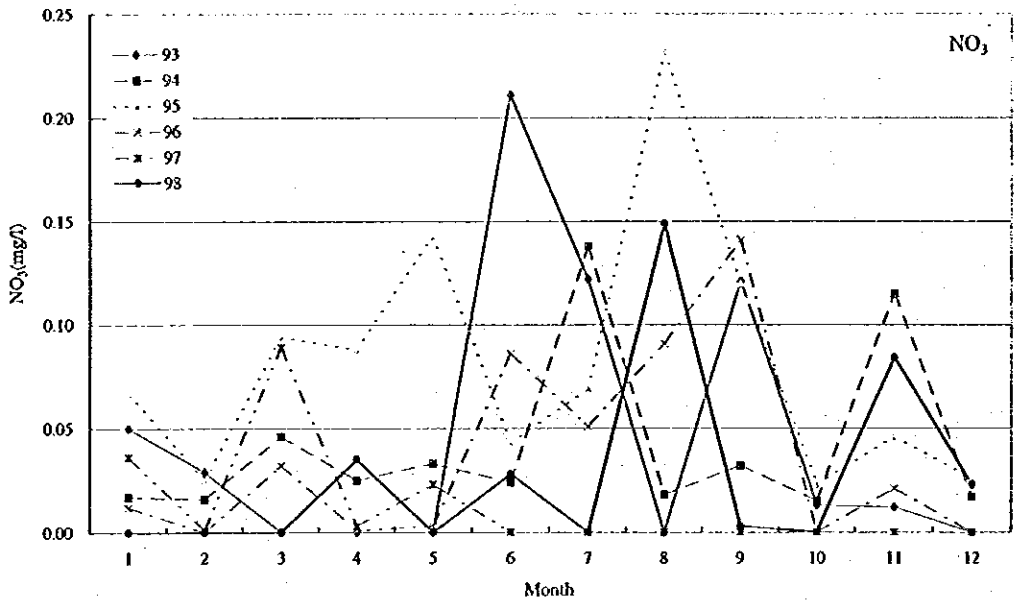
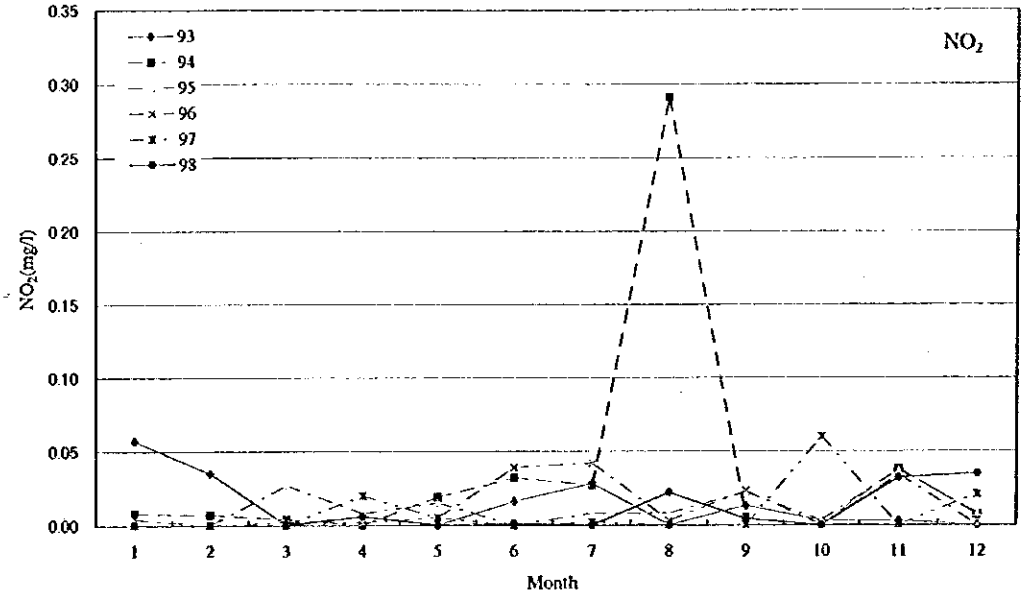


FIG. C.2 TENDENCY OF NH_4 AND NO_3 IN CANAL DE VRIDI (R_1)



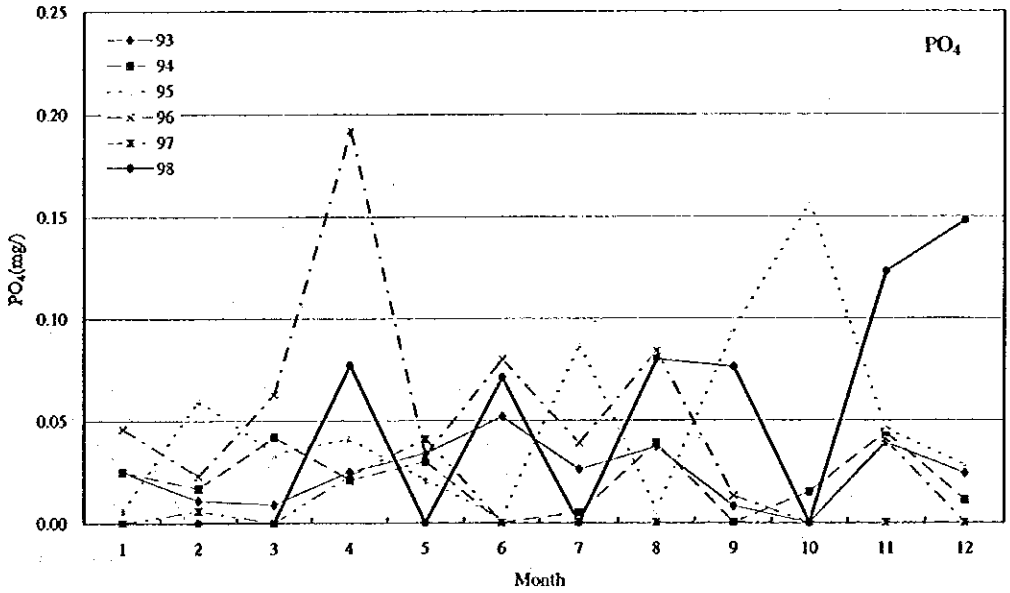
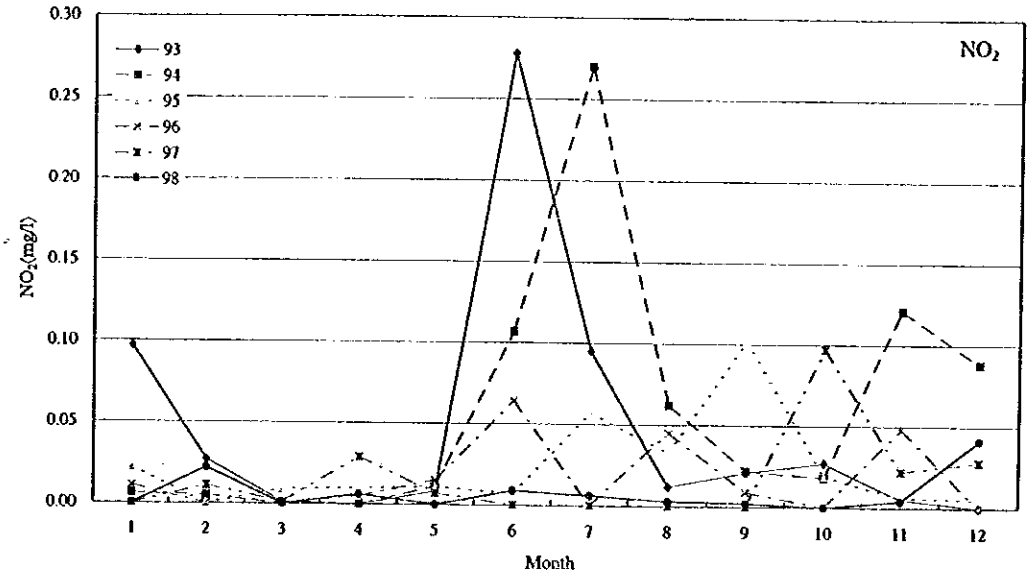


FIG. C.3 TENDENCY OF NO_2 AND PO_4 IN CANAL DE VRIDI (R_1)



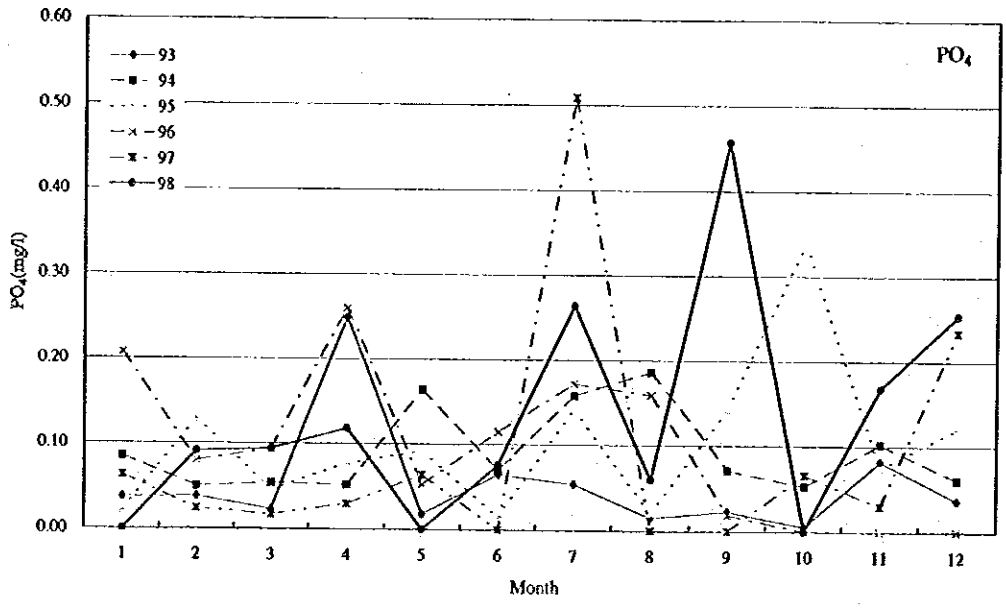
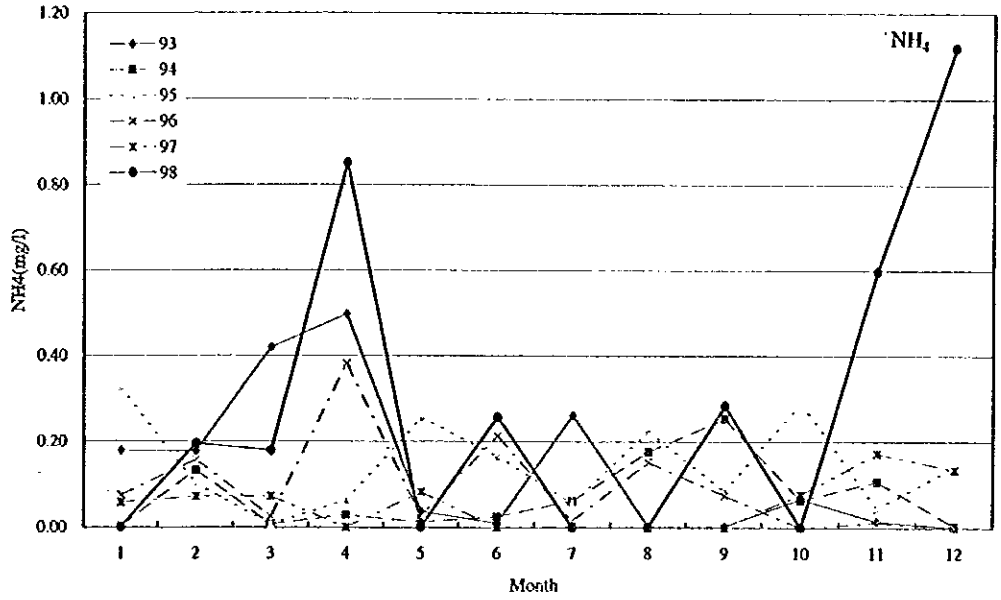


FIG. C.4 TENDENCY OF NH_4 AND NO_3 IN CANAL DE VRIDI (R_2)



