DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-16 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Water at Ben Tram Bridge
- Type of Water : Surface Water — Sample Sign : **Sample 1-1**
- Sampling Date : 13h30 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	°C	31	Thermometer
2	pH		6,62	SMEWW 2130-98
3	Dissolved Oxygene (DO)	mg/l	5,7	TCVN 5499-1995
4	Total Suspended Solid (TSS)	mg/l	8	TCVN 4560-88
5	COD	mg/l	28	TCVN 6491-1999
6	BOD (20°C)	mg/l	12	TCVN 6001-1995
7	Ammonia (NH_4) as N	mg/l	0,32	TCVN 6179-96
8	Surfactants	mg/l	0,28	SMEWW 5540C-2005
9	Total Oils & Grease	mg/l	1,00	SMEWW 5520B-2005
10	E. Coli	MPN/ 100ml	$1,5.10^1$	TCVN 6187-2-1996

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- **Marks** : Sample Water testing for Requests

Da River Water Supply & Sewerage
Construction Consulting J.S Company
Director

S.Đ.K.K.D: 0309925113 - C.T.C.P
CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG CẤP THOÁT NƯỚC SÔNG ĐÀ
Q. TÂN BÌNH - TP HỒ CHÍ MINH

Eng. Nguyen Trung Nhi

March 29, 2012
Laboratory

XD
LAS13

Eng. Ngo Trong Quoc

DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-17 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Water at Cau Noi Bridge
- Type of Water : Surface Water — Sample Sign : **Sample 1-2**
- Sampling Date : 16h30 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	°C	32	Thermometer
2	pH		7,70	SMEWW 2130-98
3	Dissolved Oxygene (DO)	mg/l	3,2	TCVN 5499-1995
4	Total Suspended Solid (TSS)	mg/l	8	TCVN 4560-88
5	COD	mg/l	440	TCVN 6491-1999
6	BOD (20°C)	mg/l	148	TCVN 6001-1995
7	Ammonia (NH_4) as N	mg/l	1,73	TCVN 6179-96
8	Surfactants	mg/l	0,64	SMEWW 5540C-2005
9	Total Oils & Grease	mg/l	0,80	SMEWW 5520B-2005
10	E. Coli	MPN/ 100ml	$0{,}9.10^1$	TCVN 6187-2-1996

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- **Marks** : Sample Water testing for Requests

Da River Water Supply & Sewerage Construction Consulting J.S Company
Director

CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG CẤP THOÁT NƯỚC SÔNG ĐÀ

Eng. Nguyen Trung Nhi

March 29, 2012
Laboratory

XD LAS13

Eng. Ngo Trong Quoc

DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-17 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Water at Dinh Ba
- Type of Water : Surface Water — Sample Sign : **Sample 1-3**
- Sampling Date : 16h00 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	°C	32	Thermometer
2	pH		7,20	SMEWW 2130-98
3	Dissolved Oxygene (DO)	mg/l	5,9	TCVN 5499-1995
4	Total Suspended Solid (TSS)	mg/l	10	TCVN 4560-88
5	COD	mg/l	26	TCVN 6491-1999
6	BOD (20°C)	mg/l	10	TCVN 6001-1995
7	Ammonia (NH_4) as N	mg/l	0,28	TCVN 6179-96
8	Surfactants	mg/l	0,24	SMEWW 5540C-2005
9	Total Oils & Grease	mg/l	1,45	SMEWW 5520B-2005
10	E. Coli	MPN/ 100ml	$2,9.10^1$	TCVN 6187-2-1996

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- **Marks** : Sample Water testing for Requests

Da River Water Supply & Sewerage
Construction Consulting J.S Company
Director

CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG CẤP THOÁT NƯỚC SÔNG ĐÀ

Eng. Nguyen Trung Nhi

March 29, 2012
Laboratory

XD LAS13

Eng. Ngo Trong Quoc

DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-20 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Water at Trang Bridge
- Type of Water : Surface Water — Sample Sign : **Sample 2-1**
- Sampling Date : 10h30 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	°C	28,5	Thermometer
2	Color	Co Unit	12	TCVN 6185-96
3	Odor	Sense	0	SMEWW 2150-98
4	Turbidity	NTU	3,0	TCVN 6184-96
5	pH		5,20	SMEWW 2130-98
6	Total Hardness	mg/l $CaCO_3$	8	TCVN 6224-96
7	Total Dissolved Solid (TDS)	mg/l	12	TCVN 4560-88
8	Aluminium (Al)	mg/l	KPH (LOD=0.02)	SMEWW 3500-2005
9	Ammonia (NH_4^+) as N	mg/l	0,15	TCVN 6179-96
10	Antimony (Sb)	mg/l	KPH(LOD=0.001)	SMEWW 3500-2005
11	Asenic (As)	mg/l	KPH(LOD=0.0005)	SMEWW 3500-2005
12	Barium (Ba)	mg/l	KPH (LOD=0.001)	EPA-Method200.7
13	Boron (B)	mg/l	KPH(LOD=0.05)	SMEWW 3500-2005
14	Cadmium (Cd)	mg/l	KPH(LOD=0.0005)	SMEWW 3500-2005
15	Chloride (Cl^-)	mg/l	8	TCVN 6194-1996
16	Chromium (Cr)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
17	Copper (Cu)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
18	Phosphate (PO_4^{3-})	mg/l	0.15	SMEWW 4500-PO_4-D
19	Cyanide (CN^-)	mg/l	KPH (LOD=0.05)	TCVN 6181-1996
20	Fluoride (F^-)	mg/l	KPH (LOD=0.01)	SMEWW 4500-2005
21	Hydrogene Sulfide (H_2S)	mg/l	KPH (LOD=0.01)	SMEWW 4500-2005
22	Iron (Fe)	mg/l	1,80	TCVN 6177-96
23	Lead (Pb)	mg/l	0,0013	SMEWW 3500-2005

24	Manganese (Mn)	mg/l	KPH (LOD=0.005)	TCVN 6002-95
25	Mecury (Hg)	mg/l	KPH (LOD=0.0001)	SMEWW 3112-Hg-B
26	Molybdenum (Mo)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
27	Nikel (Ni)	mg/l	KPH (LOD=0.005)	SMEWW 3500-2005
28	Nitrite (NO_2^-) as N	mg/l	0,006	TCVN 6178-96
29	Nitrate (NO_3^-) as N	mg/l	2,3	TCVN 6180-96
30	Selenium (Se)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
31	Sodium (Na^+)	mg/l	1,25	SMEWW 3500-2005
32	Sulfate (SO_4^{2-})	mg/l	2	TCVN 6200-96
33	Zinc (Zn)	mg/l	0,018	SMEWW 3500-2005
34	Potassium Permanganate ($KMnO_4$)	mg/l O_2	1,6	$KMnO_4$ title
35	Surfactants	mg/l	0,21	SMEWW 5540C-2005
36	Total Oils & Grease	mg/l	1,00	SMEWW 5520B-2005
37	Phenol (Total)	µg/l	0,08	KTSK21-GCMS
38	E. Coli	MPN/ 100ml	4,0	TCVN 6187-2-1996
39	Total Coliform	MPN/ 100ml	$4,6.10^2$	TCVN 6187-2-1996
40	Total Nitrogene (T-N) (Kjeldah)	mg/l	5,5	SMEWW 4500-N
41	Total P (T-P)	mg/l	0,06	SMEWW 4500-P
42	Alkalinity	mg/l	6	SMEWW 2320B-2005
43	Total Organic Carbon (TOC)	mg/l	2,72	TCVN 6634-2000
44	UV Absorption (E260)	-	KPH	UV 1800
45	Trihalomethane (THM)	µg/l	KPH (LOD=5)	KTSK27-GCMS TK EPA 5021A

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- KPH : Not Finding
- LOD : Limite Finding Value
- **Marks** : Sample Water testing for Requests

Da River Water Supply & Sewerage
Construction Consulting J.S Company
Director

CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG CẤP THOÁT NƯỚC SÔNG ĐÀ

Eng. Nguyen Trung Nhi

March 29, 2012
Laboratory

XD LAS 13

Eng. Nga Trung Quoc

DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-21 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Ground Water at Suoi Cat Hamlet, Team 2
- Type of Water : Ground Water — Sample Sign : **Sample 2-2**
- Sampling Date : 11h00 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	^{0}C	27,0	Thermometer
2	Color	Co Unit	5	TCVN 6185-96
3	Odor	Sense	0	SMEWW 2150-98
4	Turbidity	NTU	2,4	TCVN 6184-96
5	pH		5,58	SMEWW 2130-98
6	Total Hardness	mg/l $CaCO_3$	16	TCVN 6224-96
7	Total Dissolved Solid (TDS)	mg/l	23	TCVN 4560-88
8	Aluminium (Al)	mg/l	KPH (LOD=0.02)	SMEWW 3500-2005
9	Ammonia (NH_4^+) as N	mg/l	0,76	TCVN 6179-96
10	Antimony (Sb)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
11	Asenic (As)	mg/l	KPH (LOD=0.0005)	SMEWW 3500-2005
12	Barium (Ba)	mg/l	0,010	EPA-Method200.7
13	Boron (B)	mg/l	KPH(LOD=0.05)	SMEWW 3500-2005
14	Cadmium (Cd)	mg/l	KPH(LOD=0.0005)	SMEWW 3500-2005
15	Chloride (Cl^-)	mg/l	10	TCVN 6194-1996
16	Chromium (Cr)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
17	Copper (Cu)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
18	Phosphate (PO_4^{3-})	mg/l	0.1	SMEWW 4500-PO_4-D
19	Cyanide (CN^-)	mg/l	KPH(LOD=0.05)	TCVN 6181-1996
20	Fluoride (F^-)	mg/l	KPH(LOD=0.01)	SMEWW 4500-2005
21	Hydrogene Sulfide (H_2S)	mg/l	0,12	SMEWW 4500-2005
22	Iron (Fe)	mg/l	1,20	TCVN 6177-96
23	Lead (Pb)	mg/l	KPH (LOD=0.005)	SMEWW 3500-2005
24	Manganese (Mn)	mg/l	KPH (LOD=0.005)	TCVN 6002-95

25	Mecury (Hg)	mg/l	KPH (LOD=0.0001)	SMEWW 3112-Hg-B
26	Molybdenum (Mo)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
27	Nikel (Ni)	mg/l	KPH (LOD=0.005)	SMEWW 3500-2005
28	Nitrite (NO_2^-) as N	mg/l	0,005	TCVN 6178-96
29	Nitrate (NO_3^-) as N	mg/l	0,5	TCVN 6180-96
30	Selenium (Se)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
31	Sodium (Na^+)	mg/l	0,51	SMEWW 3500-2005
32	Sulfate (SO_4^{2-})	mg/l	0.0	TCVN 6200-96
33	Zinc (Zn)	mg/l	0,029	SMEWW 3500-2005
34	Potassium Permanganate ($KMnO_4$)	mg/l O_2	1,4	$KMnO_4$ title
35	Surfactants	mg/l	KPH (LOD=0.06)	SMEWW 5540C-2005
36	Total Oils & Grease	mg/l	KPH (LOD=0.01)	SMEWW 5520B-2005
37	Phenol (Total)	µg/l	KPH (LOD=0.1)	KTSK21-GCMS
38	E. Coli	MPN/ 100ml	0,0	TCVN 6187-2-1996
39	Total Coliform	MPN/ 100ml	28	TCVN 6187-2-1996
40	Total Nitrogene (T-N) (Kjeldah)	mg/l	1,5	SMEWW 4500-N
41	Total P (T-P)	mg/l	0,04	SMEWW 4500-P
42	Alkalinity	mg/l	8	SMEWW 2320B-2005
43	Total Organic Carbon (TOC)	mg/l	KPH (LOD=0.3)	TCVN 6634-2000
44	UV Absorption (E260)	-	0,0570	UV 1800
45	Trihalomethane (THM)	µg/l	KPH (LOD=5)	KTSK27-GCMS TK EPA 5021A

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- KPH : Not Finding
- LOD : Limite Finding Value
- **Marks** : Sample Water testing for Requests

Da River Water Supply & Sewerage
Construction Consulting J.S Company
Director

CÔNG TY CỔ PHẦN TƯ VẤN XÂY DỰNG CẤP THOÁT NƯỚC SÔNG ĐÀ

Eng. Nguyen Trung Nhi

March 29, 2012
Laboratory

XD LAS 13

Eng. Ngo Trong Quoc

DA RIVER WATER SUPPLY & SEWERAGE CONSTRUCTION CONSULTING J.S COMPANY

No : 12-03-22 /PTN-TVCTNMT

RESULTS OF WATER SAMPLE ANALYSIS

- Works : Water Supply And Sewewage Treatment System Project in Phu Quoc Island, VN
- From : KOBELCO ECO-SOLUTIONS CO., LTD.
- Source of Water : Kien Giang Province – Phu Quoc Island
- Location : Duong Dong Lake
- Type of Water : Surface Water — Sample Sign : **Sample 2-3**
- Sampling Date : 12h30 09/03/2012 — Testing Date : 10/03/2012
- Name of Collector : Eng. Ngo Trong Quoc

No	Items	Unit	Results	Test methods
1	Temperature	°C	32	Thermometer
2	Color	Co Unit	8	TCVN 6185-96
3	Odor	Sense	0	SMEWW 2150-98
4	Turbidity	NTU	1,9	TCVN 6184-96
5	pH		5,68	SMEWW 2130-98
6	Total Hardness	mg/l $CaCO_3$	8	TCVN 6224-96
7	Total Dissolved Solid (TDS)	mg/l	10	TCVN 4560-88
8	Aluminium (Al)	mg/l	KPH (LOD=0.02)	SMEWW 3500-2005
9	Ammonia (NH_4^+) as N	mg/l	0,15	TCVN 6179-96
10	Antimony (Sb)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
11	Asenic (As)	mg/l	KPH (LOD=0.0005)	SMEWW 3500-2005
12	Barium (Ba)	mg/l	KPH (LOD=0.001)	EPA-Method200.7
13	Boron (B)	mg/l	KPH(LOD=0.05)	SMEWW 3500-2005
14	Cadmium (Cd)	mg/l	KPH(LOD=0.0005)	SMEWW 3500-2005
15	Chloride (Cl^-)	mg/l	8	TCVN 6194-1996
16	Chromium (Cr)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
17	Copper (Cu)	mg/l	KPH(LOD=0.005)	SMEWW 3500-2005
18	Phosphate (PO_4^{3-})	mg/l	0.14	SMEWW 4500-PO_4-D
19	Cyanide (CN^-)	mg/l	KPH (LOD=0.05)	TCVN 6181-1996
20	Fluoride (F^-)	mg/l	KPH (LOD=0.01)	SMEWW 4500-2005
21	Hydrogene Sulfide (H_2S)	mg/l	KPH (LOD=0.01)	SMEWW 4500-2005
22	Iron (Fe)	mg/l	1,60	TCVN 6177-96
23	Lead (Pb)	mg/l	KPH (LOD=0.005)	SMEWW 3500-2005
24	Manganese (Mn)	mg/l	KPH (LOD=0.005)	TCVN 6002-95

25	Mecury (Hg)	mg/l	KPH (LOD=0.0001)	SMEWW 3112-Hg-B
26	Molybdenum (Mo)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
27	Nikel (Ni)	mg/l	KPH (LOD=0.005)	SMEWW 3500-2005
28	Nitrite (NO_2^-) as N	mg/l	0,008	TCVN 6178-96
29	Nitrate (NO_3^-) as N	mg/l	2,0	TCVN 6180-96
30	Selenium (Se)	mg/l	KPH (LOD=0.001)	SMEWW 3500-2005
31	Sodium (Na^+)	mg/l	0,60	SMEWW 3500-2005
32	Sulfate (SO_4^{2-})	mg/l	1.0	TCVN 6200-96
33	Zinc (Zn)	mg/l	0,049	SMEWW 3500-2005
34	Potassium Permanganate ($KMnO_4$)	mg/l O_2	1,4	$KMnO_4$ title
35	Surfactants	mg/l	0,20	SMEWW 5540C-2005
36	Total Oils & Grease	mg/l	0,72	SMEWW 5520B-2005
37	Phenol (Total)	µg/l	0,07	KTSK21-GCMS
38	E. Coli	MPN/ 100ml	18	TCVN 6187-2-1996
39	Total Coliform	MPN/ 100ml	$2,9.10^2$	TCVN 6187-2-1996
40	Total Nitrogene (T-N) (Kjeldah)	mg/l	1,1	SMEWW 4500-N
41	Total P (T-P)	mg/l	0,05	SMEWW 4500-P
42	Alkalinity	mg/l	6	SMEWW 2320B-2005
43	Total Organic Carbon (TOC)	mg/l	2,18	TCVN 6634-2000
44	UV Absorption (E260)	-	KPH	UV 1800
45	Trihalomethane (THM)	µg/l	KPH (LOD=5)	KTSK27-GCMS TK EPA 5021A

- Notes : The result is only valuable on the actual sample
- SMEWW : Standard Method for The Examination of Water And WasteWater (APHA), Edition 20th
- KPH : Not Finding
- LOD : Limite Finding Value
- **Marks** : Sample Water testing for Requests

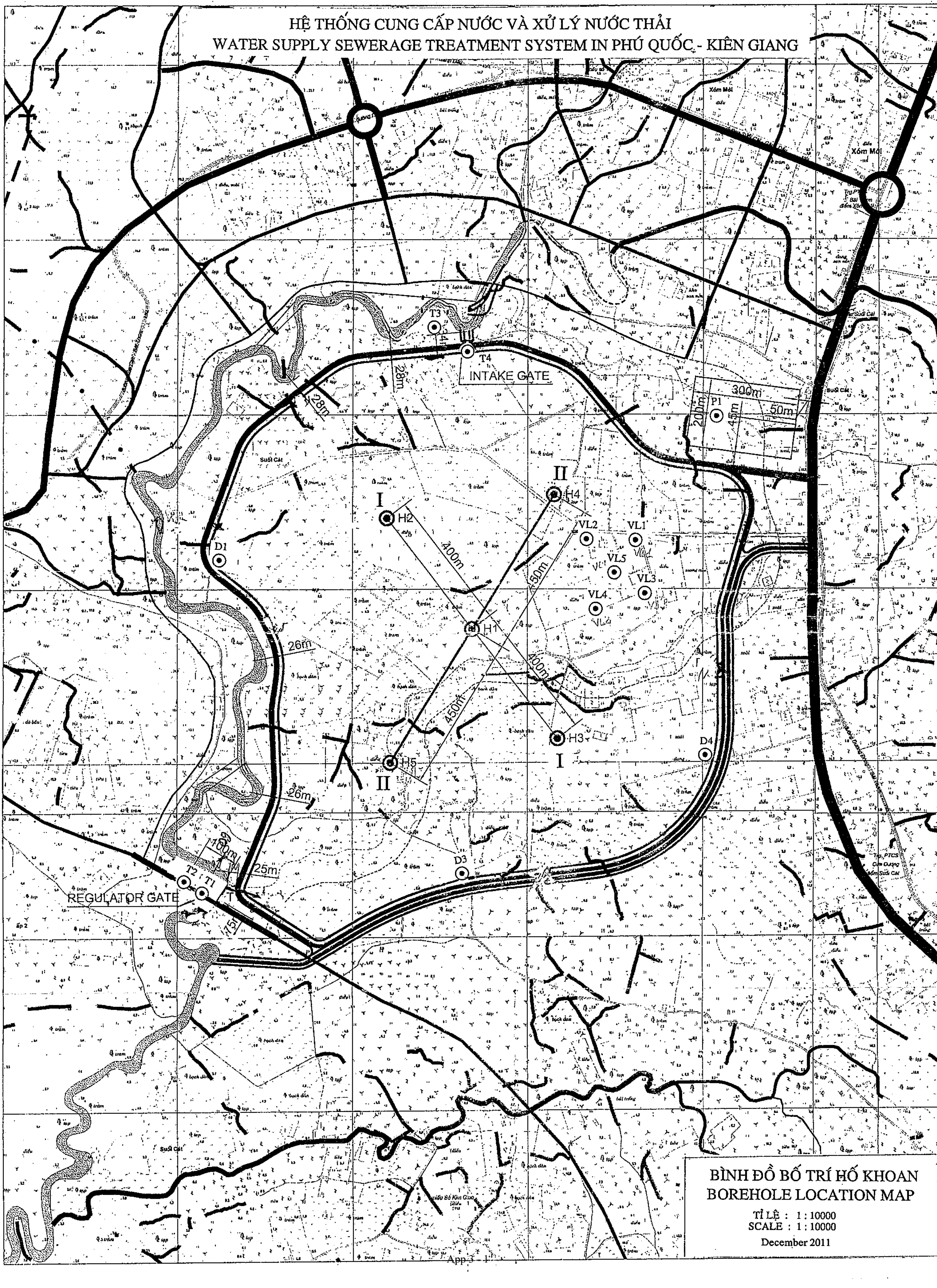
Da River Water Supply & Sewerage
Construction Consulting J.S Company
Director

Eng. Nguyen Trung Nhi

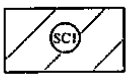
March 29, 2012
Laboratory

Engr. Nga Trong Quoc

添付資料-3　土質試験結果と検討


HỆ THỐNG CUNG CẤP NƯỚC VÀ XỬ LÝ NƯỚC THẢI
WATER SUPPLY SEWERAGE TREATMENT SYSTEM IN PHÚ QUỐC - KIÊN GIANG
INTAKE GATE
REGULATOR GATE
T1
T2
T3
T4
P1
300m
50m
200m
45m
H1
H2
H3
H4
H5
VL1
VL2
VL3
VL4
VL5
D1
D3
D4
I
II
400m
450m
50m
28m
26m
25m
100m
Suối Cát
Xóm Mới
BÌNH ĐỒ BỐ TRÍ HỐ KHOAN
BOREHOLE LOCATION MAP
TỈ LỆ : 1 : 10000
SCALE : 1 : 10000
December 2011

KÝ HIỆU ĐỊA CHẤT
GEOLOGICAL LEGEND

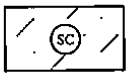


Á sét nhẹ màu xám trắng, nâu vàng, có chỗ nâu đỏ, kết cấu chặt vừa, trạng thái thay đổi từ nửa cứng đến dẻo mềm. Trong lớp đôi chỗ đất chuyển á cát nặng, cát hạt mịn - trung, đều hạt.

Medium dense, stiff to plasticity, whitish grey, yellowish brown, reddish brown, slightly sandy clay. Clayey sand mixtures in some place, fines - medium sand,well graded.

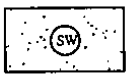
Á sét trung màu xám trắng, nâu vàng, xám nhạt, kết cấu chặt vừa, trạng thái dẻo mềm, trong lớp có chỗ lẫn đất á sét nhẹ, á sét nặng.

Medium dense, plasticity, whitish grey, yellowish brown, light grey, sandy clay. Slightly sandy clay mixtures in some place.



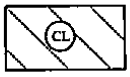
Á cát - cát hạt mịn màu xám trắng, nâu đỏ nhạt, xám đen nhạt, kết cấu chặt vừa, bão hòa nước, cát đều hạt.

Medium dense, water saturated and well graded, whitish grey, light reddish brown, light blackish grey, clayey sand to fines sand.



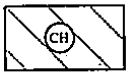
Cát hạt mịn -vừa, màu xám trắng, vàng nhạt, kết cấu chặt vừa, bão hòa nước,cát đều hạt.

Medium dense, water saturated and well graded, whitish grey, light yellow, fines to medium sand.



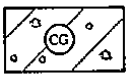
Sét - á sét nặng màu xám vàng loang nâu đỏ, xám trắng, trạng thái dẻo cứng -nửa cứng, ít chỗ dẻo mềm.

Stiff to medium stiff, plasticity in some place, yellowish grey, reddish brow, whitish grey, clay to sandy clay.



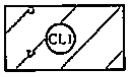
Sét - á sét nặng màu xám đen, xám nhạt, trạng thái dẻo mềm - dẻo chảy.

Plasticity to soft, blackish grey, light grey, clay - sandy clay.



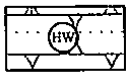
Á cát nặng - á sét nhẹ lẫn nhiều dăm sạn màu nâu đỏ, xám vàng, kết cấu chặt, trạng thái nửa cứng.

Medium stiff, dense, gravels mixtures, reddish brown, yellowish grey, clayey sand to slightly sandy clay.



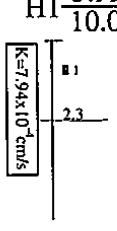
Tàn tích đá cát kết, đất á sét nặng lẫn ít dăm sạn cát kết màu nâu đỏ, xám vàng, xám trắng, dẻo cứng - nửa cứng.

Residual origin (complete weathered sandstone), medium stiff to stiff, with a little sandstone gravels, reddish brown, whitish grey, yellowish grey, sandy clay.



Đá cát kết phong hóa mạnh, màu xám nâu vàng, nâu nhạt, có chỗ đã phong hóa thành đất, trạng thái nửa cứng. nõn khoan có độ cứng trung bình.

Moderately weak, brownish yellowish grey, hightly weathered (H.W) sandstone. Complete weathered (C.W) sandstone is medium stiff soil in some place.



Hố Khoan (Borehole) $\frac{\text{Cao độ (Elevation)}}{\text{Độ sâu hố (depth) m}}$

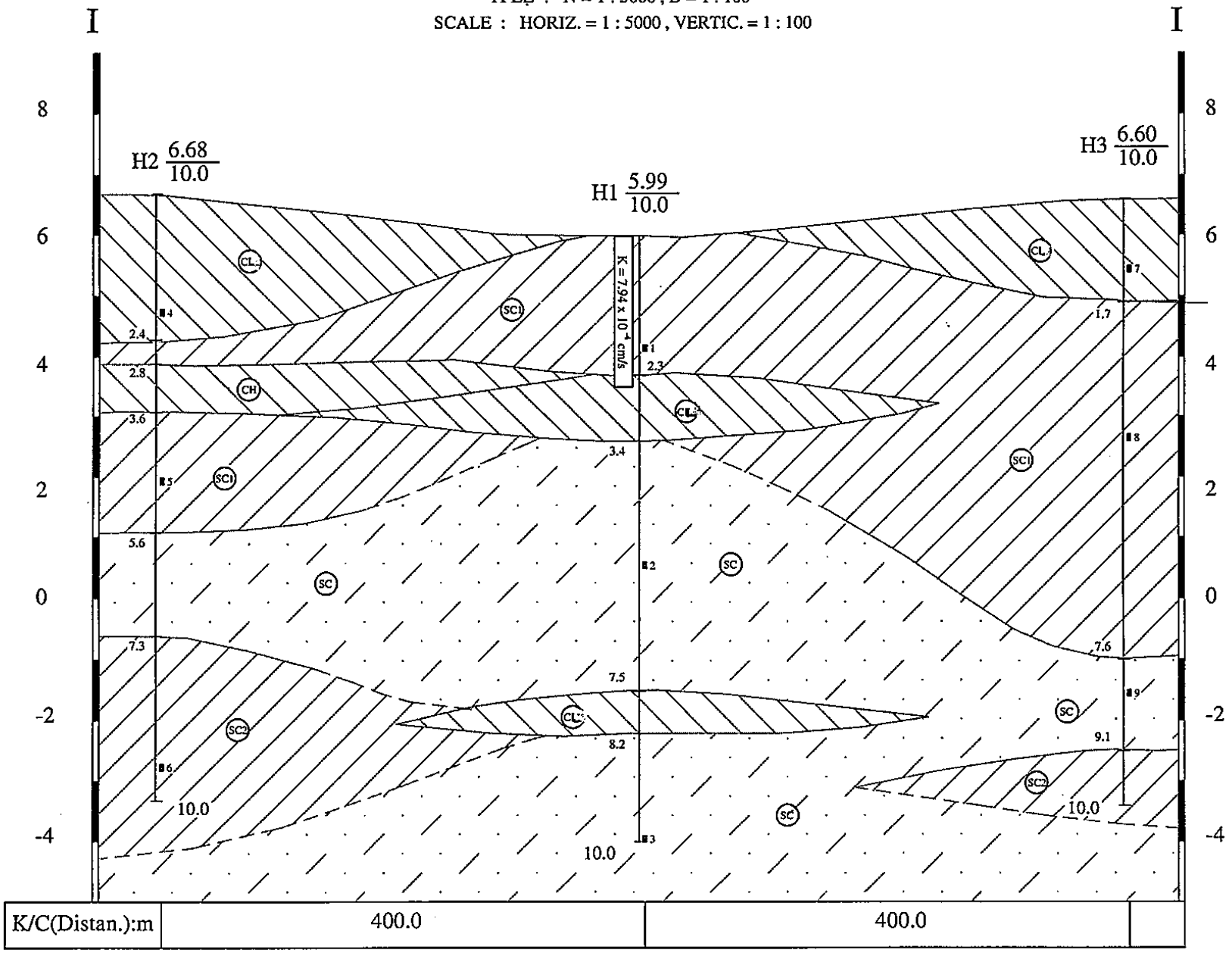
Ranh giới phân lớp và độ sâu đáy lớp tính từ mặt đất (m).
Layer boundary and the depth of layer from ground (m).

B1 Vị trí lấy mẫu đất và số thứ tự thí nghiệm mẫu.
The location sample and number of test.

Kết quả đổ nước thí nghiệm.
The water pouring result.