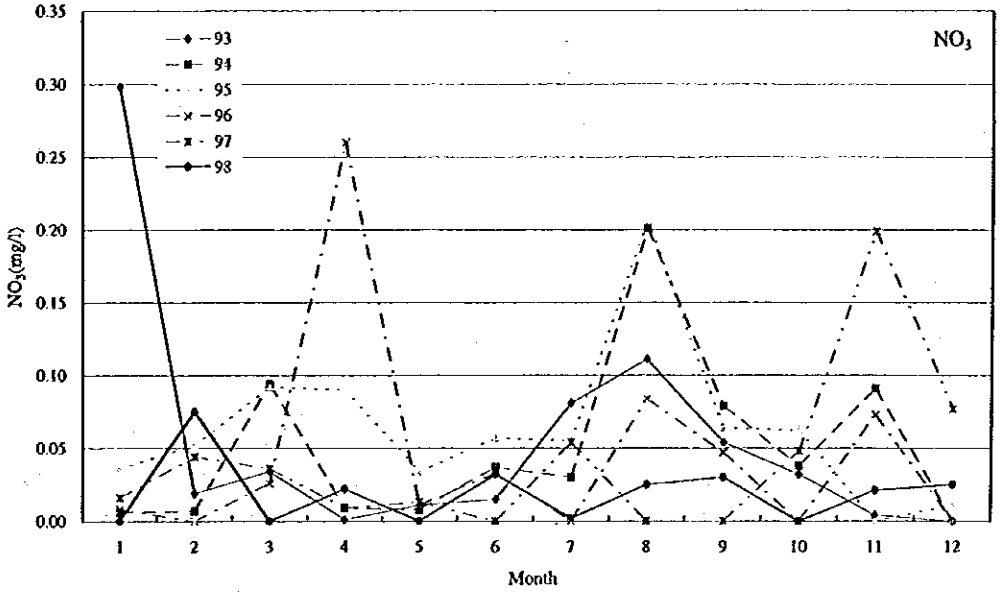
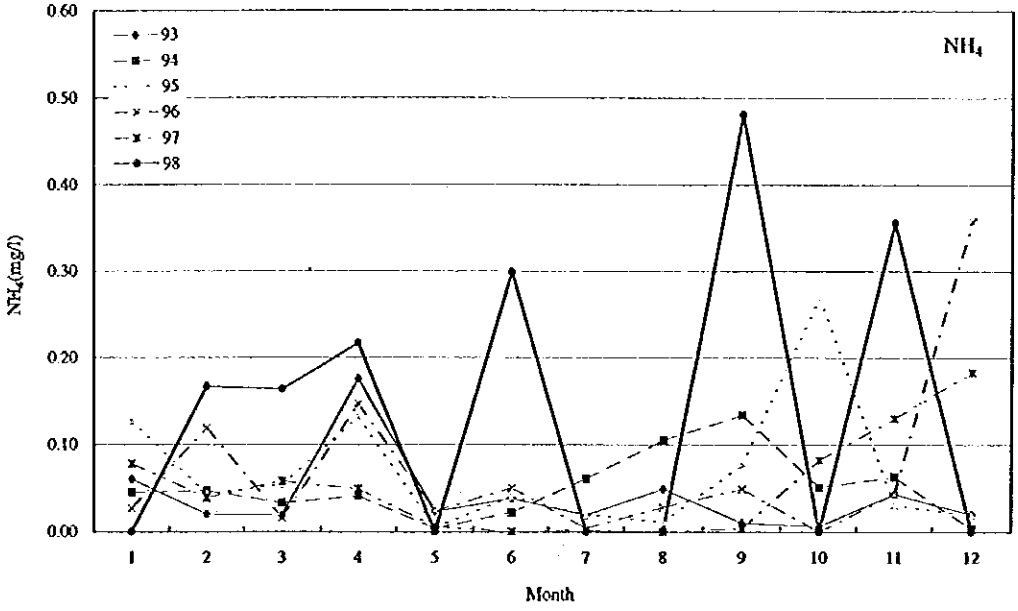


FIG. C.5 TENDENCY OF NO_2 AND PO_4 IN CANAL DE VRIDI (R_2)



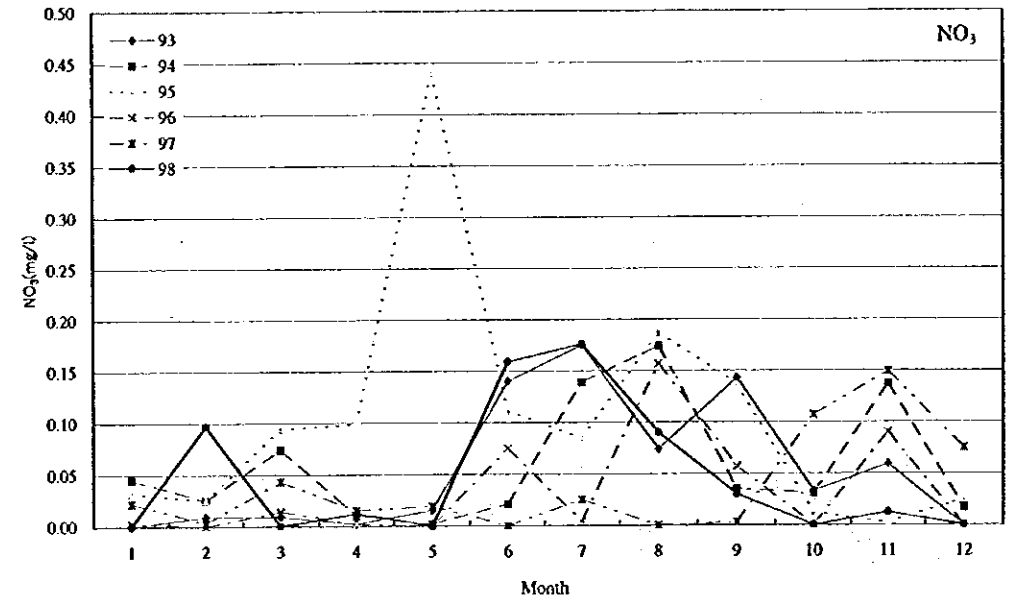
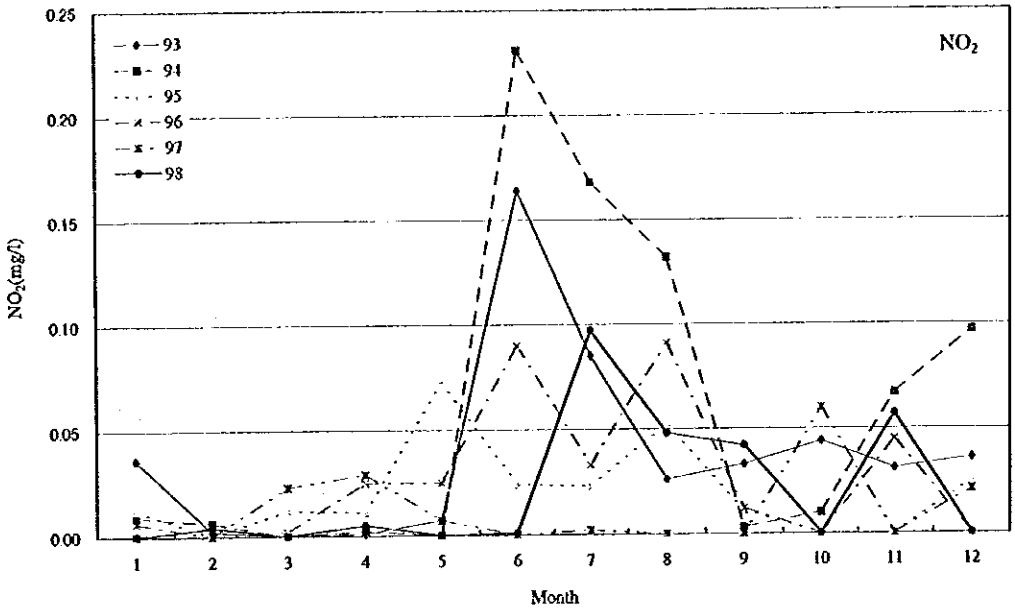


FIG. C.6 TENDENCY OF NH_4 AND NO_3 IN AZITO (R_3)



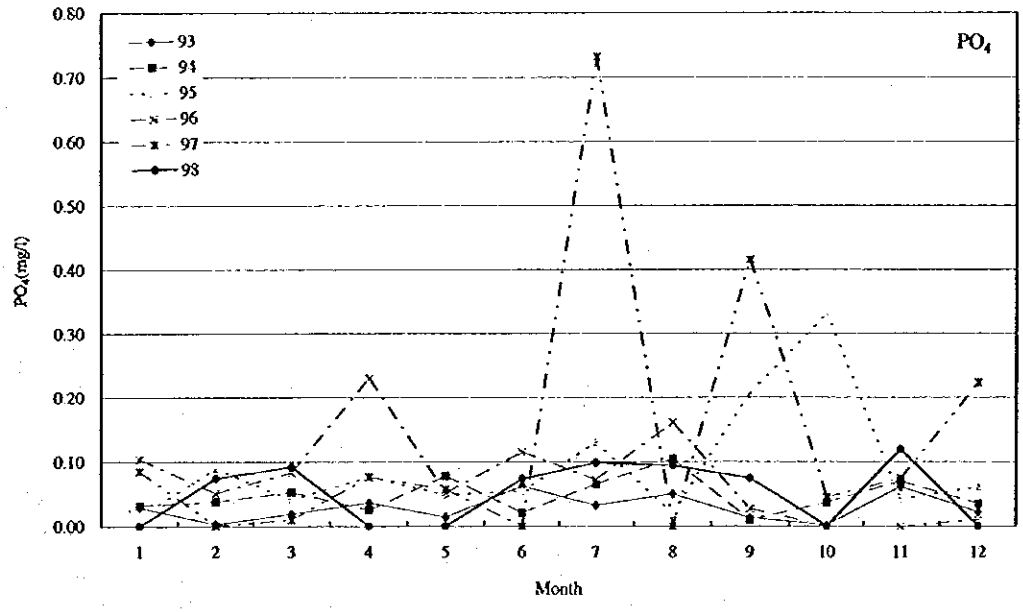
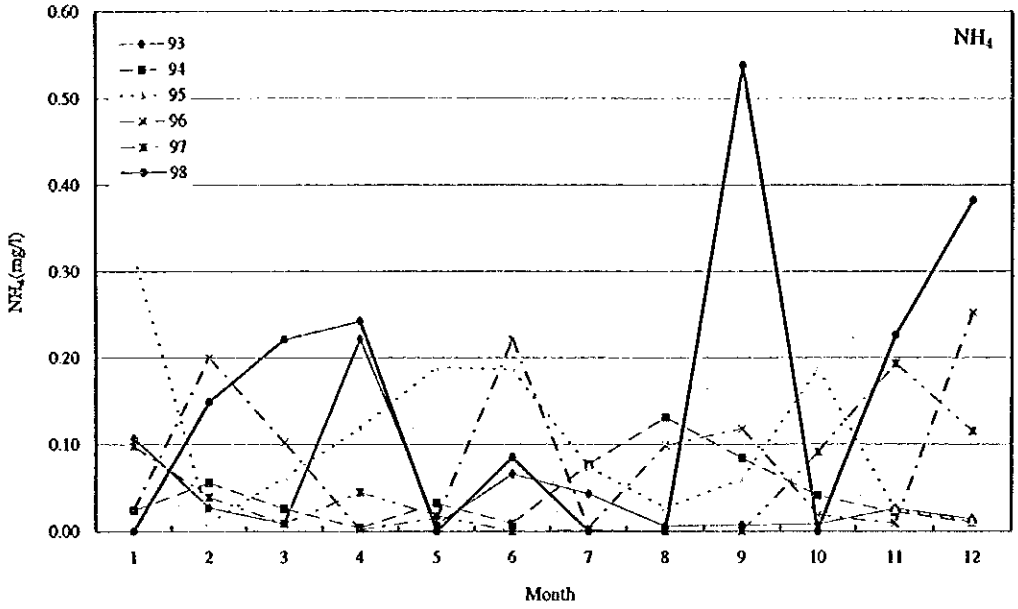


FIG. C.7 TENDENCY OF NO_2 AND PO_4 IN AZITO (R_3)