MẶT CẮT ĐỊA CHẤT TUYẾN I - I (LÒNG HỒ)
GEOLOGICAL CROSS SECTION I - I (IN SITE RESEVOIR)

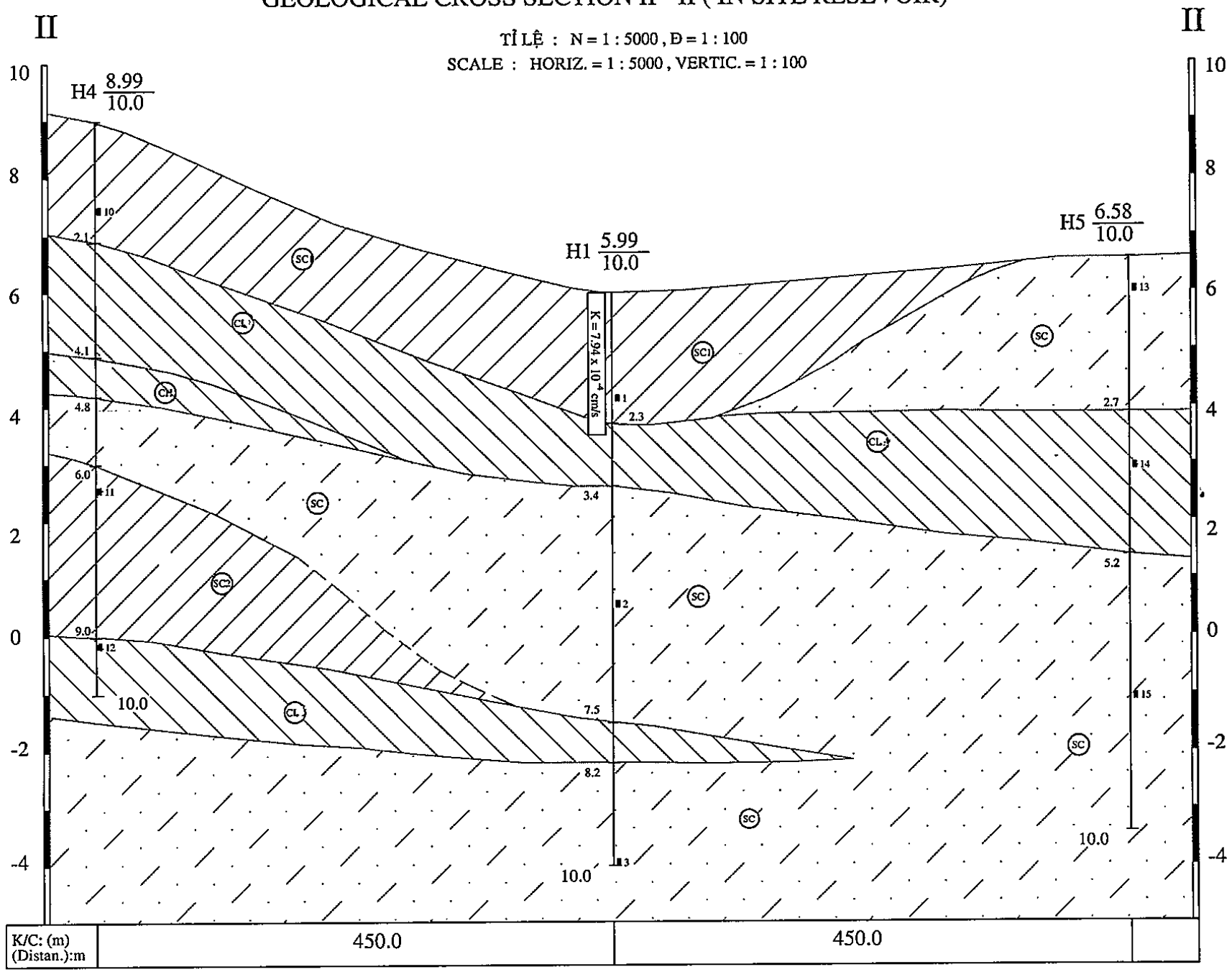
TỈ LỆ : N = 1 : 5000 , Đ = 1 : 100
SCALE : HORIZ. = 1 : 5000 , VERTIC. = 1 : 100



MẶT CẮT ĐỊA CHẤT TUYẾN II - II (LÒNG HỒ)
GEOLOGICAL CROSS SECTION II - II (IN SITE RESEVOIR)

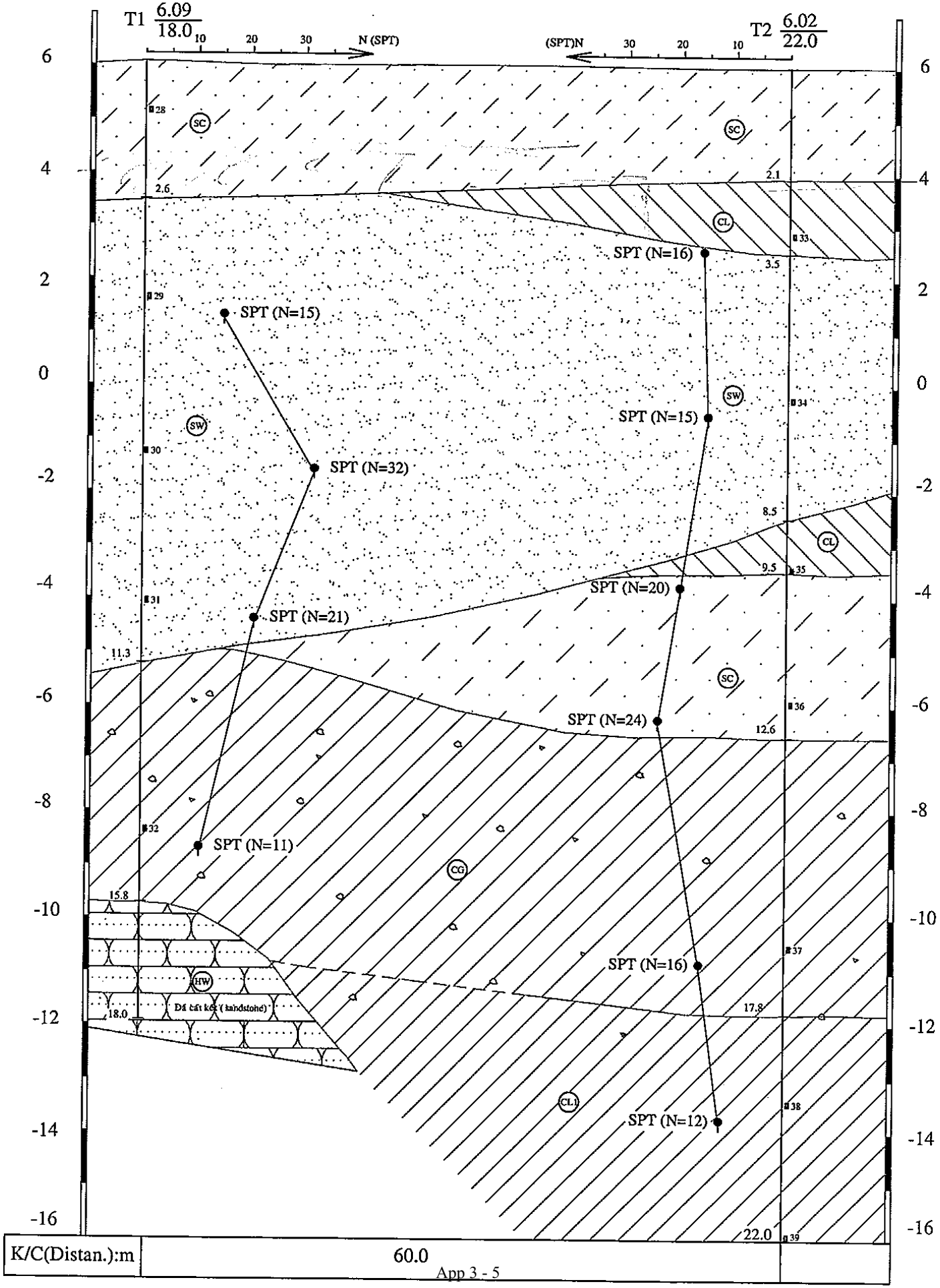
TỈ LỆ : N = 1 : 5000 , Đ = 1 : 100

SCALE : HORIZ. = 1 : 5000 , VERTIC. = 1 : 100



MẶT CẮT ĐỊA CHẤT CỬA ĐIỀU KHIỂN
GEOLOGICAL CROSS SECTION REGULATOR GATE

TỈ LỆ : N = 1 : 500 , Đ = 1 : 100
SCALE : HORIZ. = 1 : 500 , VERTIC. = 1 : 100

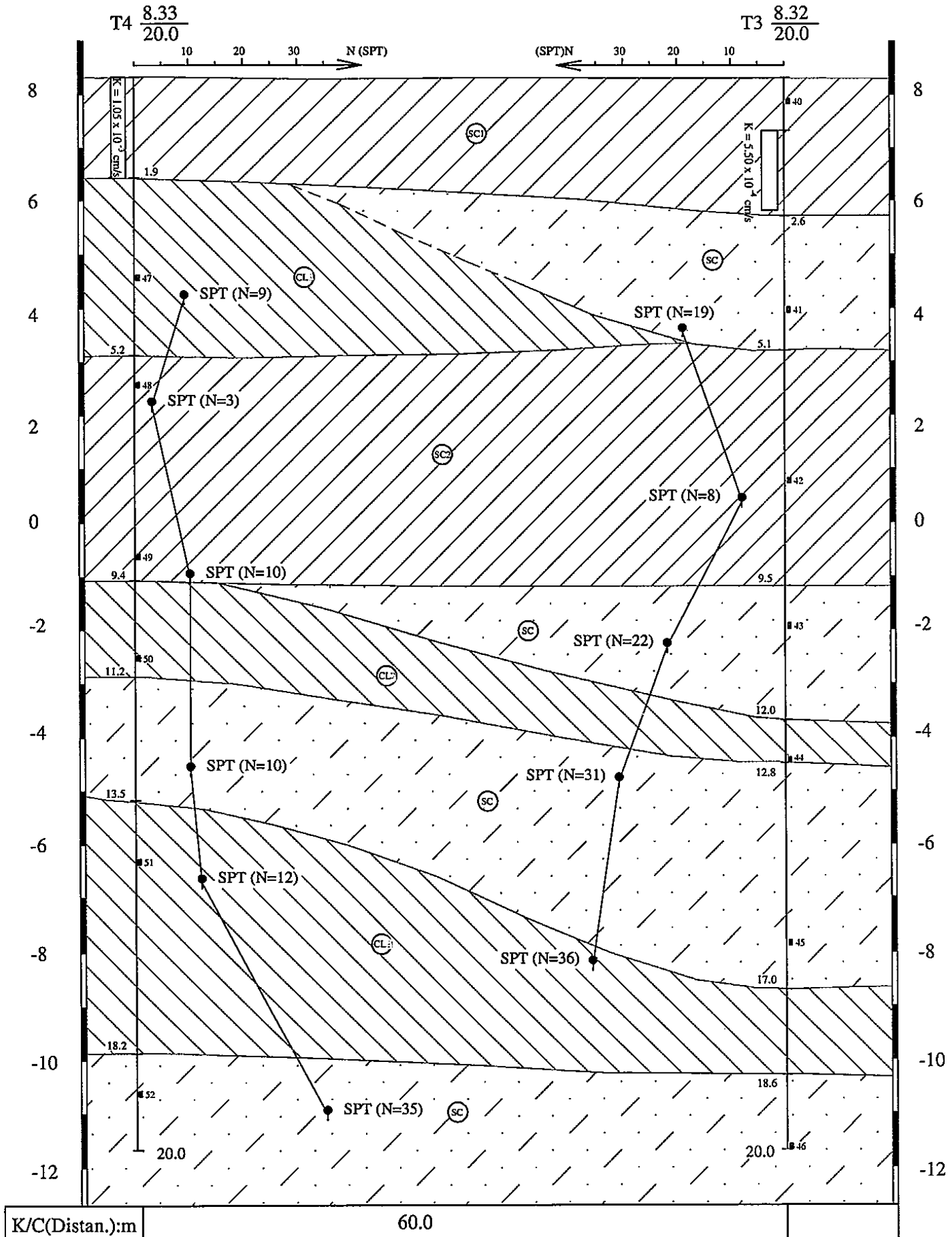


K/C(Distan.):m	60.0

MẶT CẮT ĐỊA CHẤT CỬA NHẬN NƯỚC
GEOLOGICAL CROSS SECTION INTAKE GATE

TỈ LỆ : N = 1 : 500 , Đ = 1 : 100

SCALE : HORIZ. = 1 : 500 , VERTIC. = 1 : 100



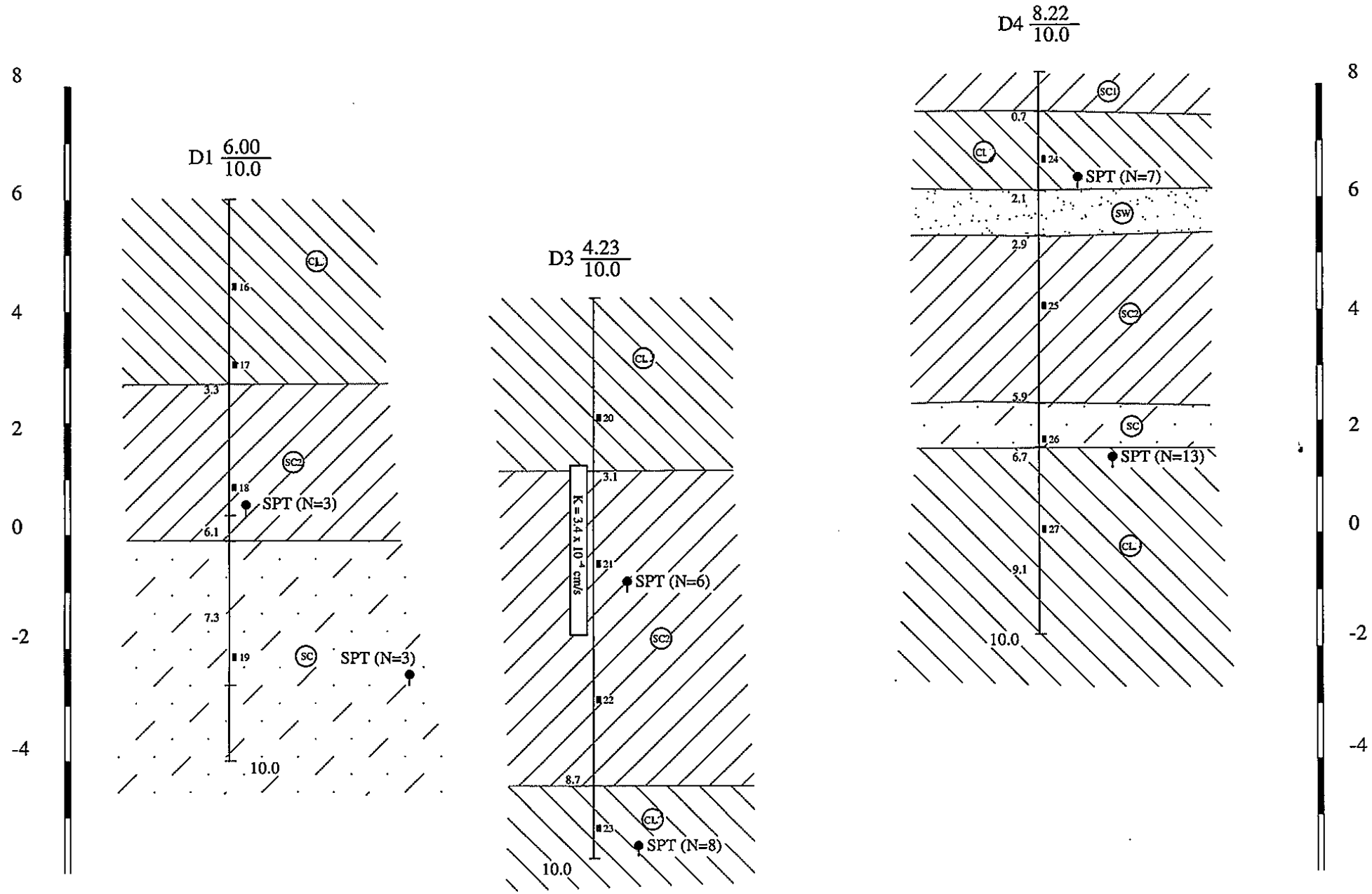
K/C(Distan.):m	60.0	

MẶT CẮT ĐỊA CHẤT CÁC HỐ KHOAN D1 - D3 - D4

GEOLOGICAL CROSS SECTION BOREHOLE D1 - D3 - D4

TỈ LỆ : N = 1 : 5000 , Đ = 1 : 100

SCALE : HORIZ. = 1 : 5000 , VERTIC. = 1 : 100

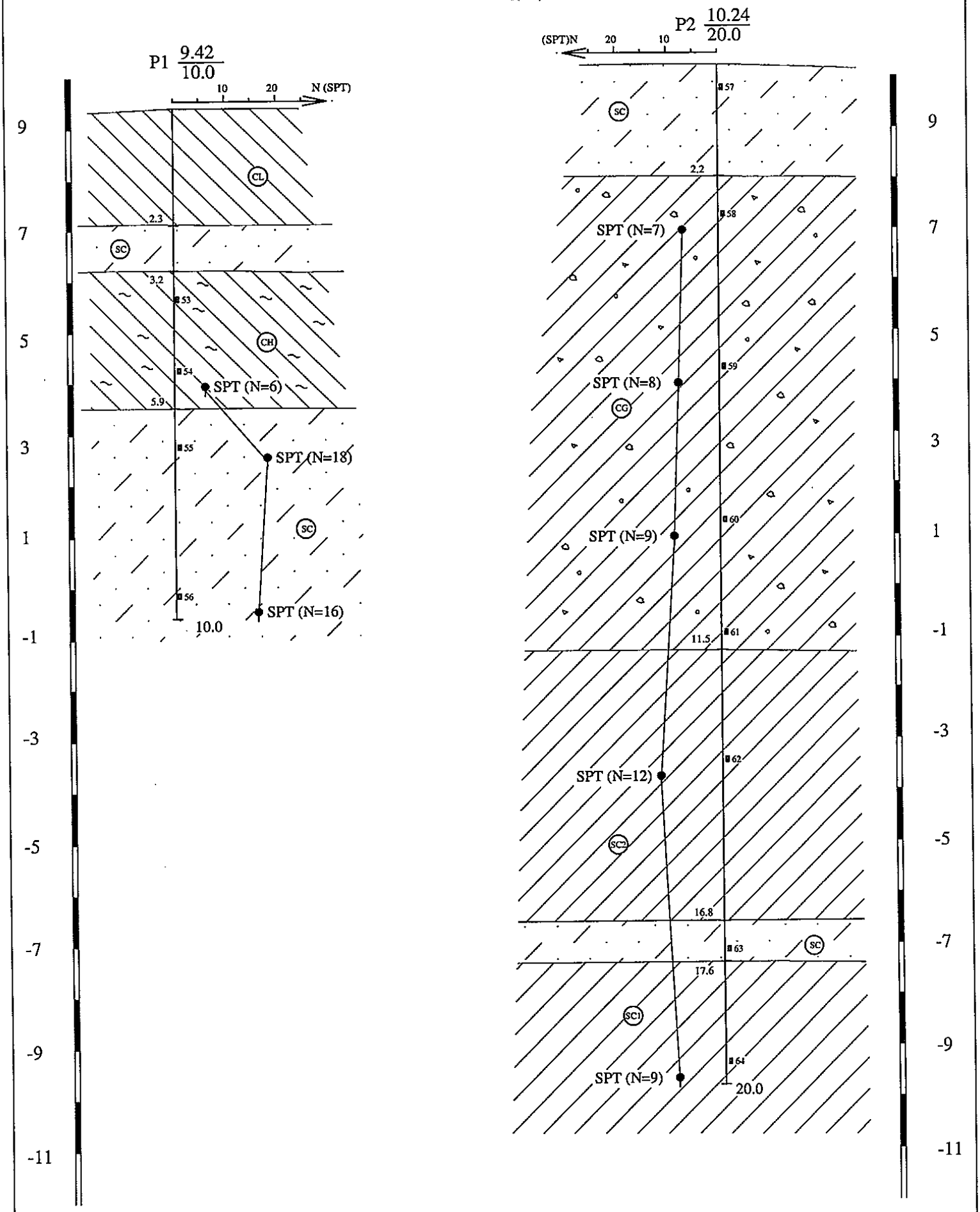


MẶT CẮT ĐỊA CHẤT CÁC HỐ KHOAN P1 - P2

GEOLOGICAL CROSS SECTION BOREHOLE P1 - P2

TỈ LỆ : N = 1 : 5000 , Đ = 1 : 100

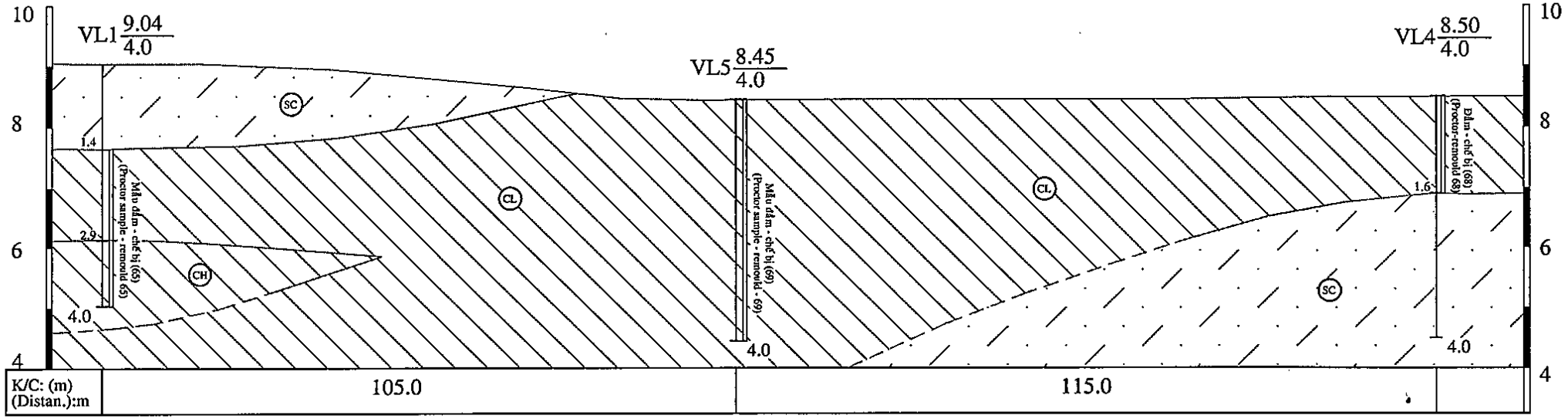
SCALE : HORIZ. = 1 : 5000 , VERTIC. = 1 : 100

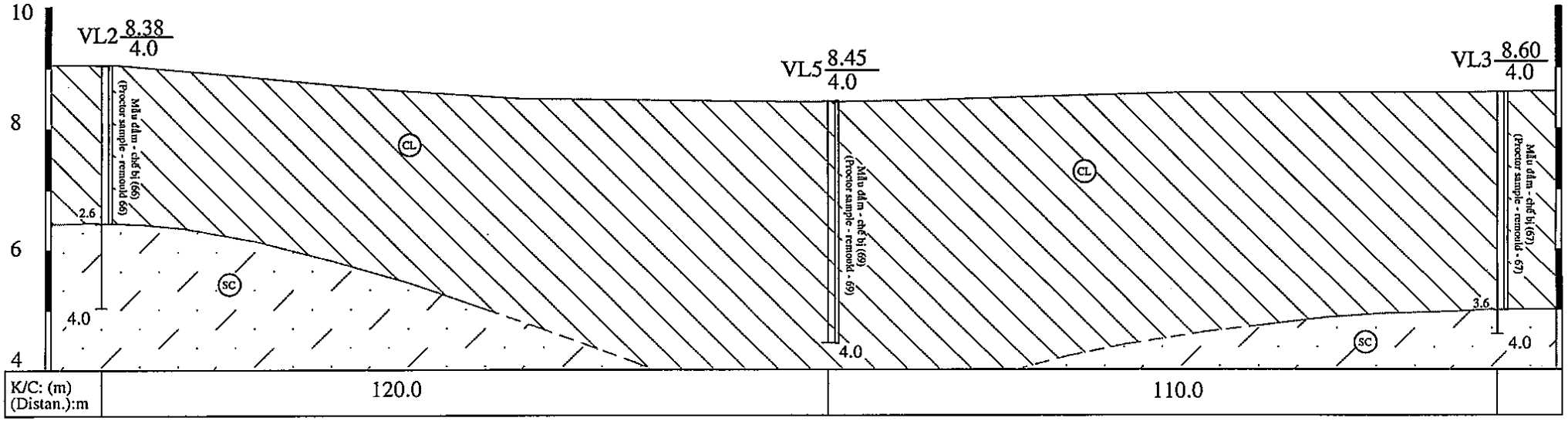


MẶT CẮT ĐỊA CHẤT BÃI V.L.X.D ĐẤT
GEOLOGICAL CROSS SECTION BORROW AREA

TỈ LỆ : N = 1 : 1000 , Đ = 1 : 100

SCALE : HORIZ. = 1 : 1000 , VERTIC. = 1 : 100





GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : D1
Borehole :

- Vị trí (location):Đập đất (earth dam) - Cao độ (elevation) : 6.00
- P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 18-12-2011 - H.thành (complete date):18-12-2011
- Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m
- Mực nước tĩnh : 3.2 m (19/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°19′10″N - 103°57′16″ E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	CL			1.4	1.6				0.0 - 3.0m K = 8.9 x 10^{-6}cm/s	(0.0 - 3.3) m Sét xám vàng loang nâu đỏ, dẻo cứng-nửa cứng. Stiff to medium stiff, yellowish grey, reddish brown clay-silty clay.
2.0				U	U					
3.0		3.3	3.3	2.4	3.0					
4.0	SC2									(3.3 - 6.1) m Á sét trung-nặng màu xám trắng-xám vàng, trạng thái dẻo mềm-dẻo chảy. Plasticity to soft, whitish grey, yellowish grey, sandy clay.
5.0				5.0	5.2					
6.0		6.1	2.8	SPT(5.20-5.65)m				1-1-2 (N=3)		
7.0	SC									(6.1 - 10.0) m Á cát hạt mịn màu xám trắng, chặt vừa, bão hòa nước. Medium dense, water saturated and well graded, whitish grey clayey sand.
8.0				8.0	8.2					
9.0				SPT(8.20-8.65)m				10-15-17 (N=32)		
10.0		10.0	3.9							
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : D3
Borehole :

- Vị trí (location): Đập đất (earth dam)- Cao độ (elevation) : 4.23
- P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 21-12-2011 - H.thành (complete date):21-12-2011
- Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m
- Mực nước tĩnh : 2.6 m (21/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°18'39"N - 103°57'36" E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0										(0.0 - 3.1) m Á sét nặng-sét màu xám vàng, nâu đỏ, xám trắng, dẻo cứng-nửa cứng. Stiff-medium stiff, yellowish grey, reddish brown, whitish grey, sandy clay-clay.
2.0	CL			2.0	2.2					
3.0		3.1	3.1							(3.1 - 8.7) m Á sét trung, màu xám trắng-xám vàng, nâu đỏ, trạng thái dẻo mềm. Plasticity, whitish grey, yellowish grey, reddish brown, sandy clay.
4.0				U	U				3.0 - 6.0m K = 3.4 x 10^{-4} cm/s	
5.0	SC2			4.4 SPT(4.80-5.25)m	4.8			2-3-3 (N=6)		
6.0										
7.0				7.0	7.2					
8.0		8.7	5.6							(8.7 - 10.0) m Á sét nặng màu xám trắng, xám vàng, nâu đỏ, trạng thái dẻo mềm - dẻo cứng. Plasticity to medium stiff, whitish grey, yellowish grey, reddish grey, sandy clay.
9.0	CL			9.3 SPT(9.5-9.95)m	9.5			3-3-5 (N=8)		
10.0		10.0	1.3							
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM	C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang	
	H.TRỤ HỐ KHOAN (BOREHOLE LOG)	Hố khoan : D4 Borehole :

- Vị trí (location):Đập đất (earth dam) - Cao độ (elevation) : 8.22 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 22-12-2011 - H.thành (complete date): 22-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m - Mực nước tĩnh : 1.4 m (22/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°18'50"N - 103°57'57" E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
	SC1	0.7	0.7						0.0 - 2.0 m K=5.2x10⁻⁴cm/s	(0.0 - 0.7) m Á sét trung - nặng màu xám đen, trạng thái nửa cứng. Medium stiff, blackish grey, sandy clay.
	CL	2.1	1.4	U 1.2 SPT(1.60-2.05)m	U 1.6			2-3-4 (N=7)		(0.7 - 2.1) m Sét màu nâu đỏ loang xám vàng, dẻo mềm - dẻo cứng. Plasticity to medium stiff, reddish brown, yellowish grey, clay.
	SW	2.9	0.8							(2.1 - 2.9) m Cát hạt mịn màu xám trắng, bão hòa nước chặt vừa, đều hạt. Medium dense, water saturated, well graded, whitish grey, fines sand.
	SC2	5.9	3.0	4.0	4.2					(2.9 - 5.9) m Á sét trung màu xám vàng, nâu đỏ, xám trắng, dẻo mềm. Plasticity, yellowish grey, reddish brown, whitish grey, sandy clay.
	SC	6.7	0.8	6.4 SPT(6.60-7.05)m	6.6			3-5-8 (N=13)		(5.9 - 6.7) m Á cát hạt mịn màu xám trắng, bão hòa nước, chặt vừa, cát đều hạt. Medium dense, water saturated, well graded, fines sands, whitish grey, clayey sand, sand and clay mixtures.
	CL	10.0	3.3	8.0	8.2					(6.7 - 10.0) m Á sét nặng màu xám trắng, ít nâu đỏ, dẻo mềm, chặt vừa. Plasticity, medium dense, whitish grey, reddish brown, sandy clay- clay.