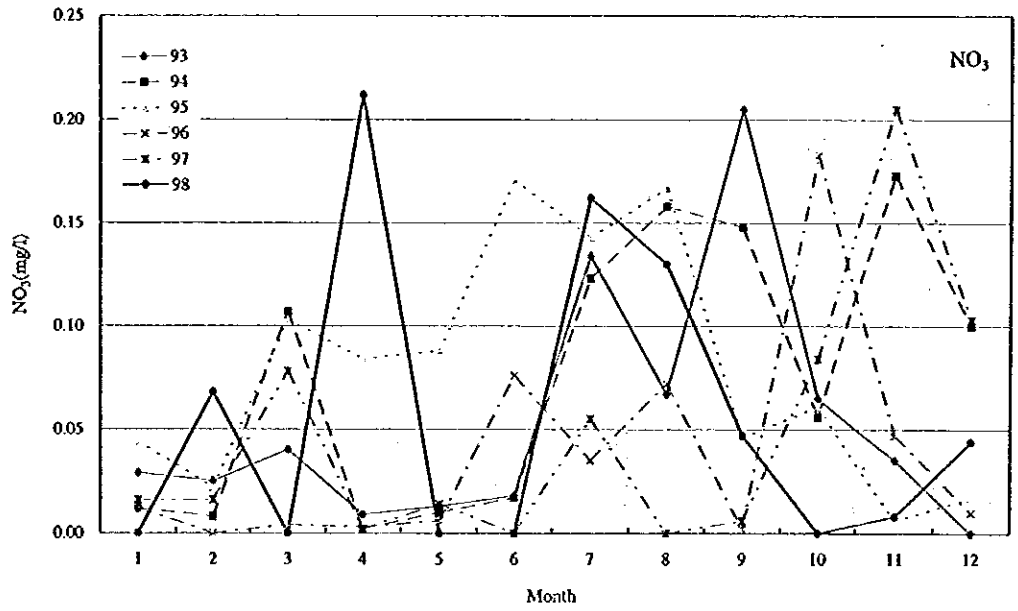
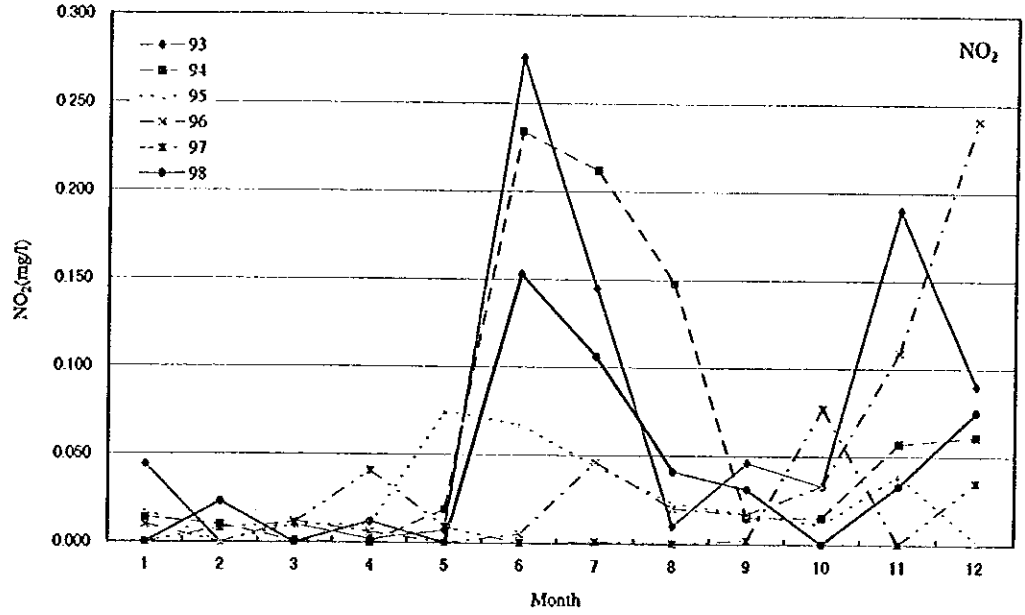


FIG. C.8 TENDENCY OF NH_4 AND NO_3 IN YOUPGON (R_4)



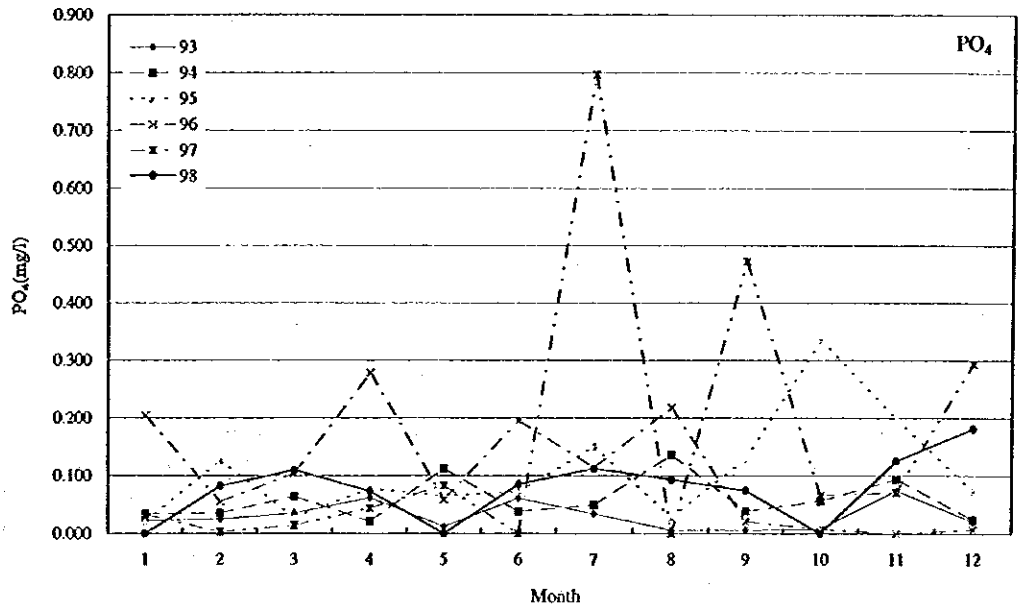
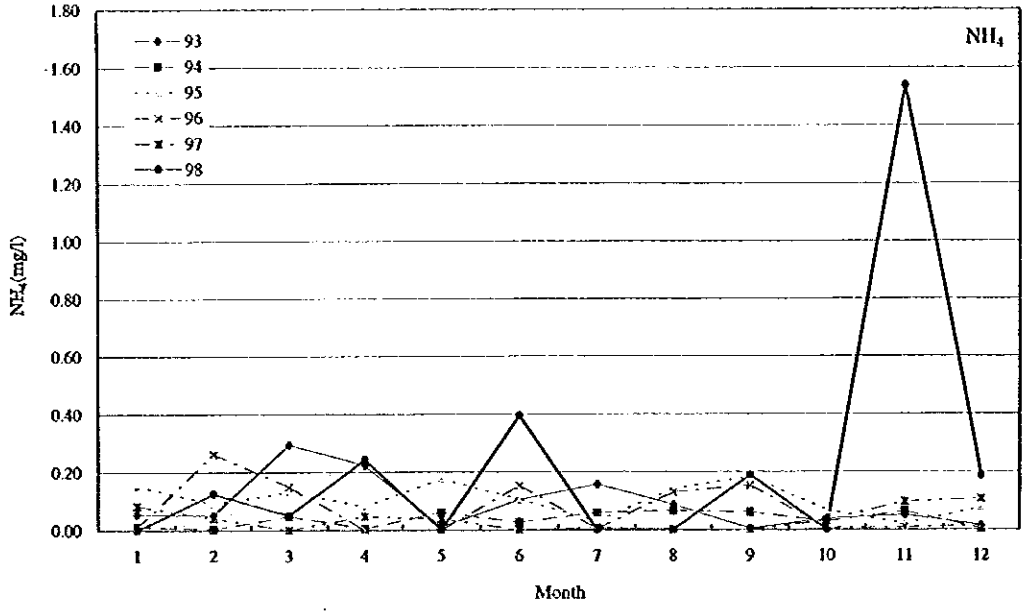


FIG. C.9 TENDENCY OF NO_2 AND PO_4 IN YOUPGON (R_4)



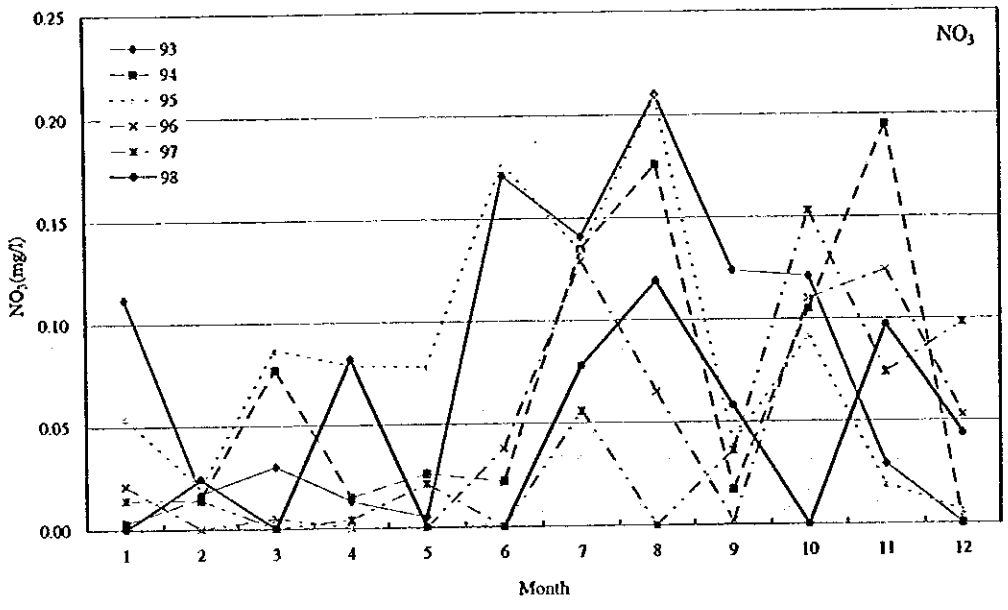
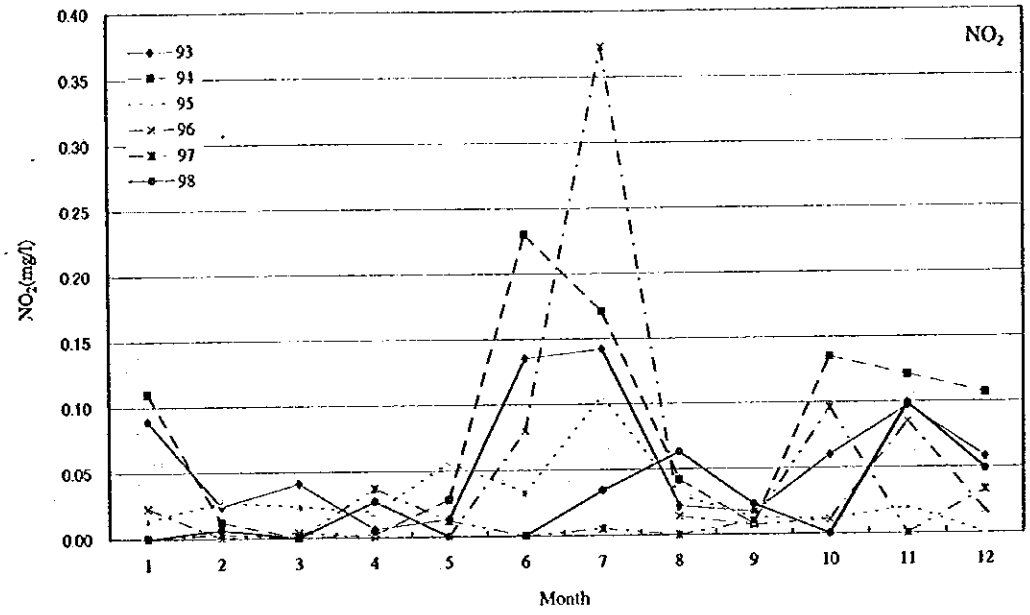


FIG. C.10 TENDENCY OF NH_4 AND NO_3 BAIE DU BANCO (R_5)



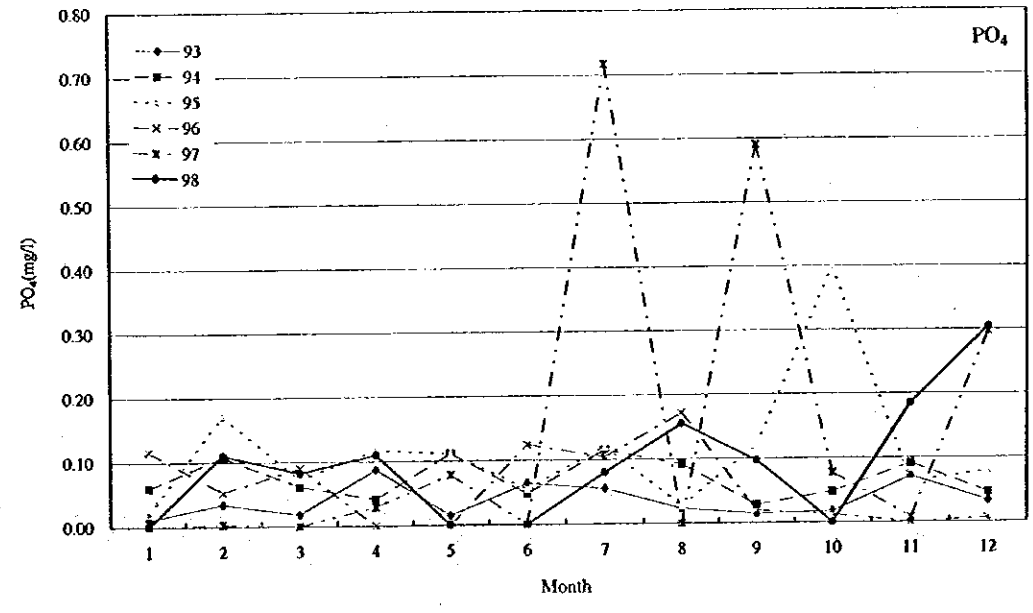
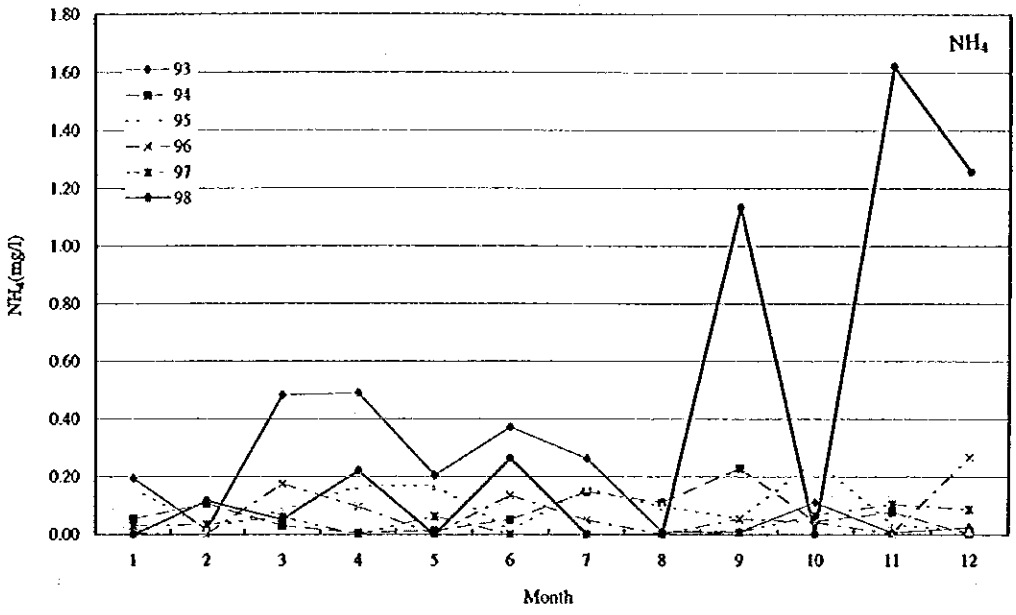