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : H1
Borehole :

- Vị trí (location): Insite resevoir
- Cao độ (elevation) : 5.99
- P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 22-12-2011
- H.thành (complete date): 22-12-2011
- Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm
- Đ.sâu LK(borehole depth) : 10.0 m
- Mực nước tĩnh : 1.5 m (22/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°18'54"N - 103°57'40" E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC1	2.3	2.3	1.7	1.9				0.0 - 2.0 m K= 7.9 x 10^{-4} cm/s	(0.0 - 2.3) m Á sét nhẹ màu xám trắng, xám vàng,trạng thái nửa cứng (0.0-1.4)m, dẻo mềm (1.4-2.3) m, chặt vừa.
2.0										
3.0	CL	3.4	1.1							Medium stiff (0.0-1.4) m to plasticity (1.4-2.3) m, whitish grey, yellowish grey, slightly sandy clay.
4.0										(2.3 - 3.4) m Sét màu xám nâu đen, trạng thái dẻo mềm chặt vừa. Plasticity, blackish brown, brownish grey, clay.
5.0	SC			5.3	5.5					
6.0										
7.0		7.5	4.1							(3.4 - 7.5) m Cát hạt mịn - á cát màu xám trắng, xám đen, bão hòa nước, đều hạt, chặt vừa. Medium dense, whitish grey, blackish grey, water saturated, well graded, fines sand, and sand-silt-clay mixtures.
8.0	CL	8.2	0.7							(7.5 - 8.2) m Sét màu xám trắng, dẻo mềm-dẻo cứng, chặt vừa. Plasticity - medium stiff, whitish grey clay.
9.0	SC									
10.0		10.0	1.8	9.8	10.0					(8.2 - 10.0) m Á sét nhẹ- á cát, màu xám trắng, cát hạt mịn, chặt vừa, bão hòa nước. Medium dense, whitish grey, clayey sand and sand clay mixtures, fines sand well graded.
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM	C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang	
	H.TRỤ HỐ KHOAN (BOREHOLE LOG)	Hố khoan : H2 Borehole :

- Vị trí (location): Insite resevoir - Cao độ (elevation) : 6.68 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 18-12-2011 - H.thành (complete date): 18-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m - Mực nước tĩnh : 1.5 m (18/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'11"N - 103°57'28" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
		0.3	0.3							
1.0	CL									(0.0 - 0.3) m Sét màu xám đen-đen, nửa cứng,chặt vừa. Medium stiff, blackish grey to black, clay.
2.0		2.4	2.1	1.8	2.0					
	SC1	2.8	0.4							(0.3 - 2.4) m Sét màu xám trắng, nâu đỏ, trạng thái dẻo mềm - dẻo cứng. Plasticity to medium stiff, whitish grey, reddish grey, clay.
3.0	CH	3.6	0.8							
4.0	SC1			4.6	4.8					
5.0		5.6	2.0							
6.0	SC									(2.4 - 2.8) m Á sét trung - nhẹ màu hồng nhạt, mềm bở, chặt vừa. Plasticity, medium dense, light pink, sandy clay.
7.0		7.3	1.7							
8.0	SC2									(2.8 - 3.6) m Sét màu xám đen, dẻo mềm, chặt vừa. Plasticity to soft, blackish grey, clay.
9.0				9.3	9.5					
10.0		10.0	2.7							(3.6 - 5.6) m Á sét nhẹ-trung, màu xám trắng, nâu đỏ, xám vàng, chặt vừa, dẻo mềm. Plasticity, medium dense, whitish grey, reddish brown, yellowish grey, sandy clay.
11.0										
12.0										
13.0										(5.6 - 7.3) m Á cát màu nâu đỏ, xám đen, chặt vừa,bão hòa nước, cát mịn, đều hạt. Medium dense, reddish brown, blackish grey, water saturated, fines sand, well graded.
14.0										
15.0										
16.0										
17.0										(7.3 - 10.0) m Á sét trung màu xám trắng, xám nhạt, dẻo mềm, chặt vừa. plasticity, medium dense, whitish grey, light grey, sandy clay.
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : H3
Borehole :

- Vị trí (location): Insite resevoir
- Cao độ (elevation) : 6.60
- P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 22-12-2011 - H.thành (complete date): 22-12-2011
- Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m
- Mực nước tĩnh : 1.3 m (22/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°18'48"N - 103°57'51" E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	CL	1.7	1.7	1.0	1.2					(0.0 - 1.7) m Sét màu nâu đỏ, xám vàng, trạng thái dẻo cứng-nửa cứng. Medium stiff to stiff, reddish brown, yellowish grey, clay.
2.0										
3.0										
4.0				3.8	4.0					(1.7 - 7.6) m Á sét nhẹ màu xám trắng, xám nhạt, dẻo mềm, chặt vừa. Plasticity, whitish grey, light grey, slightly sandy clay.
5.0	SC1									
6.0										
7.0		7.6	5.9							(7.6 - 9.1) m Á cát - cát hạt mịn màu xám trắng nhạt, bão hòa nước - cát đều hạt, chặt vừa. Medium dense, light whitish grey, water saturated, well graded, clayey sand-sand.
8.0	SC			8.0	8.2					
9.0		9.1	1.5							(9.1 - 10.0) m Á sét trung-nặng màu xám trắng nhạt, dẻo mềm, chặt vừa. Plasticity, medium dense, light whitish grey, sandy clay.
10.0	SC2	10.0	0.9							
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : H4
Borehole :

- Vị trí (location): Insite resevoir - Cao độ (elevation) : 8.99 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 19-12-2011 - H.thành (complete date): 19-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m - Mực nước tĩnh : 1.8 m (19/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'10"N - 103°57'50" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC1	2.1	2.1	1.4	1.6					(0.0 - 2.1) m Á sét nhẹ màu xám trắng, xám vàng, nâu đỏ, chặt vừa. Medium dense, whitish grey, yellowish grey, slightly sandy clay, sand-silt-clay mixtures.
3.0	CL	4.1	2.0							(2.1 - 4.1) m Sét màu nâu đỏ, xám vàng, dẻo cứng-nửa cứng, chặt. Medium stiff to stiff, reddish brown, yellowish grey, clay.
4.0	CH	4.8	0.7							
5.0	SC	6.0	1.2							
6.0	SC2	9.0	3.0	6.3	6.5					(4.1 - 4.8) m Sét - á sét nặng màu xám đen, dẻo mềm, dẻo chảy, kém chặt. Plasticity to soft, blackish grey, clay-sandy clay.
9.0	CL	10.0	1.0	9.0	9.2					(4.8 - 6.0) m Á cát hạt mịn màu xám trắng, chặt vừa, bão hòa nước. Medium dense, whitish grey, water saturated, clayey sand.
10.0										(6.0 - 9.0) m Á sét nhẹ-trung màu xám trắng, dẻo mềm, chặt vừa. Plasticity, medium dense, whitish grey, slightly sandy clay - sandy clay.
15.0										(9.0 - 10.0) m Sét màu nâu đỏ, nâu nhạt, dẻo mềm. Plasticity, reddish brown, light brown, clay.
20.0										

Kỹ thuật theo dõi : Trương Đình Luân
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Kiểm tra : Bùi Lộc
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GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : H5
Borehole :

- Vị trí (location): Insite resevoir - Cao độ (elevation) : 6.58 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 21-12-2011 - H.thành (complete date): 21-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m - Mực nước tĩnh : 1.5 m (21/12/2011)
- Tọa độ GPS (Coordinate) : 10°18'48"N - 103°57'32" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC	2.7	2.7	0.4	0.6					(0.0 - 2.7) m Á cát nặng-á sét nhẹ màu xám vàng, nâu đỏ, chặt vừa, nửa cứng. Medium dense and stiff, yellowish grey, reddish brown, clayey sand.
3.0	CL	5.2	2.5	3.5	3.7					(2.7 - 5.2) m Sét màu nâu đỏ, xám nâu, dẻo cứng-nửa cứng, chặt. Medium stiff to stiff, reddish brown, brownish grey, clay.
6.0	SC	10.0	4.8	7.5	7.7					(5.2 - 10.0) m Á cát - cát hạt mịn màu xám trắng, phớt vàng, bão hòa nước, đều hạt, chặt vừa. Medium dense, water saturated, well graded, whitish grey, light yellow, clayey sand, sand - silt - clay mixtures.
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : T1
Borehole :

- Vị trí (location): Tr.Bơm (Pumping station) - Cao độ (elevation) : 6.09 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 20-12-2011 - H.thành (complete date):20-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 18.0 m - Mực nước tĩnh : 3.2 m (20/12/2011) (Groundwater level)
- Tọa độ GPS (Coordinate) : 10°18'38"N - 103°57'12" E

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC	2.6	2.6	0.8	1.0					(0.0 - 2.6) m Á cát-á sét nhẹ màu xám trắng,xám vàng, chặt vừa, cát hạt mịn. Medium dense, whitish grey, yellowish grey, clayey sand, well graded sand.
3.0	SW	11.3	8.7	4.3 SPT(4.50-4.95)m	4.5			4-7-8 (N=15)		(2.3 - 11.3) m Cát hạt mịn - vừa màu xám trắng, phớt vàng, bão hòa nước, chặt vừa. Trong lớp có chỗ lẫn ít sỏi nhỏ thạch anh. Medium dense, whitish grey, light yellow, well graded, fines to medium sand, with a little quartz gravels mixtures.
7.0				7.2 SPT(7.40-7.85)m	7.4			5-13-19 (N=32)		(11.3 - 15.8) m Tàn tích cát kết, đất á sét nặng xen kẹp nhiều chỗ á sét nhẹ - á cát hạt mịn-vừa, lẫn ít dăm sạn cát kết, màu nâu đỏ, xám vàng, xám trắng, dẻo cứng-nửa cứng. Từ 11.3-12.0m lẫn nhiều dăm sạn. Residual origin (complete weathered sandstone) medium stiff to stiff, yellowish grey, reddish brown, whitish grey, sandy clay with a little sandstone gravel, clayey sand mixtures in some place. Gravels mixtures much 11.3 - 12.0m.
11.0				10.0 SPT(10.0-10.45)m	10.2			7-9-12 (N=21)		
12.0	CI	15.8	4.5	14.3 SPT(14.5-14.95)m	14.5			7-5-6 (N=11)		(15.8 - 18.0) m Đá cát kết phong hóa mạnh, màu xám nâu vàng, nâu nhạt, có chỗ đã phong hóa thành đất, nửa cứng. Nõn đá cứng trung bình. Moderately weak, browish yellowish grey, highly weathered (H.W) sandstone. Complete weathered (C.W) sandstone is medium stiff soil in some place.
16.0	HW	18.0	2.2							
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : T2
Borehole :

- Vị trí (location): Tr.Bơm (Pumping station) - Cao độ (elevation) : 6.02 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 20-12-2011 - H.thành (complete date):20-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 22.0 m - Mực nước tĩnh : 3.0 m (20/12/2011)
- Tọa độ GPS (Coordinate) : 10°18'36"N - 103°57'14" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC									(0.0 - 2.1) m Á cát - á sét nhẹ màu xám vàng nhạt, xám trắng, chặt vừa. Cát hạt mịn , đều hạt. Medium dense, well graded, fines sand, light yellowish grey, whitish grey, clayey sand, sand-silt-clay mixtures.
2.0		2.1	2.1							
3.0	CL	3.5	1.4	U - U 2.8 SPT(3.20-3.65)m	3.2			4-7-9 (N=16)		(2.1 - 3.5) m Sét màu xám trắng, xám nâu, nửa cứng. Medium stiff, whitish grey, brownish grey, clay.
4.0										
5.0										
6.0	SW			6.1 SPT(6.30-6.75)m	6.3			4-6-9 (N=15)		(3.5 - 8.5) m Cát hạt mịn - vừa màu xám trắng, phớt vàng, bão hòa nước, chặt vừa. Trong lớp có chỗ lẫn ít sỏi nhỏ thạch anh. Medium dense, whitish grey, light yellow, well graded, water saturated, fines to medium sand, with a little quartz gravels mixtures.
7.0										
8.0		8.5	5.0							
9.0	CL	9.5	1.0	9.3	9.5					(8.5 - 9.5) m Sét màu nâu nhạt, nâu đỏ, dẻo mềm - dẻo cứng. Plasticity to medium stiff, light brown, reddish brown, clay.
10.0	SC			SPT(9.50-9.95)m				6-8-12 (N=20)		
11.0										(9.5 - 12.6) m Á cát-cát hạt mịn màu xám trắng, nâu đỏ, chặt vừa, bão hòa nước, cát đều hạt. Medium dense, water saturated, well graded, whitish grey, reddish brown, clayey sand.
12.0		12.6	3.1	11.8 SPT(12.0-12.45)m	12.0			5-10-14 (N=24)		
13.0	CG									(12.6 - 17.8) m Á sét nhẹ - á cát lẫn nhiều dăm sạn, màu nâu đỏ, xám vàng, chặt, nửa cứng. Medium stiff, dense, reddish brown, yellowish grey, slightly sandy clay to clayey sand, with gravel mixtures.
14.0										
15.0										
16.0				16.4 SPT(16.6-17.05)m	16.6			6-7-9 (N=16)		
17.0		17.8	5.2							
18.0	CL1									(17.8 - 22.0) m Tàn tích cát kết, đất á sét nặng màu nâu đỏ, xám vàng, trạng thái dẻo cứng - nửa cứng. Residual origin (complete weathered sandstone) medium stiff to stiff, yellowish grey, reddish brown, whitish grey, sandy clay.
19.0				19.3 SPT(19.5-19.95)m	19.5			4-5-7 (N=12)		
20.0										
21.0										
22.0		22.0	4.2	21.8	22.0					

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : T3
Borehole :

- Vị trí (location): Trạm bơm(Pumping station) - Cao độ (elevation) : 8.32 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 17-12-2011 - H.thành (complete date):17-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 20.0 m - Mực nước tĩnh : 3.6 m (17/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'27"N - 103°57'40" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC1	2.6	2.6	0.3	0.5				1.0 - 2.5m K=5.5 x 10⁻⁴cm/s	(0.0 - 2.6) m Á sét nhẹ -trung màu màu xám vàng nhạt, nâu đỏ, nửa cứng, chặt vừa. Stiff to medium stiff, medium dense, light yellowish grey, sandy clay.
3.0	SC	5.1	2.5	4.2	4.4 SPT(4.40-4.85)m			4-9-10 (N=19)		(2.6 - 5.1) m Á sét nhẹ- á cát nặng hạt mịn,màu xám phớt vàng, bão hòa nước, chặt vừa. Medium dense, water saturated, light yellowish grey, fines sand, clayey sand to slightly sandy clay.
6.0	SC2	9.5	4.4	7.4	7.6 SPT(7.60-8.05)m			2-4-4 (N=8)		(5.1 - 9.5) m Á sét trung màu xám trắng, phớt vàng, dẻo mềm - dẻo cứng, chặt vừa. Plasticity - mediumstiff, medium dense, whitish grey, light yellow, sandy clay.
9.0										(9.5 - 12.0) m Á cát hạt mịn - cát, màu xám trắng, phớt vàng, chặt vừa, bão hòa nước.
12.0	SC	12.0	2.5	10.1	10.3 SPT(10.3-10.75)m			5-9-13 (N=22)		Medium dense, water saturated, whitish grey, light yellow, fines and well graded sand, clayey sand to sand.
	CL	12.8	0.8	12.6	12.8 SPT(12.8-13.25)m			4-12-19 (N=31)		(12.0 - 12.8) m Á sét nặng - sét màu xám trắng, nâu, dẻo mềm, chặt vừa. Plasticity, medium dense, whitish grey, brown, sandy clay to clay.
15.0	SC	17.0	4.2	16.0	16.2 SPT(16.2-16.65)m			6-15-21 (N=36)		(12.8 - 17.0) m Á cát hạt mịn - cát màu xám trắng, phớt vàng, chặt vừa, bão hòa nước. Medium dense, water saturated, whitish grey, light yellow, fines and well graded sand, clayey sand to sand.
18.0	CL	18.6	1.6							(17.0 - 18.6) m Á sét nặng - sét màu nâu trắng, nâu hồng, dẻo mềm, chặt vừa. Plasticity, medium dense, whitish grey, brown, sandy clay to clay.
20.0	SC	20.0	1.4	19.8	20.0					(18.6 - 20.0) m Á cát hạt mịn - cát màu xám trắng, phớt vàng, chặt vừa, bão hòa nước. Medium dense, water saturated, whitish grey, light yellow, fines and well graded sand, clayey sand to sand.