FIG. C.11 TENDENCY OF NO_2 AND PO_4 BAIE DU BANCO (R_5)



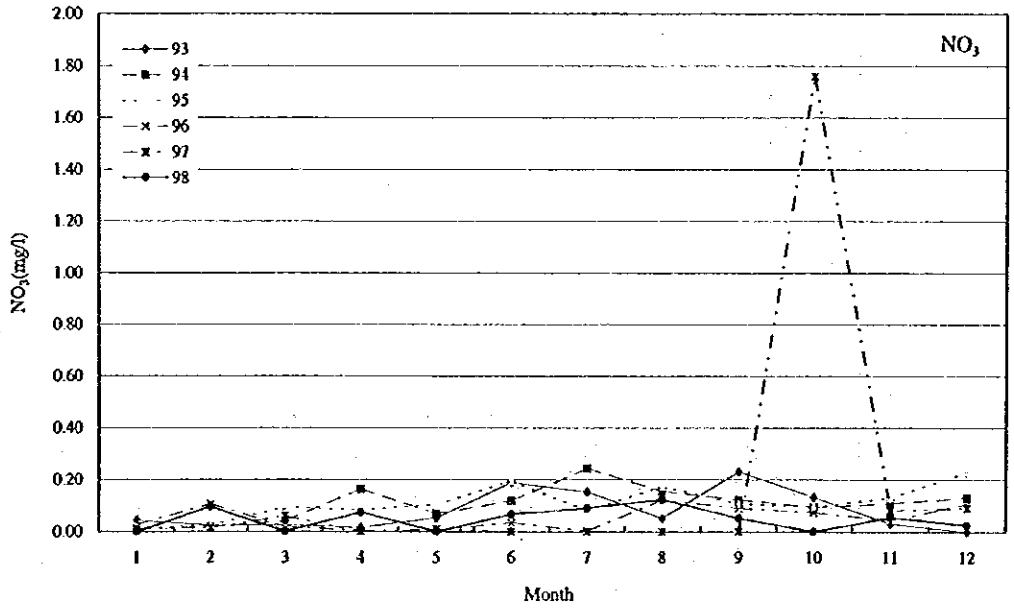
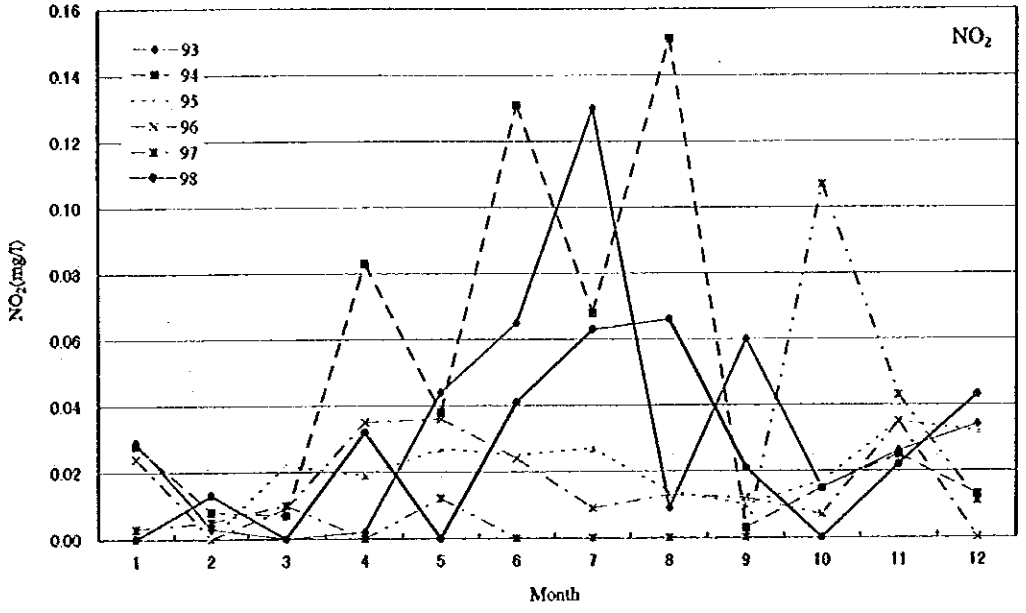


FIG. C.12 TENDENCY OF NH_4 AND NO_3 IN BAIE DE COCODY (R_6)



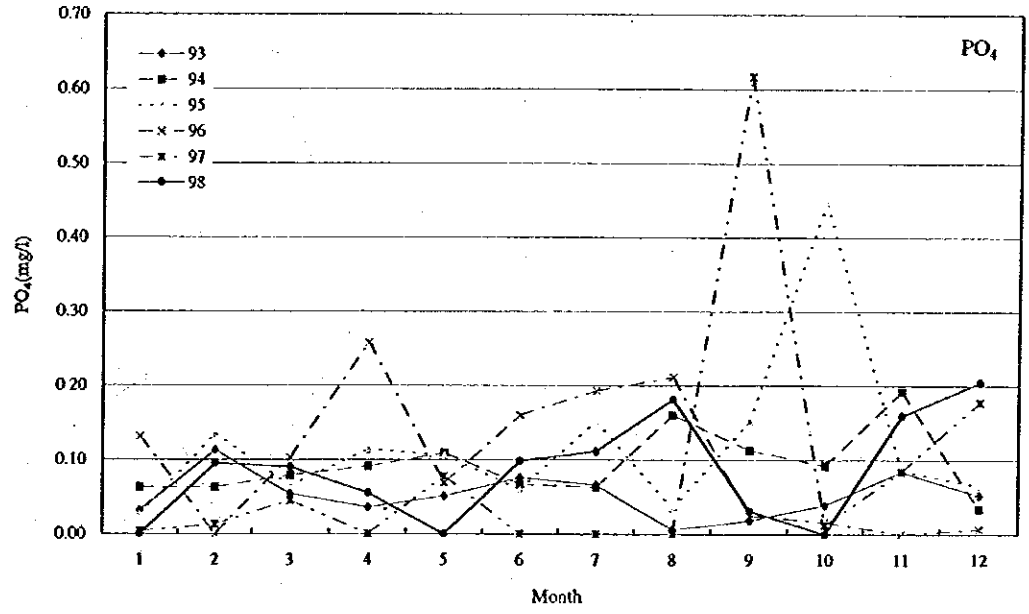
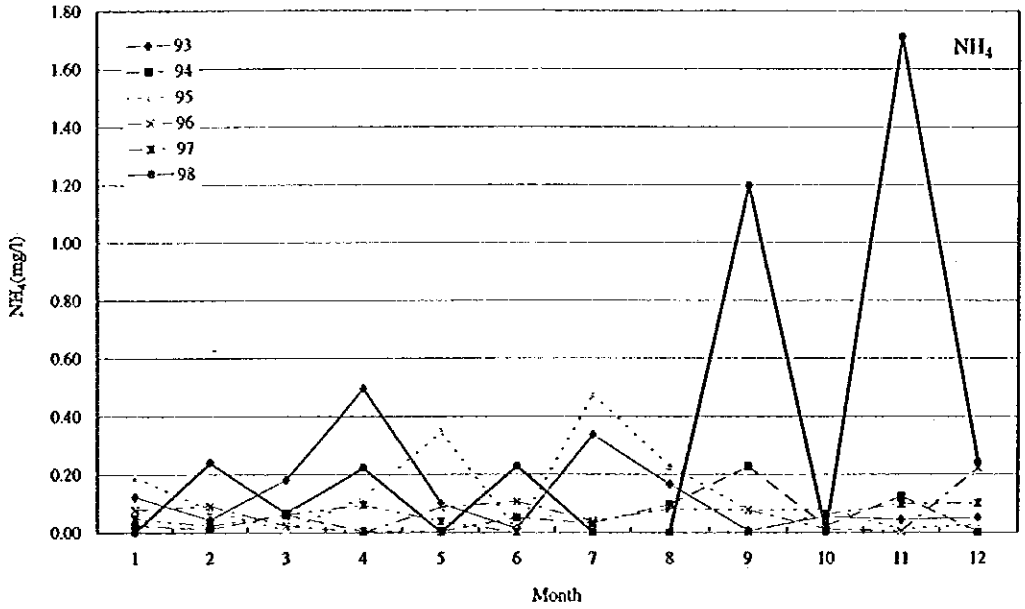


FIG. C.13 TENDENCY OF NO_2 AND PO_4 IN BAIE DE COCODY (R_6)



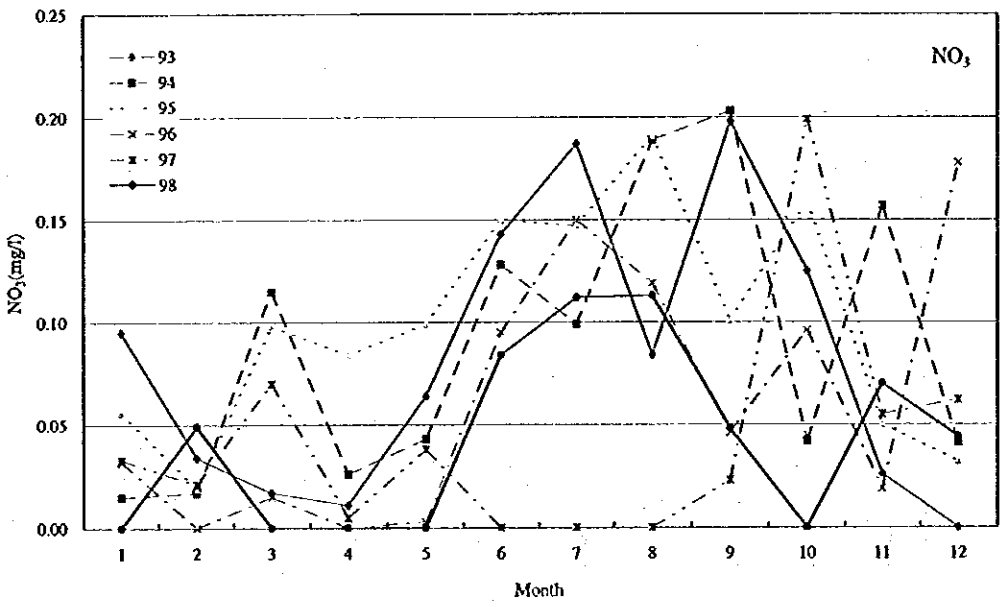
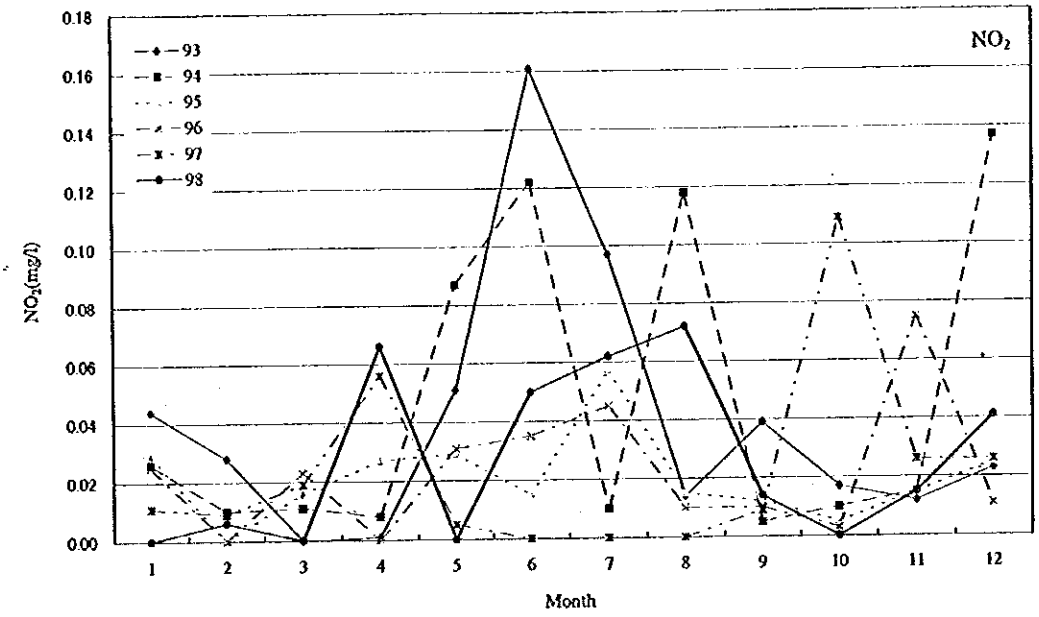