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : T4
Borehole :

- Vị trí (location): Trạm bơm(Pumping station) - Cao độ (elevation) : 8.33 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 16-12-2011 - H.thành (complete date):17-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 20.0 m - Mực nước tĩnh : 3.5 m (17/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'26"N - 103°57'42" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC1	1.9	1.9						0.0 - 1.9m K=1.05x10⁻³cm/s	(0.0 - 1.9) m Á cát - á sét nhẹ màu xám trắng, chặt vừa Medium dense, whitish grey, clayey sand to slightly sandy clay.
2.0										
3.0	CL	5.2	3.3	3.6 SPT(3.80-4.25)m	3.8			3-4-5 (N=9)		(1.9 - 5.2) m Sét màu nâu đỏ, xám vàng, dẻo cứng-nửa cứng, chặt. Stiff - medium stiff, dense, reddish brown, yellowish grey, clay.
4.0										
5.0										
6.0	SC2	9.4	4.2	5.6 SPT(5.80-6.25)m	5.8 8.8 SPT(9.00-9.45)m			1-1-2 (N=3) 3-4-6 (N=10)		(5.2 - 9.4) m Á sét nặng-trung màu xám trắng, xám nâu, dẻo mềm - rất mềm, chặt vừa. Plasticity, medium dense, whitish grey, brownish grey, sandy clay. (9.4 - 11.2) m Sét - á sét nặng màu xám trắng, dẻo cứng-dẻo mềm. Medium stiff to plasticity, whitish grey, clay to sandy clay.
7.0										
8.0										
9.0										
10.0	CL	11.2	1.8	10.7	10.9					(11.2 - 13.5) m Á cát-cát hạt mịn màu xám trắng, bão hòa nước, chặt vừa, cát đều hạt. Medium dense, water saturated, well graded, clayey sand to fines sand.
11.0										
12.0	SC	13.5	2.3	SPT(12.6-13.05)m				3-4-6 (N=10)		(13.5 - 18.2) m Sét màu nâu đỏ, xám trắng, dẻo cứng- nửa cứng, chắc. Medium stiff to stiff, reddish brown, whitish grey, clay.
13.0										
14.0				14.5	14.7					
15.0				SPT(14.7-15.15)m				4-5-7 (N=12)		
16.0	CL									(18.2 - 20.0) m Á cát hạt mịn - cát màu xám trắng, nâu đỏ, chặt vừa, bão hòa nước, đều hạt. Medium dense, water saturated, whitish grey, light yellow, fines and well graded sand, clayey sand to sand.
17.0										
18.0		18.2	4.7							
19.0	SC	20.0	1.8	18.8 SPT(19.0-19.45)m	19.0			14-17-18 (N=35)		
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : P1
Borehole :

- Vị trí (location): NMXLN(water treatment sta.) - Cao độ (elevation) : 9.42 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 19-12-2011 - H.thành (complete date):19-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 10.0 m - Mực nước tĩnh : 1.9 m (19/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'17"N - 103°58'05" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
		0.4	0.4							(0.0 - 0.4) m Á sét trung màu xám trắng, nửa cứng, chặt vừa. Medium stiff, medium dense, whitish grey, sandy clay.
1.0	CL									
2.0		2.3	1.9							
3.0	SC	3.2	0.9							(0.4 - 2.3) m Sét-á sét nặng màu xám trắng-xám vàng, nâu đỏ, trạng thái dẻo cứng-nửa cứng. Medium stiff to stiff, whitish grey, yellowish grey, reddish brown, clay-sandy clay.
4.0	C.H			U 3.4	U 3.8					
5.0				5.0 SPT(5.20-5.65)m	5.2			1-2-4 (N=6)		
		5.9	2.7							(2.3 - 3.2) m Á cát hạt mịn màu xám trắng, nâu đỏ, chặt vừa, bão hòa nước. Medium dense, whitish grey, reddish brown, water saturated, clayey sand, well graded sands.
6.0	SC			6.5 SPT(6.70-7.05)m	6.7			5-7-11 (N=18)		
7.0										
8.0										
9.0				9.4	9.6			4-6-10 (N=16)		(3.2 - 5.9) m Sét bùn màu xám đen, xám nâu đen, dẻo mềm-dẻo chảy, từ 5.5-5.7m kẹp á sét nhẹ. Soft to plasticity, blackish grey, brownish grey, mudy clay to clay. From 5.5 to 5.7m, clayey sand mixtures.
10.0		10.0	4.1							
11.0										(5.9 - 10.0) m Á cát-cát hạt mịn màu xám trắng, phớt vàng chặt vừa, bão hòa nước. trong lớp đôi chỗ lẫn ít mùn xác thực vật. Medium dense, whitish grey, light yellow, water saturated, clayey sand to sand, well graded sands, a little organic mixtures some place.
12.0										
13.0										
14.0										
15.0										
16.0										
17.0										
18.0										
19.0										
20.0										
21.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : P2
Borehole :

- Vị trí(location):nmxl n.thải(water sewerage sta.) - Cao độ (elevation) : 10.24 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 24-12-2011 - H.thành (complete date):24-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 20.0 m - Mực nước tĩnh : 2.2 m (24/12/2011)
- Tọa độ GPS (Coordinate) : 10°16'16"N - 103°56'16" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chân lớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
	SC	2.2	2.2	0.3	0.5					(0.0 - 2.2) m Á cát nặng-á sét nhẹ màu xám vàng, nửa cứng, chặt vừa. Medium stiff, medium dense, yellowish grey, clayey sand.
	CG	11.5	9.3	2.8 SPT(3.00-3.45)m	3.0			2-3-4 (N=7)		(2.2 - 11.5) m Á sét nhẹ-trung lẫn dăm sạn, màu nâu đỏ, xám trắng, xám vàng, trạng thái dẻo cứng. Medium stiff, reddish brown, whitish grey, yellowish grey, sandy clay to clayey sand, with gravels.
				5.8 SPT(6.00-6.45)m	6.0			2-3-5 (N=8)		(11.5 - 16.8) m Á sét trung -nặng màu xám vàng, nâu đỏ, trạng thái nửa cứng. Medium stiff to stiff, yellowish grey, reddish brown, sandy clay.
				8.8 SPT(9.00-9.45)m	9.0			2-4-5 (N=9)		(16.8 - 17.6) m Á cát hạt mịn màu xám vàng. nâu đỏ, cát đều hạt, bão hòa nước, chặt vừa. Medium dense, water saturated, well graded, yellowish grey, reddish brown, clayey sand.
				U 10.8	U 11.2					
	SC2	16.8	5.3	U 13.3 SPT(13.7-14.05)m	U 13.7			3-5-7 (N=12)		(17.6 - 20.0) m Á sét nhẹ màu xám vàng, nâu đỏ, trạng thái nửa cứng-dẻo cứng. stiff to medium stiff, yellowish grey, reddish brown, sandy clay.
	SC	17.6	0.8	17.2	17.4					
	SC1	20.0	2.4	19.4 SPT(19.6-20.05)m	19.6			3-4-5 (N=9)		

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

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C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : VL1
Borehole :

- Vị trí (location): Bãi VL (borrow area) - Cao độ (elevation) : 9.04 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 23-12-2011 - H.thành (complete date): 23-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 4.0 m - Mực nước tĩnh : 1.1 m (23/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'07"N - 103°57'58" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	SC	1.4	1.4							(0.0 - 1.4) m Á cát nhẹ màu xám trắng, xám vàng, nâu đỏ, chặt vừa. Medium dense, whitish grey, yellowish grey, clayey sand, sand-silt-clay mixtures.
2.0	CL	2.9	1.5	1.4	4.0					(1.4 - 2.9) m Sét - á sét nặng màu nâu đỏ, xám trắng xám vàng, dẻo mềm-dẻo cứng. Plasticity to medium stiff, reddish brown, yellowish grey, whitish grey, clay-sandy clay.
3.0	CH	4.0	1.1	Proctor sample and remould						(2.9 - 4.0) m Sét màu xám đen, xám vàng, dẻo mềm, chặt vừa. Plasticity, medium dense, blackish grey, yellowish grey, clay.
4.0										
5.0										
6.0										
7.0										

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : VL2
Borehole :

- Vị trí (location): Bãi VL (borrow area) - Cao độ (elevation) : 8.38 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 23-12-2011 - H.thành (complete date): 23-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 4.0 m - Mực nước tĩnh : 1.0 m (23/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'08"N - 103°57'52" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	CL	2.6	2.6	0.0	2.6					(0.0 - 2.6) m Á sét trung-nặng màu xám trắng, xám vàng, nâu đỏ, dẻo cứng, chặt vừa. Medium stiff, medium dense, whitish grey, yellowish grey, reddish brown, sandy clay.
2.0				Proctor sample and remould						
3.0	SC	4.0	1.4							(2.6 - 4.0) m Á cát hạt mịn-vừa màu xám vàng, bão hòa nước, cát đều hạt, chặt vừa. Medium dense, water saturated,well graded, fines sand, yellowish grey, clayey sand to sand.
4.0										
5.0										
6.0										
7.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : VL3
Borehole :

- Vị trí (location): Bãi VL (borrow area) - Cao độ (elevation) : 8.60 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 23-12-2011 - H.thành (complete date): 23-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 4.0 m - Mực nước tĩnh : 1.3 m (23/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'02"N - 103°57'59" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0 2.0 3.0 4.0 5.0 6.0 7.0	CL	3.6	3.6	0.0 Proctor sample and remould	3.6					(0.0 - 3.6) m Sét - á sét nặng màu xám trắng, xám vàng, ít nâu đỏ, dẻo mềm-dẻo cứng. Plasticity to medium stiff, reddish brown, yellowish grey, whitish grey, clay-sandy clay.
	SC	4.0	0.4							(3.6 - 4.0) m Á cát nhẹ hạt mịn màu xám trắng, xám vàng, chặt vừa. Medium dense, whitish grey, yellowish grey, clayey sand, fines sands-silt-clay mixtures.

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : VL4
Borehole :

- Vị trí (location): Bãi VL (borrow area) - Cao độ (elevation) : 8.50 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 23-12-2011 - H.thành (complete date): 23-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 4.0 m - Mực nước tĩnh : 1.0 m (23/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'08"N - 103°57'52" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0 2.0 3.0 4.0 5.0 6.0 7.0	CL	1.6	1.6	0.0 Proctor sample and remould	1.6					(0.0 - 1.6) m Sét-á sét nặng màu xám trắng, xám vàng, nâu đỏ, dẻo cứng, chặt vừa. Medium stiff, medium dense, whitish grey, yellowish grey, reddish brown, clay-sandy clay.
	SC	4.0	2.4							(1.6 - 4.0) m Á cát hạt mịn-vừa màu xám vàng, bão hòa nước, cát đều hạt, chặt vừa. Medium dense, water saturated,well graded, fines sand, yellowish grey, clayey sand to sand.

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan : VL5
Borehole :

- Vị trí (location): Bãi VL (borrow area) - Cao độ (elevation) : 8.45 - P.P. Khoan(Dril.method):K.máy (Rota.)
- Ngày k.công (start date): 23-12-2011 - H.thành (complete date): 23-12-2011 - Tổ khoan (drill.team): ĐC1
- Đ.kính LK(borehole diame.) : 91mm - Đ.sâu LK(borehole depth) : 4.0 m - Mực nước tĩnh : 1.0 m (23/12/2011)
- Tọa độ GPS (Coordinate) : 10°19'03"N - 103°57'55" E (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0	CL.	0.5	0.5	0.0 Proctor sample and remould	4.0					(0.0 - 0.5) m Sét màu xám đen, xám trắng, cứng, chặt. Hard to medium stiff, blackisk grey, whitish grey, clay.
2.0										
3.0										(0.5 - 4.0) m Sét màu nâu đỏ, xám trắng, xám vàng, trạng thái dẻo cứng-nửa cứng. Medium stiff to stiff, reddish brown,whitish grey, yellowish grey, clay.
4.0		4.0	3.5							
5.0										
6.0										
7.0										

GEOLOGICAL SURVEY TEAM

C.T (Project): HTCC Nước & XL Nước Thải-Water Supply And Sewerage Treatment System in Phú Quốc-Kiên Giang

H.TRỤ HỐ KHOAN (BOREHOLE LOG)

Hố khoan :
Borehole :

- Vị trí (location): - Cao độ (elevation) : - P.P. Khoan(Dril.method):
- Ngày k.công (start date): - H.thành (complete date): - Tổ khoan (drill.team):
- Đ.kính LK(borehole diame.) : - Đ.sâu LK(borehole depth) : - Mực nước tĩnh :
- Tọa độ GPS (Coordinate) : (Groundwater level)

Tỷ Lệ Scale 1/100	Ký hiệu tên lớp Layer	Độ sâu chânlớp Depth m	Bề dày lớp thickness m	Lấy mẫu Sampling Từ from m	Lấy mẫu Sampling Đến to m	Ký hiệu thạch học Geology Legend	RQD >10cm	Thí nghiệm SPT	TN đổ nước Water pouring	MÔ TẢ THẠCH HỌC Soil Description
1.0										
2.0										
3.0										
4.0										
5.0										
6.0										
7.0										

Kỹ thuật theo dõi : Trương Đình Luân
Site supervisor by

Kiểm tra : Bùi Lộc
Checked by :

GEOLOGICAL SURVEY TEAM

CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG

THÍ NGHIỆM THẤM HIỆN TRƯỜNG
FIELD PERMEABILITY TEST

Hố (Borehole): **D1**

14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) | P.P.T.N (Test Methode): **Water Pouring** | Tổ (Drill. Team): ĐC1

Khởi công(Start date): 18/12/2011 | Hoàn thành (Complete date):18/12/2011 | ĐK hố khoan: 0.091m

Height of casing: Gauge | Mực nước (groundwater): 3.2 m | Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ đi Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	0.0-3.0	3.0	7:00	10	0.52	0.05	1.5	0.035
				10	0.45	0.05		0.030
				10	0.40	0.04		0.027
				10	0.35	0.04		0.023
				10	0.35	0.04		0.023
				10	0.35	0.04		0.023

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 4.498

Q = 0.052 m^3/ngđ

K = **0.00774** m/ngđ

K = **8.95 x10 $^{-6}$** cm/s

TÊN LỚP THÍ NGHIỆM : Sét nâu đỏ (CL1)

LAYER TESTING : Clay to silty clay (CL1)

GEOLOGICAL SURVEY TEAM

CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG

THÍ NGHIỆM THẤM HIỆN TRƯỜNG
FIELD PERMEABILITY TEST

Hố (Borehole): **D3**

14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) | P.P.T.N (Test Methode): **Water Pouring** | Tổ (Drill. Team): ĐC1

Khởi công(Start date): 21/12/2011 | Hoàn thành (Complete date):21/12/2011 | ĐK hố khoan: 0.091m

Height of casing: Gauge | Mực nước (groundwater): 2.6 m | Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ đi Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	3.0-6.0	3.0	10:00	10	38.0	3.80	2.8	1.357
				10	33.0	3.30		1.179
				10	29.0	2.90		1.036
				10	27.0	2.70		0.964
				10	26.0	2.60		0.929
				10	26.0	2.60		0.929

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 4.498

Q = 3.744 m^3/ngđ

K = **0.29728** m/ngđ

K = **3.44 x10 $^{-4}$** cm/s

TÊN LỚP THÍ NGHIỆM : Á sét trung (SC2)

LAYER TESTING : Sandy clay (SC2)

NGƯỜI LẬP : Trương Đình Luân

Calculated by:

NGƯỜI KIỂM TRA : Bùi Lộc

Checked by :

GEOLOGICAL SURVEY TEAM	CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG	
	THÍ NGHIỆM THẤM HIỆN TRƯỜNG	Hố (Borehole): D4
	FIELD PERMEABILITY TEST	14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) P.P.T.N (Test Methode): **Water Pouring** Tổ (Drill. Team): ĐC1

Khởi công(Start date): 22/12/2011 Hoàn thành (Complete date):22/12/2011 ĐK hố khoan: 0.091m

Height of casing: Gauge Mực nước (groundwater): 1.4 m Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ đi Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	0.0-2.0	2.0	8:00	10	18.0	1.80	1.4	1.286
				10	16.2	1.62		1.080
				10	15.0	1.50		1.000
				10	14.6	1.46		0.973
				10	14.2	1.42		0.947
				10	14.2	1.42		0.947

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 3.320

Q = 2.088 m^3/ngđ

K = **0.44923** m/ngđ

K = **5.20 x10 $^{-4}$** cm/s

TÊN LỚP THÍ NGHIỆM : Á sét trung -sét nâu đỏ (SC1 - CL1)

LAYER TESTING : sandy clay to clay (SC1 - CL1)

GEOLOGICAL SURVEY TEAM	CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG	
	THÍ NGHIỆM THẤM HIỆN TRƯỜNG	Hố (Borehole): H1
	FIELD PERMEABILITY TEST	14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) P.P.T.N (Test Methode): **Water Pouring** Tổ (Drill. Team): ĐC1