FIG. C.14 TENDENCY OF TENDENCY OF NH_4 AND NO_3 IN BAIE DE MARCORY (R_7)



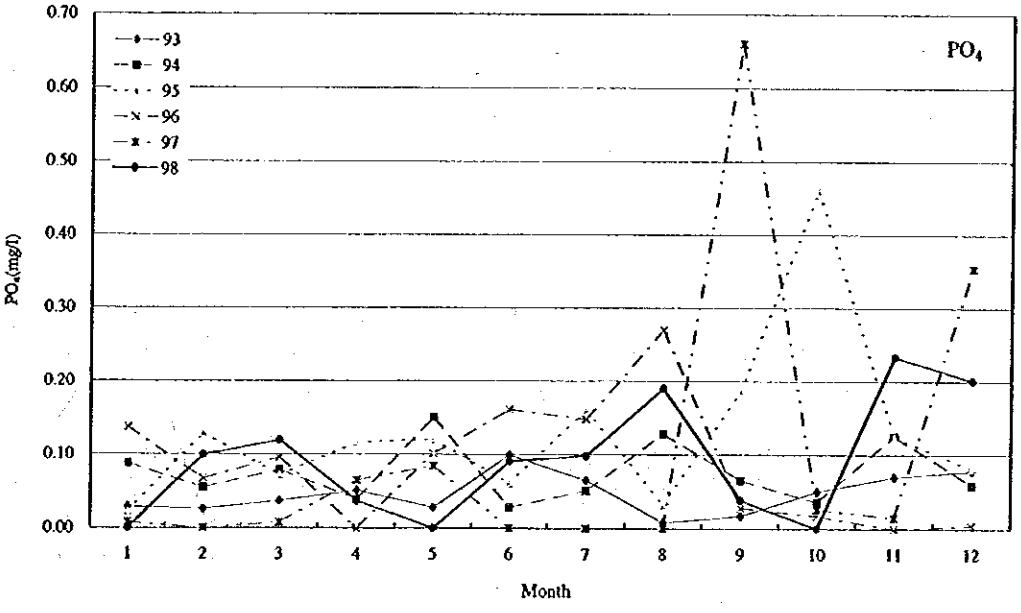
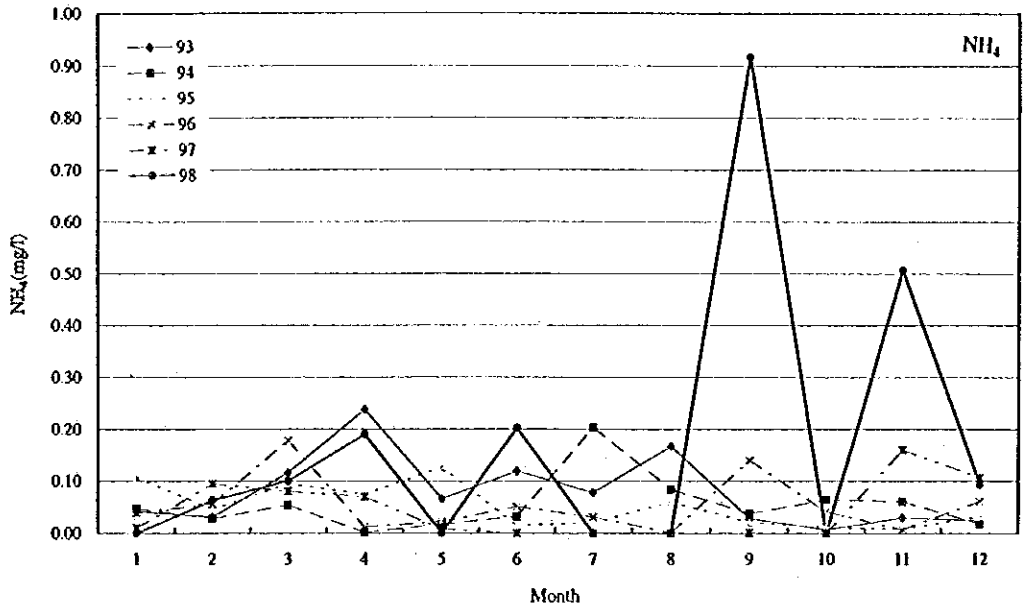


FIG. C.15 TENDENCY OF TENDENCY OF NO_2 AND PO_4 IN BAIE DE MARCORY (R_7)



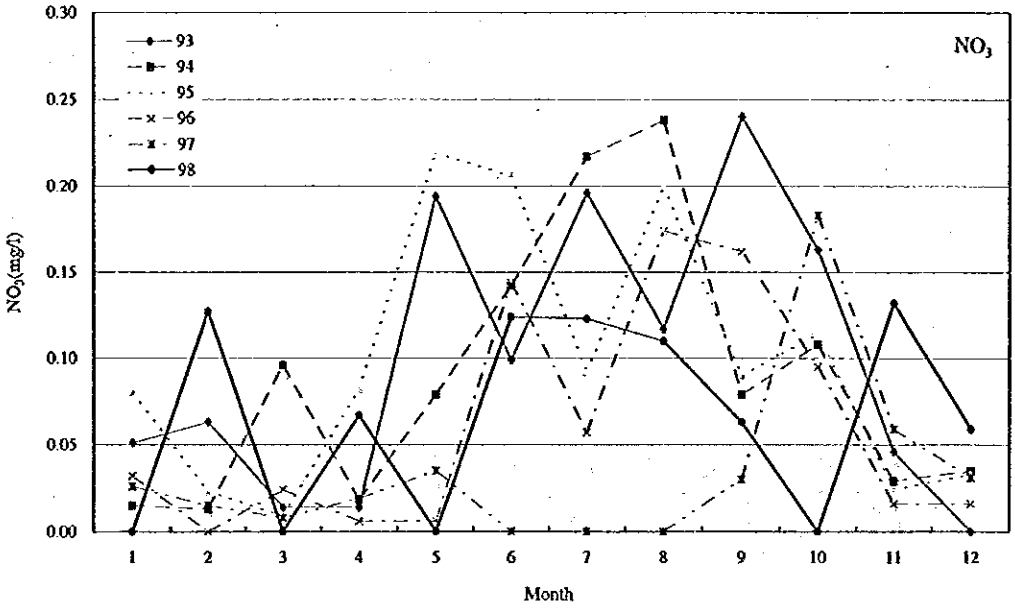
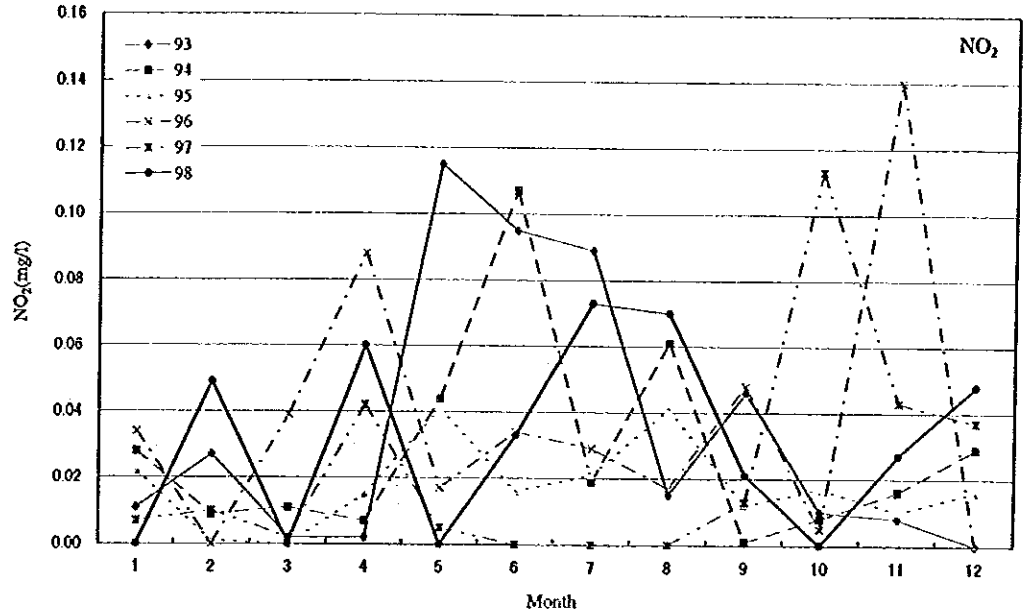


FIG. C.16 TENDENCY OF NH_4 AND NO_3 IN CANAL EST (R_8)



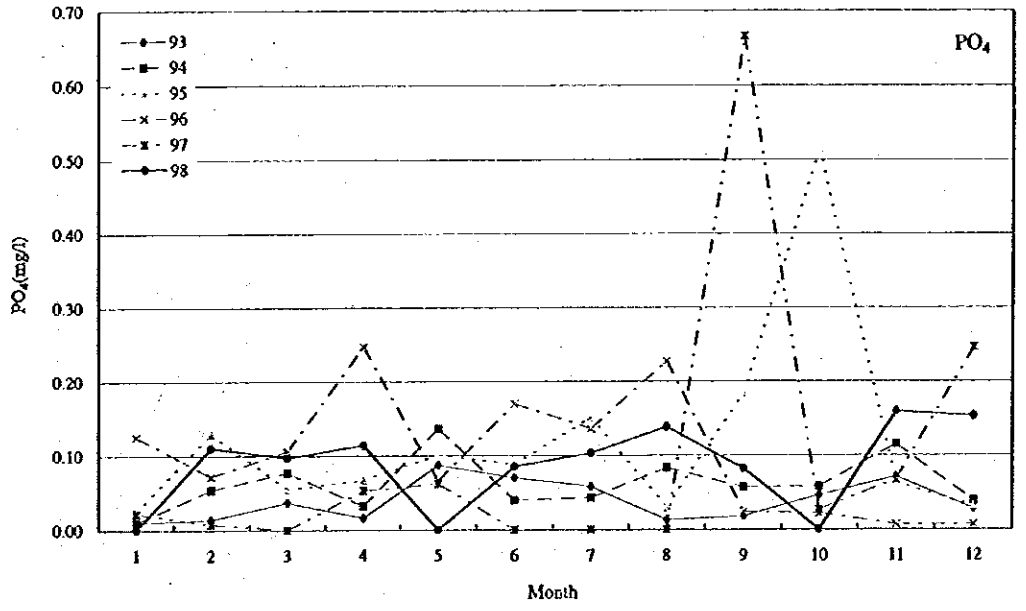
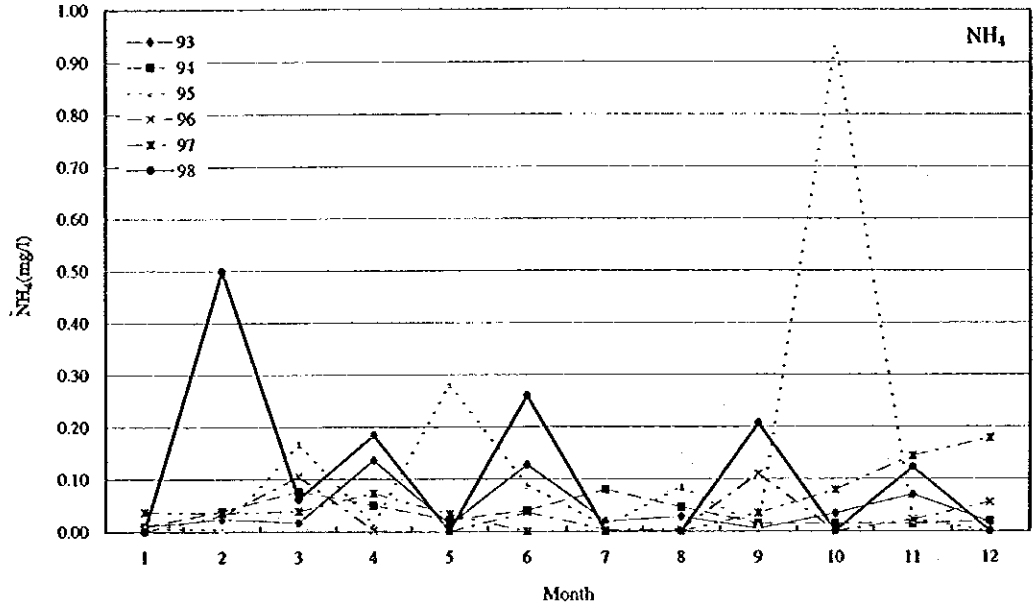


FIG. C.17 TENDENCY OF NO_2 AND PO_4 IN CANAL EST (R_8)