Khởi công(Start date): 22/12/2011 Hoàn thành (Complete date):22/12/2011 ĐK hố khoan: 0.091m

Height of casing: Gauge Mực nước (groundwater): 1.5 m Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ đi Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	0.0-2.5	2.5	13:00	10	38.0	3.80	1.5	2.533
				10	33.0	3.30		1.179
				10	30.0	3.00		1.071
				10	28.0	2.80		1.000
				10	28.0	2.80		1.000
				10	28.0	2.80		1.000

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 3.919

Q = 4.032 m^3/ngđ

K = **0.68593** m/ngđ

K = **7.94 x10 $^{-4}$** cm/s

TÊN LỚP THÍ NGHIỆM : Á sét nhẹ (SC1)

LAYER TESTING : Slightly sandy clay (SC1)

NGƯỜI LẬP : Trương Đình Luân NGƯỜI KIỂM TRA : Bùi Lộc

Calculated by: Checked by :

GEOLOGICAL SURVEY TEAM

CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG

THÍ NGHIỆM THẤM HIỆN TRƯỜNG
FIELD PERMEABILITY TEST

Hố (Borehole): T3

14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) P.P.T.N (Test Methode): Water Pouring Tổ (Drill. Team): ĐC1

Khởi công(Start date): 17/12/2011 Hoàn thành (Complete date):17/12/2011 ĐK hố khoan: 0.091m

Height of casing: 0.5m Gauge Mực nước (groundwater): 3.6 m Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ dài Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	1.0-2.5	1.5	14:00	10	31.0	3.10	2.25	1.378
				10	28.0	2.80		1.867
				10	24.0	2.40		1.600
				10	20.0	2.00		1.333
				10	18.0	1.80		1.200
				10	18.0	1.80		1.200

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 2.695

Q = 2.880 m^3/ngđ

K = **0.47497** m/ngđ

K = **5.50 x10 $^{-4}$** cm/s

TÊN LỚP THÍ NGHIỆM : Á sét nhẹ - trung (SC)

LAYER TESTING : Slightly sandy clay (SC)

GEOLOGICAL SURVEY TEAM

CT (Project):HTCC &XLNước Thải-Water Supply and Sewerage Treatment System in Phu Quôc -KG

THÍ NGHIỆM THẤM HIỆN TRƯỜNG
FIELD PERMEABILITY TEST

Hố (Borehole): T4

14TCN153:2006(STANDARD)

Hạng mục (Item): Đập đất (Earth dam) P.P.T.N (Test Methode): Water Pouring Tổ (Drill. Team): ĐC1

Khởi công(Start date): 16/12/2011 Hoàn thành (Complete date):16/12/2011 ĐK hố khoan: 0.091m

Height of casing: Gauge Mực nước (groundwater): 3.5 m Bore. diame(m) : 0.091

Đoạn TN Test N°	Từ - đến From-to (m)	Độ dài Leng L (cm)	Th. gian(time) bắt đầu (giờ-phút)	Th. gian(time) Elapsed T(min)	Tiêu hao water loss V(litre)	L.lượng discharg Q(l/min)	Áp lực Pressu. m	L.lượng đơn vị q (l/min)
1	0.0-1.9	1.9	10:00	5	44.0	8.80	2.8	3.143
				5	39.0	7.80		2.786
				5	35.0	7.00		2.500
				5	32.0	6.40		2.286
				5	29.0	5.80		2.071
				5	28.0	5.60		2.000
				5	28.0	5.60		2.000
				5	28.0	5.60		2.000

KẾT QUẢ (RESULT)

CÔNG THỨC (FORMULA)

$$K = \frac{Q}{F \times H}$$

Trong đó Q - Lưu lượng (discharg)

F - hệ số đáy H - Áp lực (total pressure)

F: bottom coefficient

K: hệ số thấm (permeability coefficient)

KẾT QUẢ (RESULT)

F = 3.197

Q = 8.136 m^3/ngđ

K = **0.90880** m/ngđ

K = **1.05 x10 $^{-3}$** cm/s

TÊN LỚP THÍ NGHIỆM : Á cát, á sét nhẹ (SC)

LAYER TESTING : Clayey sand - slightly sandy clay (SC)

NGƯỜI LẬP : Trương Đình Luân

Calculated by:

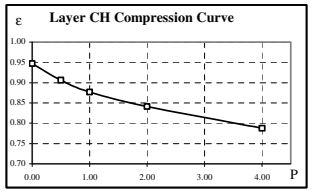
NGƯỜI KIỂM TRA : Bùi Lộc

Checked by :

BÅNG TOÅNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT NGUYEÂN DAÏNG - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF UNDISTURBED SAMPLES

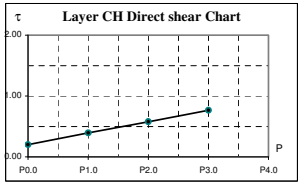
HAÏNG MUÏC: NHAØ MAÙY XÖÛ LYÙ NÖÔÙC (WATER TREATMENT STATION)

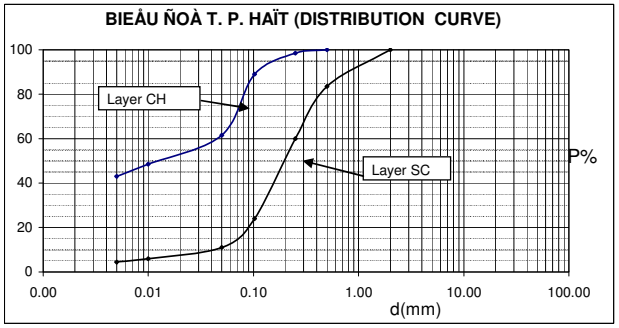
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth tõø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä ngaõo hoø saturat. G%	Heä soá thaám Coef.perme. K(cm/s)	φo	C	Neùn Luùn (compression test) P0.0 τ_1	P1.0 τ_2	P2.0 τ_3	P3.0	P0.0 ε_0	P0.5 ε_1	P1.0 ε_2	P2.0 ε_3	P4.0 ε_4
CH	1	53	P1	3.4 -3.6	44	20	36		43	22	21	0.39	30.1	1.78	1.37	2.65	48.4	0.937	85.1	5,28x10 $^{-7}$	10 ^{0} 22 $^{/}$	0.20	0.3792	0.5624	0.7456	0.937	0.906	0.882	0.850	0.799
	2	54	P1	5.0 -5.2	42	17	41		45	23	22	0.40	31.7	1.77	1.34	2.63	48.9	0.957	87.1		10 28	0.23	0.4112	0.5960	0.7808	0.957	0.906	0.872	0.832	0.776
	TOÅNG COÄNG (TOTAL)				86	37	77		88	45			61.8	3.55		5.28							0.7904	1.1584	1.5264	1.894	1.812	1.754	1.682	1.575
	TRUNG BÌNH (AVERAGE)				43	19	38		44	23	21	0.40	30.9	1.78	1.36	2.64	48.6	0.947	86.1		10 ^{0} 25 $^{/}$	0.20	0.3952	0.5792	0.7632	0.947	0.906	0.877	0.841	0.788
SC	1	55	P1	6.5 -6.7	9	9	82						17.4	2.05	1.75	2.65	34.1	0.518	89.1	2,79x10 $^{-3}$	28 ^{0} 58 $^{/}$	0.11	0.6592	1.2128	1.7664	0.518	0.511	0.505	0.498	0.489
	2	56	P1	9.4 -9.8	0	4	96						11.9	2.00	1.79	2.64	32.3	0.477	65.9		29 52	0.02	0.5920	1.1664	1.7408	0.477	0.472	0.467	0.459	0.452
	TOÅNG COÄNG (TOTAL)				9	13	178						29.3	4.05		5.29							1.2512	2.3792	3.5072	0.995	0.983	0.972	0.957	0.941
	TRUNG BÌNH (AVERAGE)				5	6	89						14.7	2.03	1.77	2.65	33.2	0.498	77.9		29 ^{0} 55 $^{/}$	0.07	0.6256	1.1896	1.7536	0.497	0.492	0.486	0.479	0.471

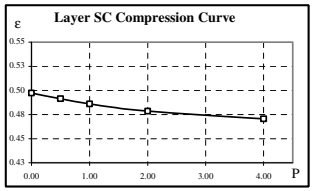


Layer CH Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.947				
0.50	0.906	21.00	0.082	23.31	9.32
1.00	0.877	35.90	0.058	32.36	12.94
2.00	0.841	54.39	0.036	51.14	20.46
4.00	0.788	81.87	0.027	66.82	26.73

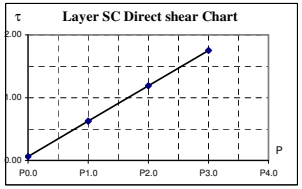






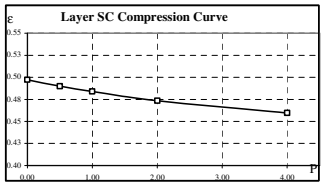
Layer SC Compression Calculating

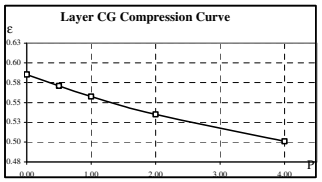
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.497				
0.50	0.492	3.90	0.012	127.59	76.55
1.00	0.486	7.58	0.011	135.09	81.05
2.00	0.479	12.59	0.007	197.13	118.28
4.00	0.471	17.93	0.004	367.63	220.58

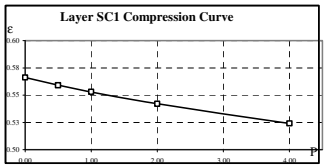


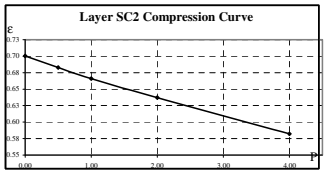
HAÏNG MUÏC: TRAÏM XÖÛ LYÙ NÖÔÙC THAÛI (WATER SEWERAGE TREATMENT STATION)

Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth tõø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä xhe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä aõo hoø saturat. G%	Heä soá thaám Coef.perme. K(cm/s)	φo	C	Neùn Luùn (compression test) P0.0 τ_1	P1.0 τ_2	P2.0 τ_3	P3.0	P0.0 ε_0	P0.5 ε_1	P1.0 ε_2	P2.0 ε_3	P4.0 ε_4
SC	1	57	P2	0.3 -0.5	8	6	86						10.7	2.01	1.82	2.65	31.5	0.459	61.7		26 ° 44 ′	0.09	0.5920	1.0960	1.6000	0.459	0.450	0.442	0.429	0.412
	2	63	-	17.2 -17.4	8	8	84						18.3	2.05	1.73	2.66	34.9	0.535	91.0	$2,82x10^{-3}$	27 54	0.09	0.6240	1.1536	1.6832	0.535	0.530	0.526	0.518	0.507
	TOÅNG COÄNG (TOTAL)				16	14	170						29.0	4.06		5.31							1.2160	2.2496	3.2832	0.994	0.980	0.968	0.947	0.919
	TRUNG BÌNH (AVERAGE)				8	7	85						14.5	2.03	1.77	2.66	33.2	0.498	77.4	$2.8X10^{-3}$	27 ° 49 ′	0.09	0.6080	1.1248	1.6416	0.497	0.490	0.484	0.474	0.460
CG	1	58	P2	2.8 -3.0	12	8	71	9	27	15	12	0.11	16.3	2.04	1.75	2.66	34.1	0.516	84.0	$1,38x10^{-4}$	26 ° 36 ′	0.14	0.6400	1.1408	1.6416	0.516	0.505	0.494	0.477	0.452
	2	59	-	5.8 -6.0	4	4	31	61					20.4	2.07	1.72	2.75	37.5	0.600	93.6												
	3	60	-	8.8 -9.0	4	6	31	59					17.2	2.12	1.81	2.74	34.0	0.515	91.6												
	4	61	-	10.8 -11.2	20	13	59	8	32	20	12	0.18	22.2	1.98	1.62	2.68	39.5	0.654	91.0		19 57	0.25	0.6128	0.9760	1.3392	0.654	0.637	0.621	0.593	0.550
	TOÅNG COÄNG (TOTAL)				40	31	192	137	59	35			76.1	8.21		10.83							1.2528	2.1168	2.9808	1.170	1.142	1.115	1.070	1.002
	TRUNG BÌNH (AVERAGE)				10	8	48	34					19.0	2.05	1.72	2.71	36.3	0.570	90.4	$1.38X10^{-4}$	23 ° 47 ′	0.20	0.6264	1.0584	1.4904	0.585	0.571	0.558	0.535	0.501
SC1	1	64	P2	19.4 -19.6	10	10	77	3	27	15	12	0.40	19.8	2.05	1.71	2.68	36.1	0.566	93.7	0.0 °	29 ° 2 ′	0.11	0.6656	1.2208	1.7760	0.566	0.559	0.553	0.542	0.524
SC2	1	62	P2	13.3 -13.7	16	15	57						22.0	1.93	1.58	2.69	41.2	0.700	84.5	$8,32x10^{-5}$	20 ° 46 ′	0.20	0.5776	0.9568	1.3360	0.700	0.683	0.666	0.637	0.582









Layer SC Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.497				
0.50	0.490	4.84	0.014	102.81	61.69
1.00	0.484	8.85	0.012	123.67	74.20
2.00	0.474	15.86	0.011	140.33	84.20
4.00	0.460	25.21	0.007	208.50	125.10

Layer CG Compression Calculating

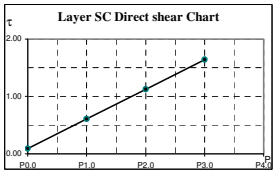
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.585				
0.50	0.571	8.98	0.028	55.16	33.10
1.00	0.558	17.50	0.027	57.69	34.61
2.00	0.535	31.69	0.023	68.22	40.93
4.00	0.501	53.14	0.017	88.29	52.98

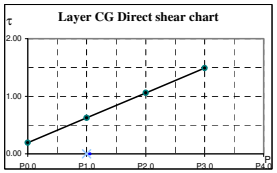
Layer SC1 Compression Calculating

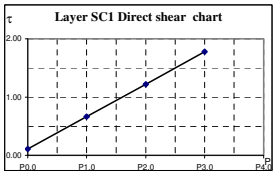
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.566				
0.50	0.559	4.58	0.014	108.78	43.51
1.00	0.553	13.17	0.012	129.42	51.77
2.00	0.542	15.43	0.011	140.18	56.07
4.00	0.524	26.92	0.009	169.33	67.73

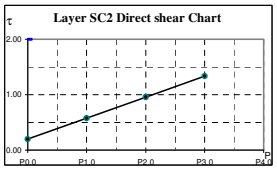
Layer SC2 Compression Calculating

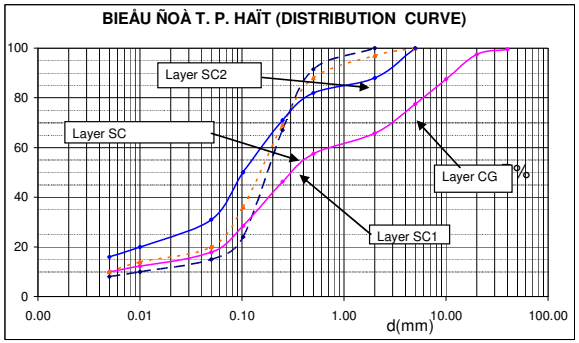
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.700				
0.50	0.683	10.24	0.035	48.32	19.33
1.00	0.666	20.24	0.034	49.00	19.60
2.00	0.637	37.29	0.029	56.45	22.58
4.00	0.582	69.64	0.028	57.53	23.01