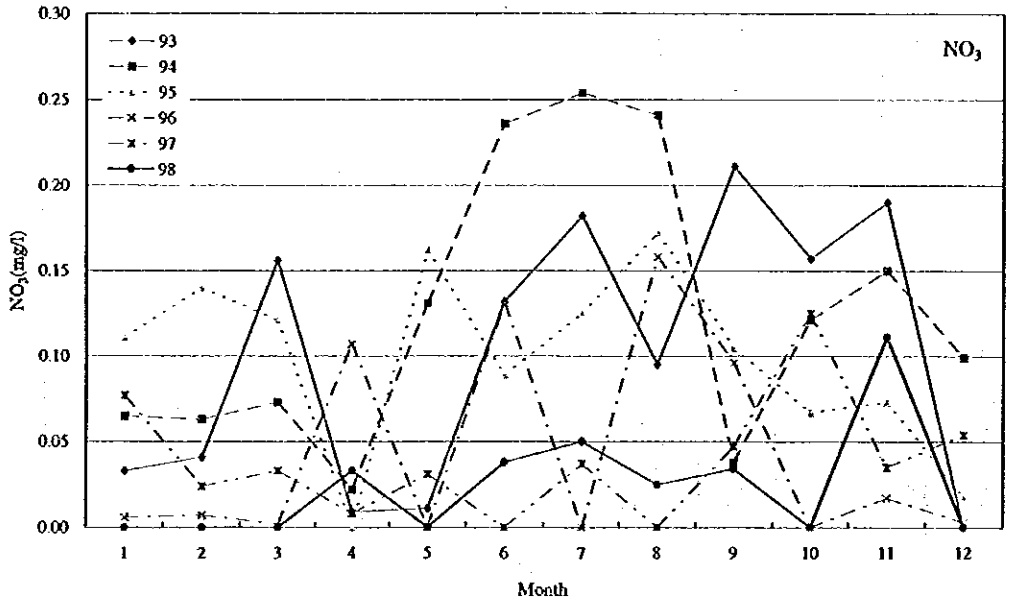
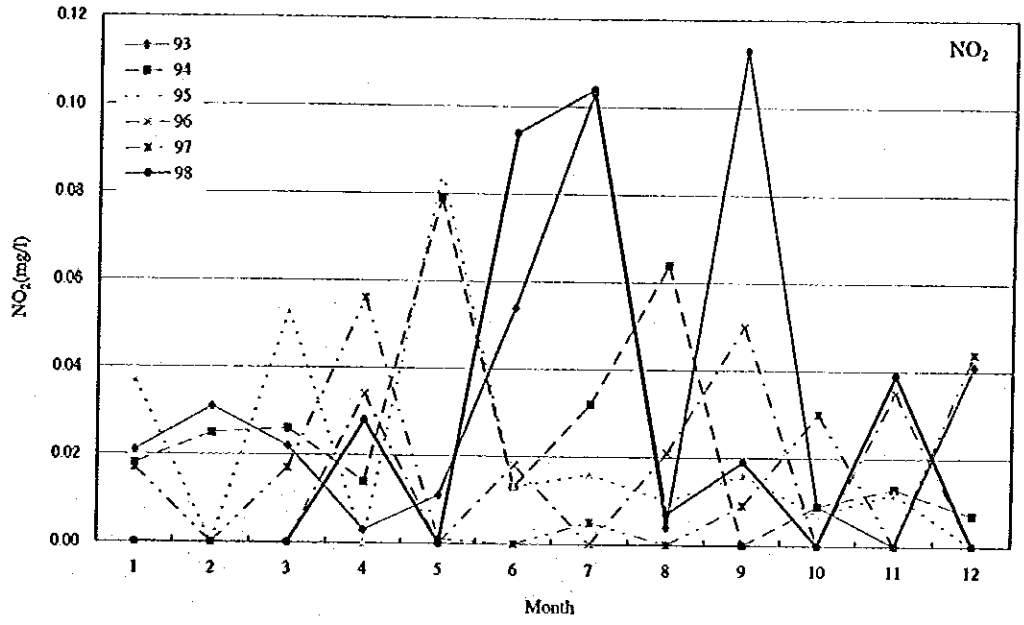


FIG. C.18 TENDENCY OF NH_4 AND NO_3 IN BAIE DE KOUMASSI (R_9)



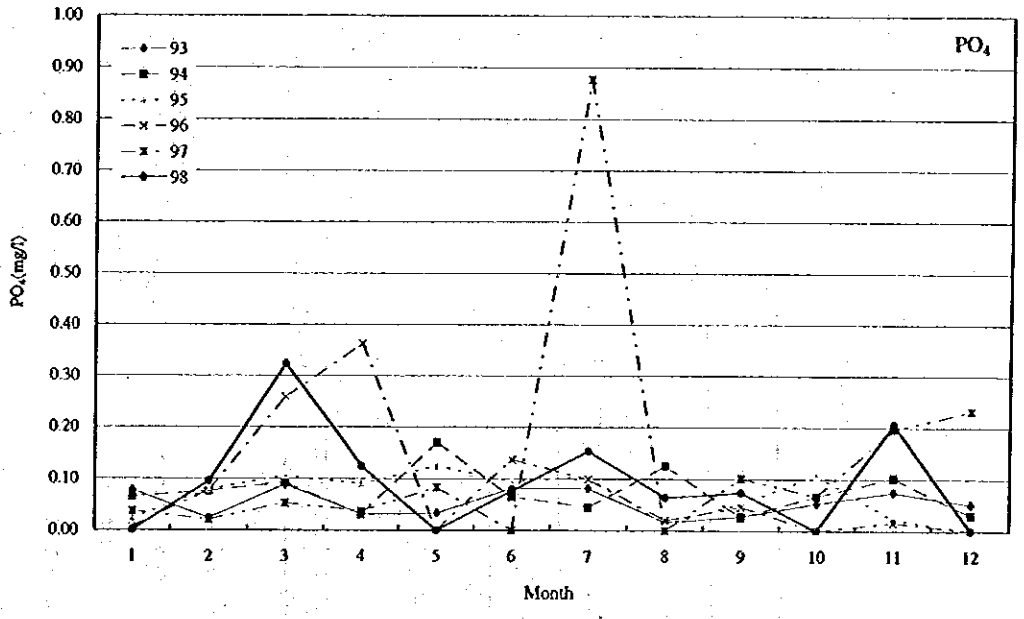


FIG. C.19 TENDENCY OF NO_2 AND PO_4 IN BAIE DE KOUMASSI (R_9)

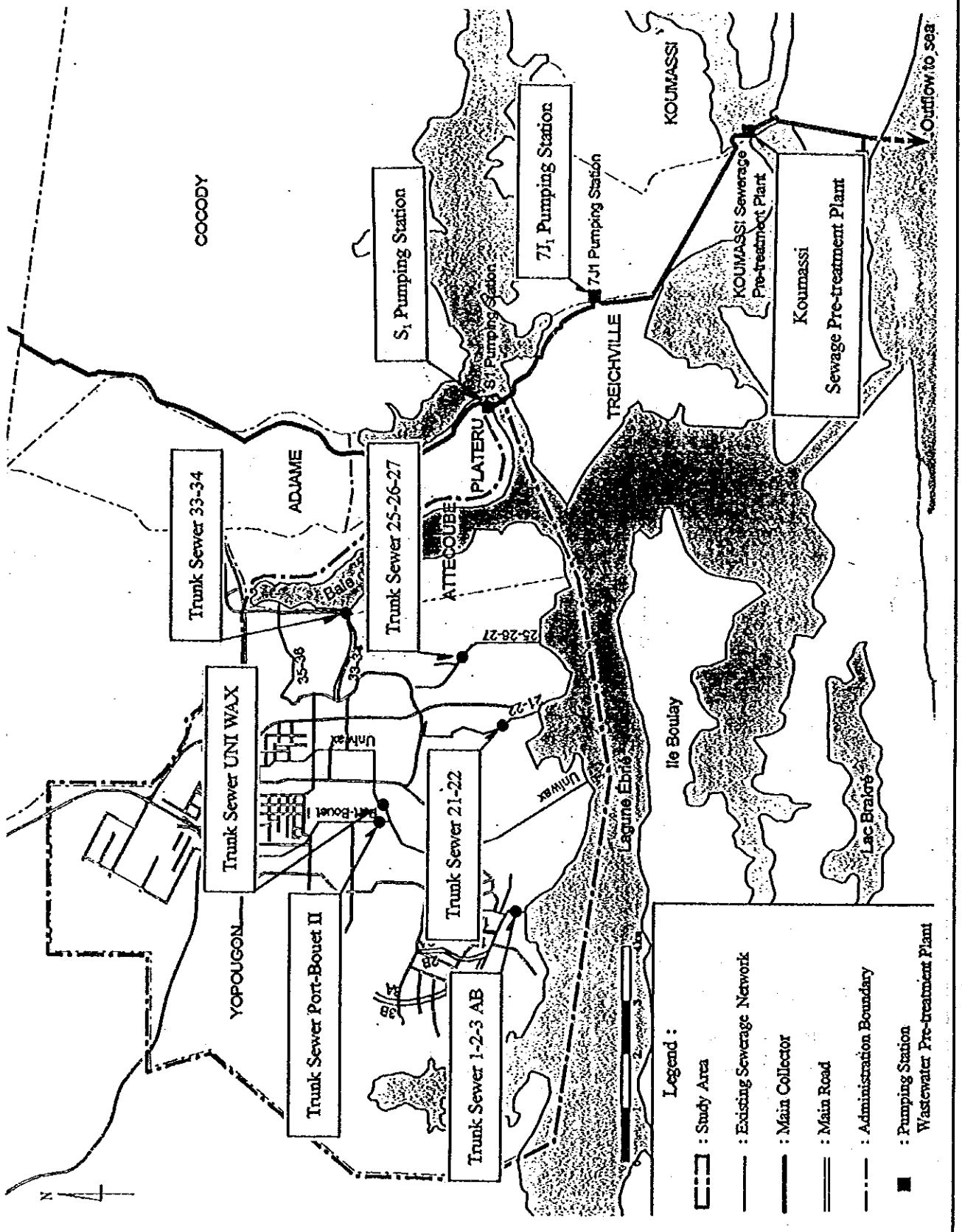
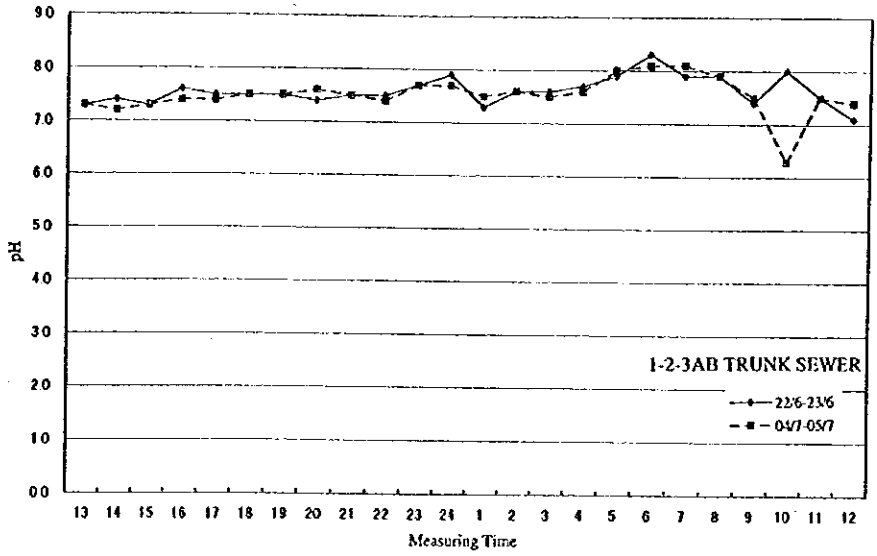
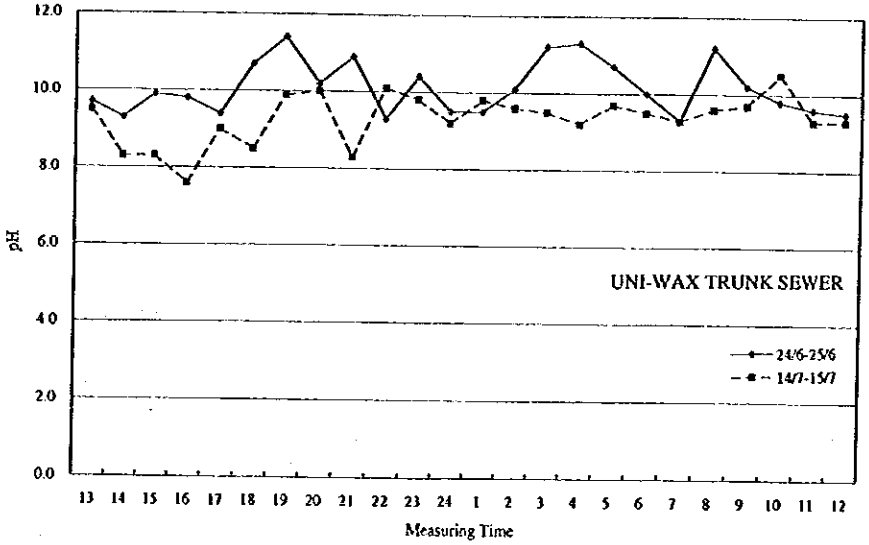


FIG. C.20 LOCATION FOR SEWAGE QUANTITY AND QUALITY SURVEY

THE FEASIBILITY STUDY ON SEWERAGE FACILITIES IN WESTERN DISTRICT OF ABIDJAN CITY IN THE REPUBLIC OF COTE D'IVOIRE





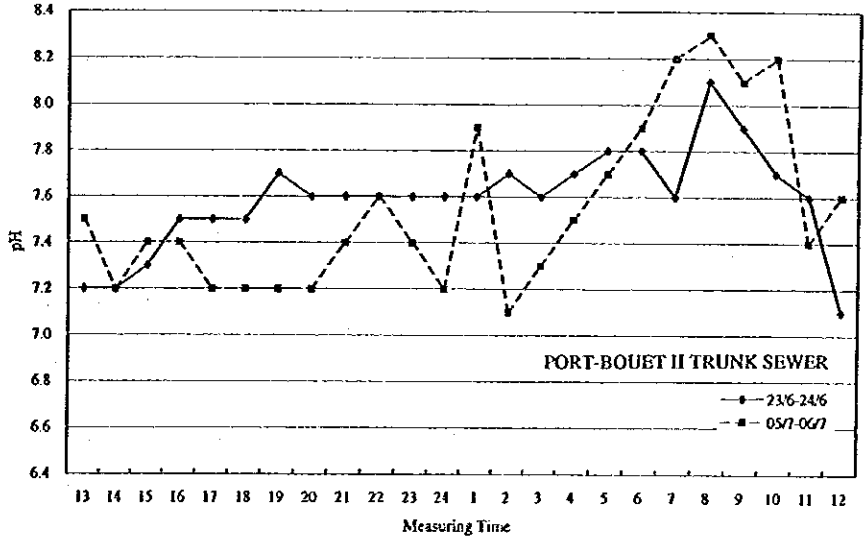
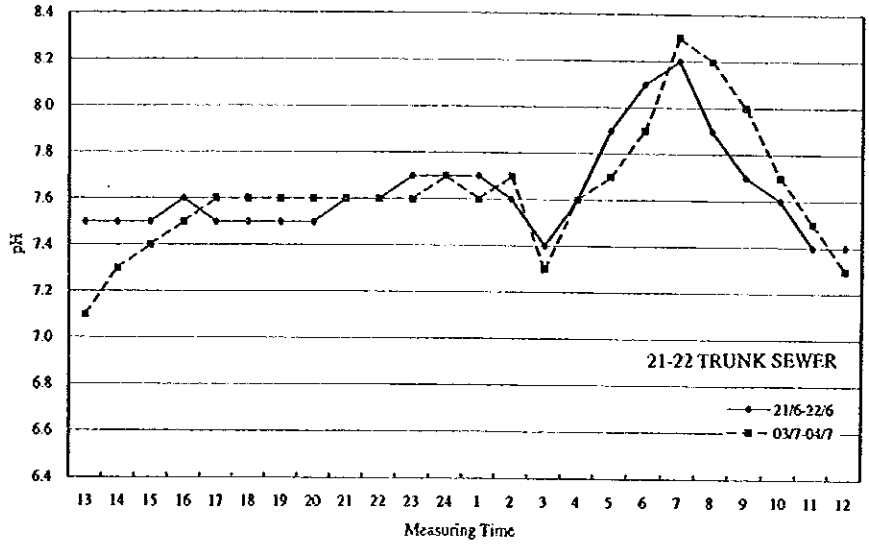
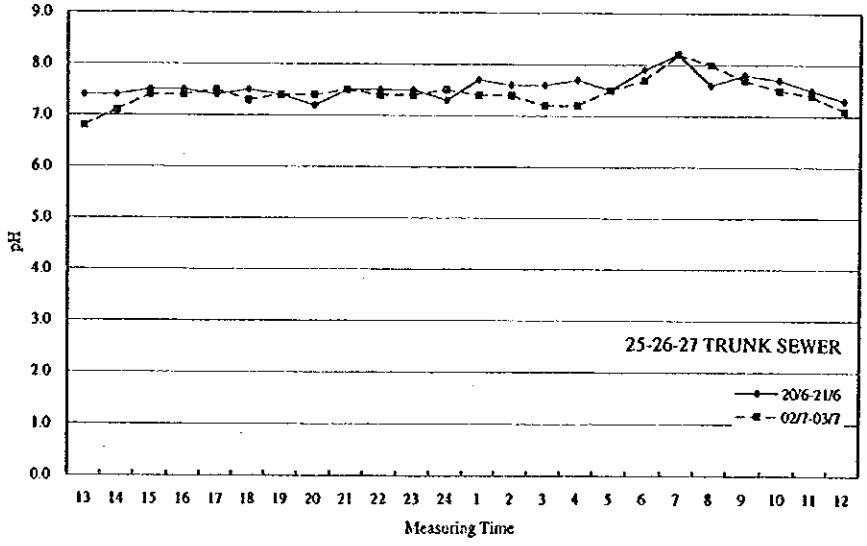


FIG. C.21 TREND OF PH IN 1-2-3AB, PORT-BOUET II AND UNIWAX TRUNK SEWER





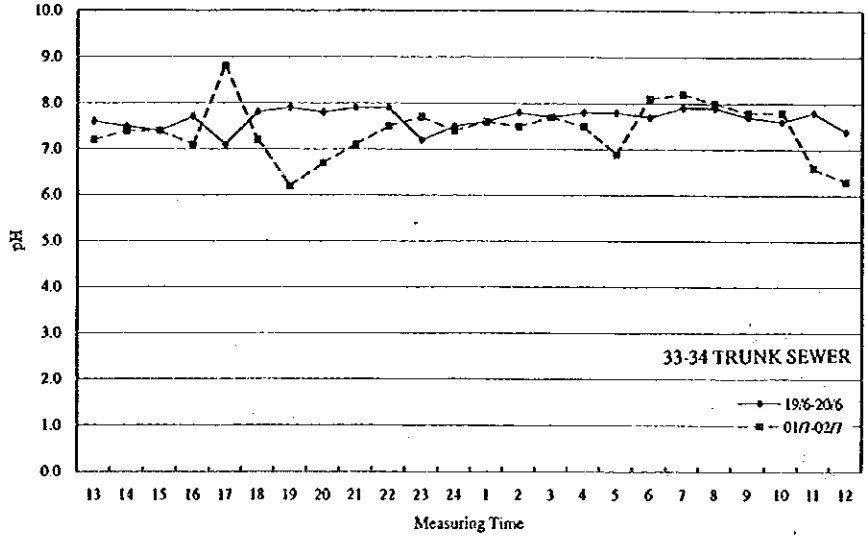
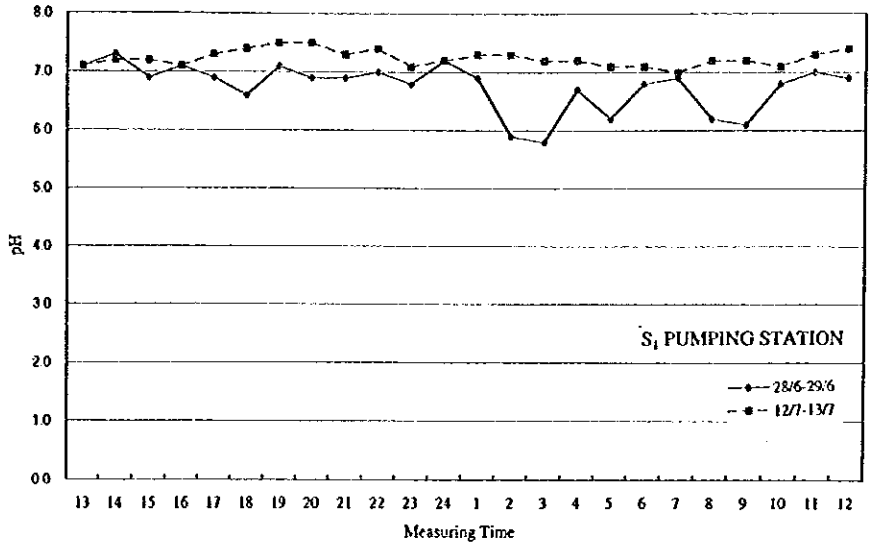
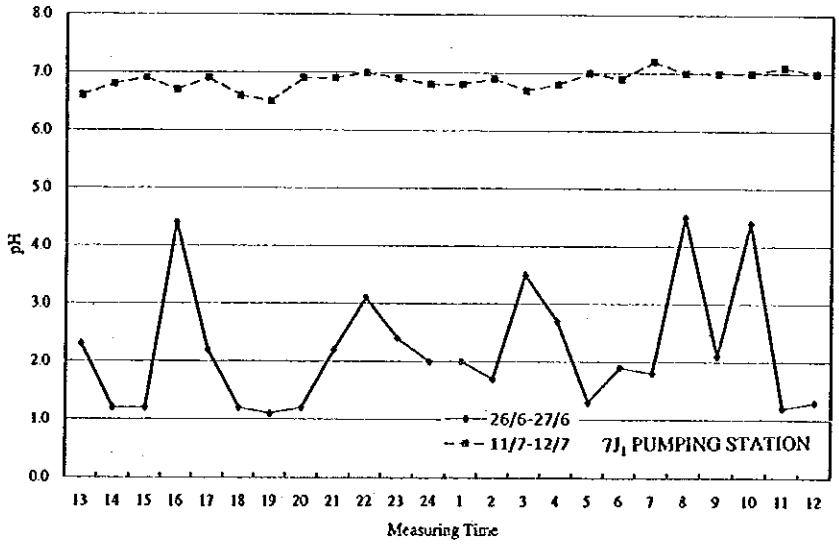


FIG. C.22	TREND OF PH IN 21-22, 25-26-27 AND 33-34 TRUNK SEWER





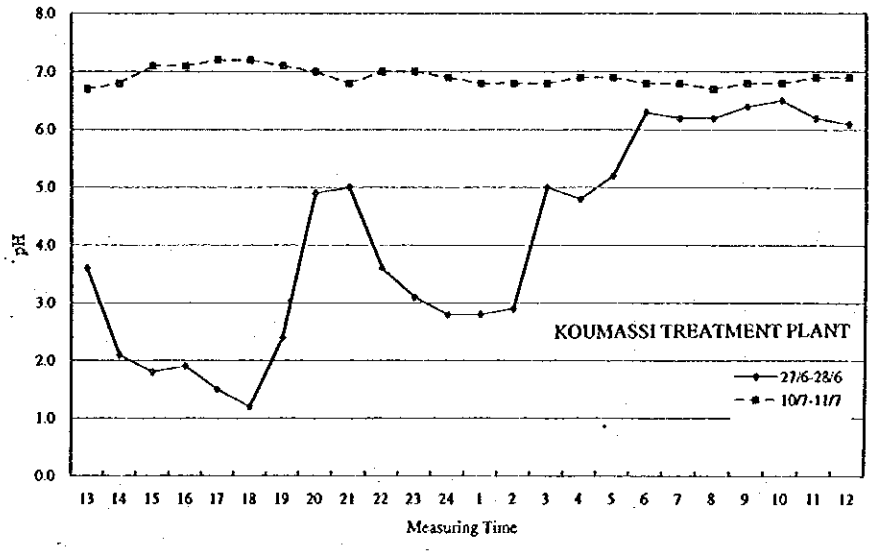
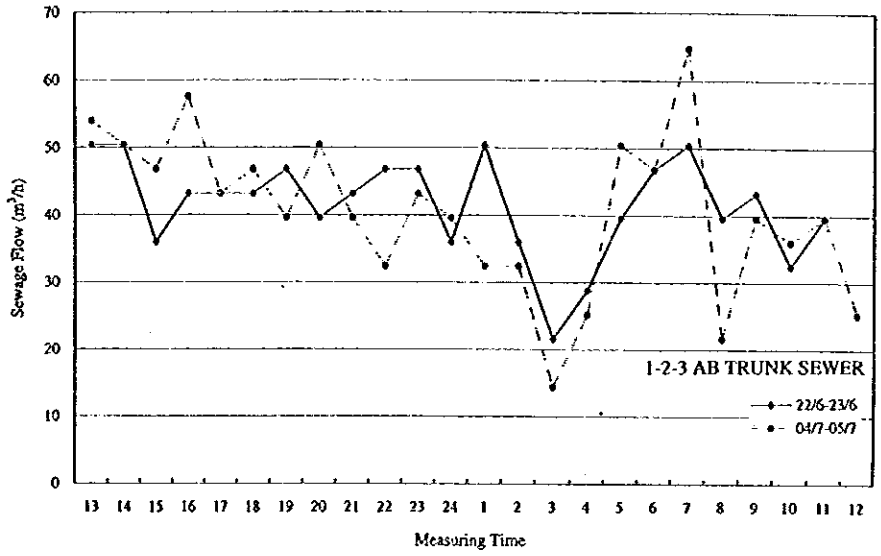
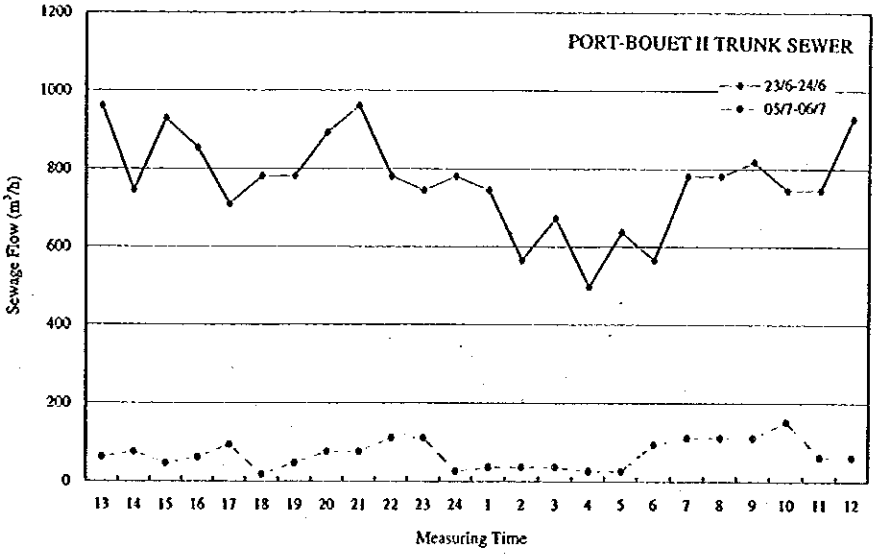


FIG. C.23 TREND OF PH IN S_1, $7J_1$ PUMPING STATION AND KOUMASSI TREATMENT PLANT





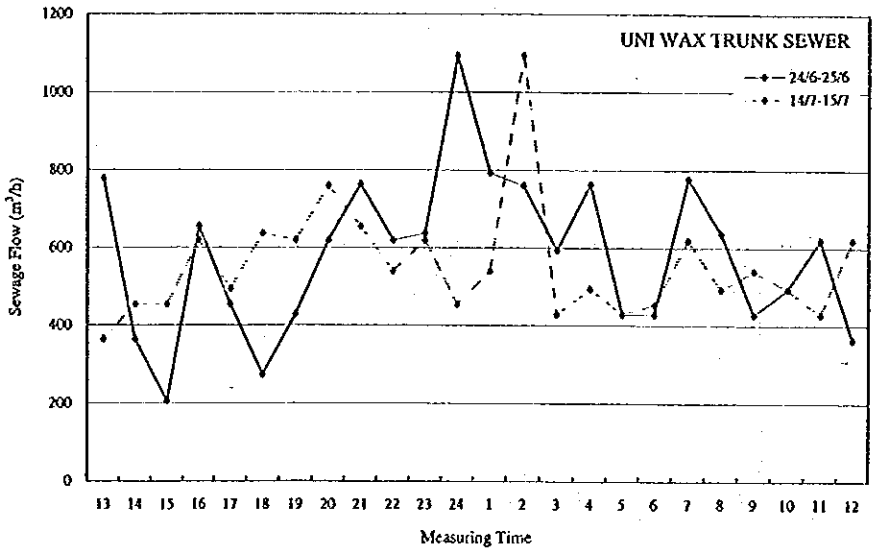
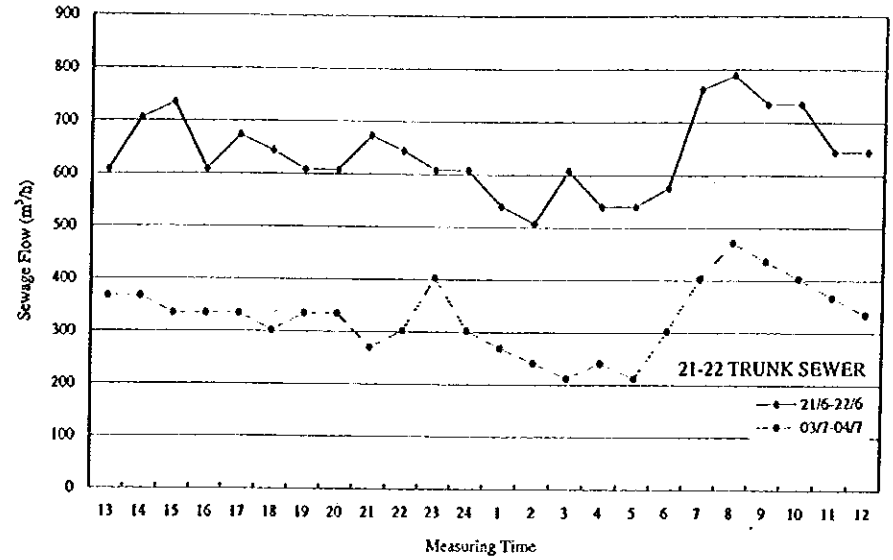
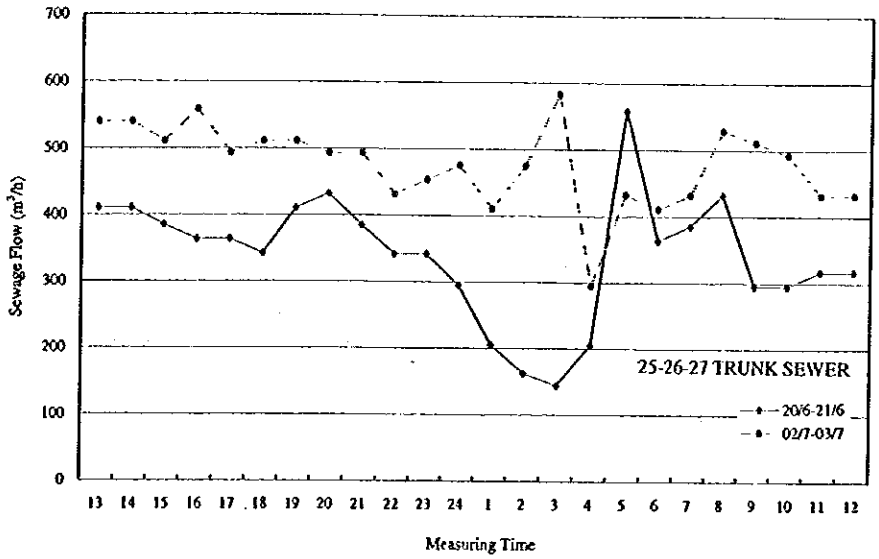


FIG. C.24 ACTUAL SEWAGE FLOW IN 1-2-3AB, PORT-BOUET II AND UNIWAX TRUNK SEWER





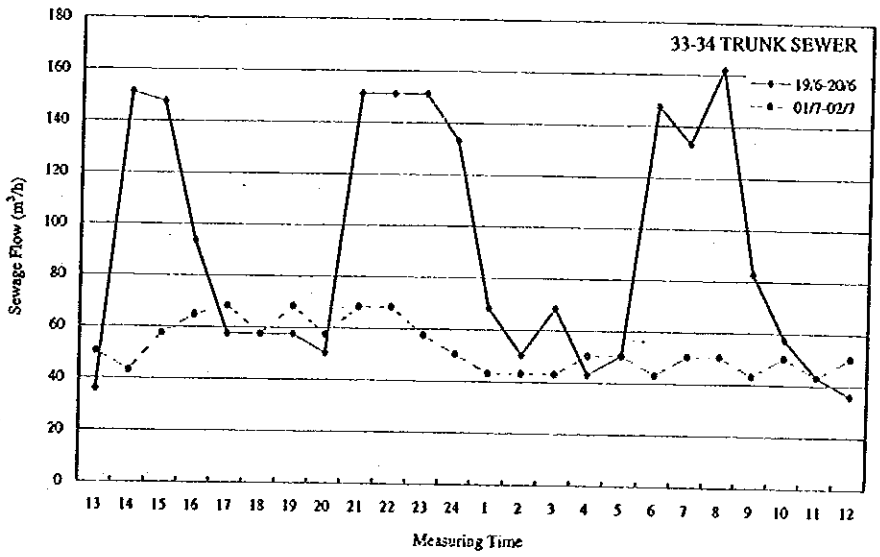
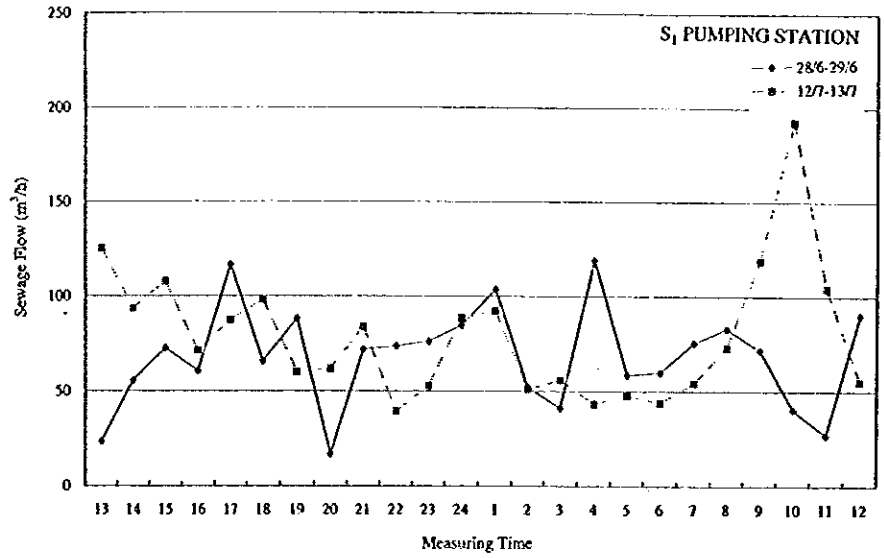
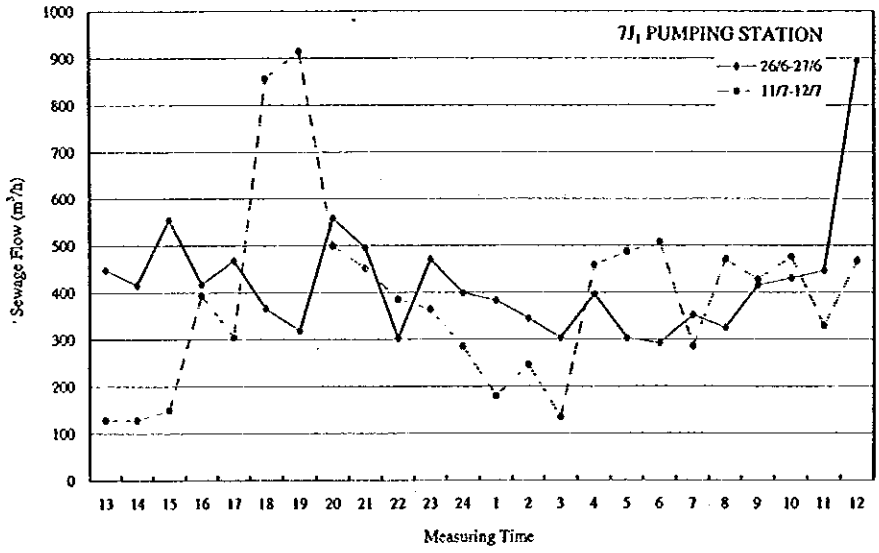


FIG. C.25	ACTUAL SEWAGE FLOW IN 21-22, 25-26-27 AND 33-34 TRUNK SEWER





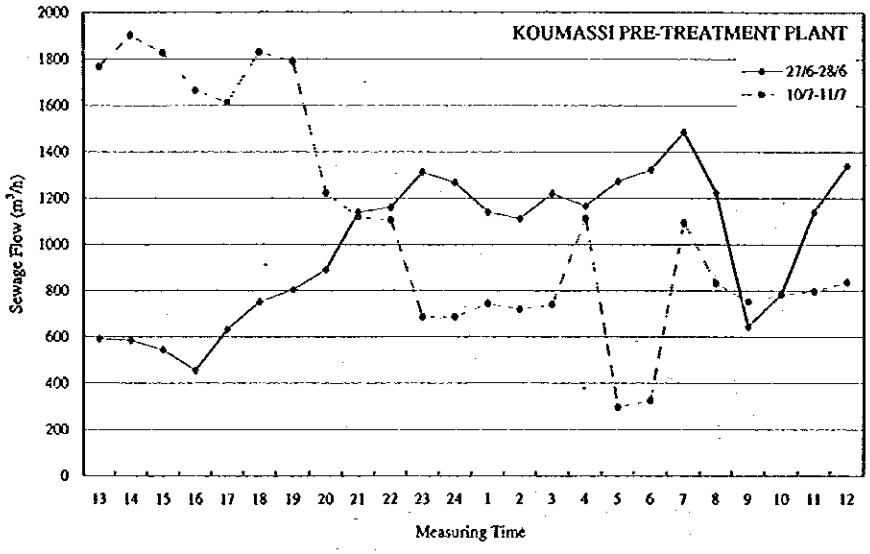


FIG. C.23 ACTUAL SEWAGE FLOW IN S_1, $7J_1$ PUMPING STATION AND KOUMASSI TREATMENT PLANT