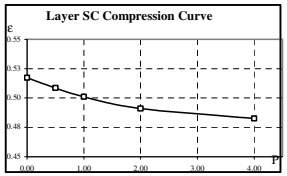


HEÄ THOÁNG CUNG CAÁP NÖÔÙC & XÖÛ LYÙ NÖÔÙC THAÛI - WATER SUPPLY SEWERAGE TREATMENT SYSTEM IN PHU QUOÁC - KIEÂN GIANG

BAÛNG TOÅNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT NGUYEÂN DAÏNG - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF UNDISTURBED SAMPLES

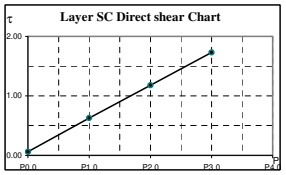
HAÏNG MUÏC: ÑAÄP ÑAÁT (EARTH DAM)

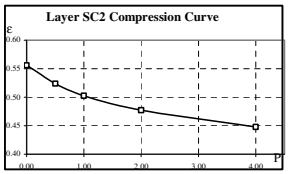
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth tõø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä aõo hoø saturat. G%	Heä soá thaám Coef.perme. K(cm/s)	φo	C	τ1	τ2	τ3	Neùn Luùn (compression test) ε0	ε1	ε2	ε3	ε4
																						P0.0	P1.0	P2.0	P3.0	P0.0	P0.5	P1.0	P2.0	P4.0
SC	1	19	D1	8.1 -8.3	5	5	87						16.8	2.05	1.76	2.66	34.0	0.516	86.7		29 0 31 /	0.06	0.6304	1.1968	1.7632	0.516	0.507	0.500	0.490	0.482
	2	26	D4	6.4 -6.6	6	4	90						16.5	2.04	1.75	2.66	34.2	0.519	84.6	7,89x10 -3	28 11	0.09	0.6240	1.1600	1.6960	0.519	0.510	0.502	0.492	0.483
	TOÅNG COÄNG (TOTAL)				11	9	177						33.3	4.09		5.32							1.2544	2.3568	3.4592	1.035	1.017	1.002	0.982	0.965
	TRUNG BÌNH (AVERAGE)				6	5	89						16.7	2.05	1.75	2.66	34.1	0.517	85.6		29 0 21 /	0.06	0.6272	1.1784	1.7296	0.517	0.509	0.501	0.491	0.483
SC2	1	18	D1	5.0 -5.2	16	16	68	0	25	13	12	0.39	17.7	2.04	1.73	2.66	34.8	0.535	88.1	9,07x10 -5	24 0 3 /	0.18	0.6272	1.0736	1.5200	0.535	0.505	0.486	0.466	0.441
	2	21	D3	4.4 -4.8	16	10	67	7	27	14	13	0.35	18.5	2.01	1.70	2.70	37.2	0.592	84.4	9,36x10 -5	17 57	0.21	0.5360	0.8600	1.1840	0.592	0.551	0.526	0.495	0.463
	3	22	D3	7.0 -7.2	12	9	79	0	25	13	12	0.38	17.5	2.02	1.72	2.64	34.9	0.536	86.3		25 0 16 /	0.15	0.6240	1.0960	1.5680	0.536	0.500	0.478	0.452	0.423
	4	25	D4	4.0 -4.2	17	9	74	0	30	16	14	0.16	18.3	2.03	1.72	2.68	36.0	0.562	87.3		20 55	0.21	0.5952	0.9776	1.3600	0.562	0.539	0.520	0.495	0.464
	TOÅNG COÄNG (TOTAL)				61	44	288	7	107	56			72.0	8.10		10.68							2.3824	4.0072	5.6320	2.224	2.095	2.010	1.908	1.791
	TRUNG BÌNH (AVERAGE)				15	11	72	2	27	14	13	0.31	18.0	2.03	1.72	2.67	35.7	0.556	86.5		22 0 33 /	0.19	0.5956	1.0018	1.4080	0.556	0.524	0.503	0.477	0.448
CL	1	16	D1	1.4 -1.6	46	21	33		55	31	24	-0.05	29.7	1.92	1.48	2.69	45.0	0.817	97.8	5,02x10 -7	17 0 34 /	0.39	0.7040	1.0208	1.3376	0.817	0.799	0.783	0.759	0.722
	2	17	D1	2.4 -3.0	44	14	42		54	30	24	-0.02	29.5	1.93	1.49	2.68	44.4	0.798	99.0		18 0 9 /	0.42	0.7520	1.0800	1.4080	0.798	0.782	0.769	0.747	0.713
	3	20	D3	2.0 -2.2	26	17	57		38	22	16	0.06	23.0	1.99	1.62	2.69	39.9	0.663	93.4	2,34x10 -5	17 0 24 /	0.29	0.6048	0.9184	1.2320	0.663	0.635	0.614	0.582	0.544
	4	23	D3	9.3 -9.5	26	12	62		39	25	14	0.03	25.4	1.98	1.58	2.67	40.9	0.691	98.1	2,18x10 -5	18 0 19 /	0.29	0.6240	0.9552	1.2864	0.691	0.675	0.660	0.634	0.588
	5	24	D4	1.2 -1.6	40	24	36		51	26	25	-0.05	24.7	2.00	1.60	2.70	40.6	0.683	97.6		16 0 59 /	0.36	0.6688	0.9744	1.2800	0.683	0.657	0.633	0.600	0.552
	6	27	D4	8.0 -8.2	27	10	63		40	25	15	0.11	26.6	1.95	1.54	2.64	41.7	0.714	98.4	1,19x10 -5	13 0 29 /	0.30	0.5440	0.7840	1.0240	0.714	0.689	0.668	0.633	0.579
	TOÅNG COÄNG (TOTAL)				209	98	293		277	159			158.9	11.77		16.07							3.8976	5.7328	7.5680	4.366	4.237	4.127	3.955	3.698
	TRUNG BÌNH (AVERAGE)				35	16	49		46	26	20	0.02	26.5	1.96	1.55	2.68	42.1	0.727	97.6		16 0 33 /	0.31	0.6496	0.9555	1.2613	0.728	0.706	0.688	0.659	0.616



Layer SC Compression Calculating

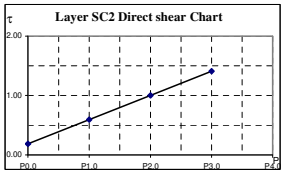
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.517				
0.50	0.509	5.81	0.018	85.61	51.37
1.00	0.501	10.75	0.015	100.07	60.04
2.00	0.491	17.34	0.010	149.10	89.46
4.00	0.483	22.94	0.004	348.82	209.29

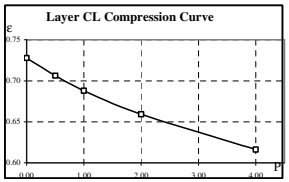




Layer SC2 Compression Calculating

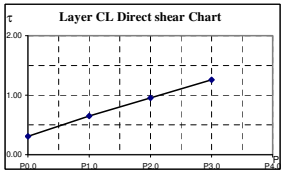
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.556				
0.50	0.524	20.72	0.064	23.63	14.18
1.00	0.503	34.37	0.043	35.35	21.21
2.00	0.477	50.76	0.026	57.92	34.75
4.00	0.448	69.56	0.015	98.99	59.39

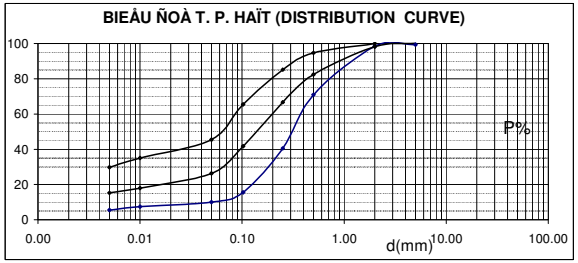




Layer CL Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.728				
0.50	0.706	12.49	0.043	39.53	19.77
1.00	0.688	23.10	0.037	46.03	23.02
2.00	0.659	39.69	0.029	57.88	28.94
4.00	0.616	64.48	0.021	75.47	37.74

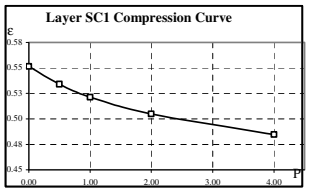




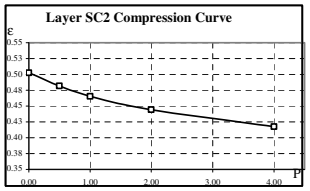
BAÛNG TOÅNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT NGUYEÂN DAÏNG - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF UNDISTURBED SAMPLES

HAÏNG MUÏC: LOØNG HOÀ (INSITE RESEVOIR)

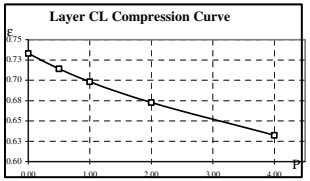
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth töø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä aõo hoø saturat. G%	Heä soá thaám Coef.perme K(cm/s)	Neùn Luùn (compression test)								
																						P0.0	P1.0	P2.0	P3.0	P0.0	P0.5	P1.0	P2.0	P4.0
																					φo	C	τ_1	τ_2	τ_3	ε_0	ε_1	ε_2	ε_3	ε_4
SC1	1	1	H1	1.7 -1.9	14	10	76		25	14	11	0.26	16.9	2.03	1.74	2.66	34.7	0.532	84.5	9.08x10 -5	23 0 44 /	0.18	0.6240	1.0640	1.5040	0.532	0.516	0.505	0.491	0.472
	2	5	H2	4.6 -4.8	12	4	77		27	15	12	0.33	19.0	2.04	1.71	2.66	35.6	0.552	91.6	1.15x10 -4	26 0	0.14	0.6240	1.1120	1.6000	0.552	0.529	0.514	0.494	0.471
	3	8	H3	3.8 -4.0	12	6	79		26	15	11	0.26	17.9	2.03	1.72	2.64	34.8	0.533	88.6	1.69x10 -4	23 44	0.14	0.5840	1.0240	1.4640	0.533	0.510	0.494	0.473	0.448
	4	10	H4	1.4 -1.6	14	12	73		29	16	13	0.32	20.1	2.01	1.67	2.66	37.1	0.589	90.7	1.55x10 -4	23 3	0.17	0.5920	1.0176	1.4432	0.589	0.581	0.573	0.561	0.547
	TOÅNG COÄNG (TOTAL)				52	32	305		107	60			73.9	8.11		10.62					0		2.4240	4.2176	6.0112	2.206	2.136	2.086	2.019	1.938
	TRUNG BÌNH (AVERAGE)				13	8	76		27	15	12	0.30	18.5	2.03	1.71	2.66	35.5	0.551	89.0	1,3x10 -4	24 0 23 /	0.16	0.6060	1.0544	1.5028	0.552	0.534	0.522	0.505	0.485
SC2	1	6	H2	9.3 -9.5	16	12	72	3	30	16	14	0.00	16.0	2.03	1.75	2.65	34.0	0.514	82.4		24 0 7 /	0.19	0.6336	1.0816	1.5296	0.514	0.492	0.474	0.450	0.421
	2	11	H4	6.3 -6.5	11	11	78	0	24	14	10	0.02	14.2	2.03	1.78	2.65	32.9	0.491	76.7		24 44	0.12	0.5824	1.0432	1.5040	0.491	0.472	0.457	0.438	0.414
	TOÅNG COÄNG (TOTAL)				27	23	150	3	54	30			30.2	4.06		5.30							1.2160	2.1248	3.0336	1.005	0.964	0.931	0.888	0.835
	TRUNG BÌNH (AVERAGE)				14	12	75	2	27	15	12	0.01	15.1	2.03	1.76	2.65	33.4	0.503	79.6		24 0 26 /	0.16	0.6080	1.0624	1.5168	0.503	0.482	0.466	0.444	0.418
CL	1	4	H2	1.8 -2.0	58	14	28		55	30	25	-0.02	29.6	1.92	1.48	2.68	44.7	0.809	98.1	8.19x10 -7	17 0 4 /	0.39	0.6976	1.0048	1.3120	0.809	0.784	0.763	0.732	0.687
	2	7	H3	1.0 -1.2	36	20	44		45	23	22	-0.03	22.3	2.02	1.65	2.69	38.6	0.629	95.4		16 3	0.38	0.6720	0.9600	1.2480	0.629	0.611	0.597	0.572	0.536
	3	12	H4	9.0 -9.2	50	19	31		51	27	24	-0.08	25.1	1.99	1.59	2.67	40.4	0.678	98.8	8.04x10 -7	13 3	0.39	0.6240	0.8560	1.0880	0.678	0.660	0.644	0.617	0.568
	4	14	H5	3.5 -3.7	56	20	24		57	32	25	-0.06	30.4	1.91	1.46	2.66	44.9	0.816	99.1	6.15x10 -7	16 54	0.42	0.7280	1.0320	1.3360	0.816	0.801	0.789	0.769	0.738
	TOÅNG COÄNG (TOTAL)				200	73	127		208	112			107.4	7.84		10.70							2.7216	3.8528	4.9840	2.932	2.856	2.793	2.690	2.529
	TRUNG BÌNH (AVERAGE)				50	18	32		52	28	24	-0.05	26.9	1.96	1.55	2.68	42.2	0.731	98.2	7,5x10 -7	16 0 16 /	0.40	0.6804	0.9632	1.2460	0.733	0.714	0.698	0.673	0.632
SC	1	2	H1	5.3 -5.5	5	4	91						16.2	2.02	1.74	2.64	34.2	0.519	82.5	9.72x10 -3	29 0 14 /	0.06	0.6240	1.1840	1.7440	0.519	0.510	0.503	0.494	0.487
	2	3	H1	9.8 -10.0	5	7	88						18.5	2.03	1.71	2.65	35.4	0.547	89.6		28 58	0.08	0.6336	1.1872	1.7408	0.547	0.537	0.528	0.519	0.508
	3	9	H3	8.0 -8.2	4	4	92						13.2	2.03	1.79	2.66	32.6	0.483	72.6		29 56	0.05	0.6240	1.2000	1.7760	0.483	0.474	0.467	0.458	0.449
	4	13	H5	0.4 -0.6	7	9	84						14.7	1.95	1.70	2.67	36.3	0.571	68.8		27 17	0.08	0.5920	1.1080	1.6240	0.571	0.559	0.548	0.529	0.494
	5	15	H5	7.5 -7.7	4	3	93						14.2	1.95	1.71	2.67	36.0	0.564	67.3		29 48	0.06	0.6304	1.2032	1.7760	0.564	0.554	0.546	0.534	0.521
	TOÅNG COÄNG (TOTAL)				25	27	448						76.8	9.98		13.29							3.1040	5.8824	8.6608	2.683	2.634	2.592	2.534	2.459
	TRUNG BÌNH (AVERAGE)				5	5	90						15.4	2.00	1.73	2.66	34.9	0.536	76.1	1,0x10 -2	28 0 39 /	0.07	0.6208	1.1765	1.7322	0.537	0.527	0.518	0.507	0.492



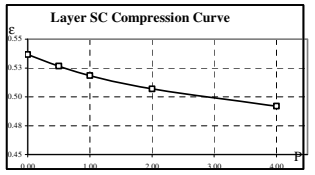
Layer SC1 Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.552				
0.50	0.534	11.30	0.035	43.75	26.25
1.00	0.522	19.36	0.025	60.86	36.52
2.00	0.505	30.15	0.017	89.84	53.90
4.00	0.485	43.20	0.010	146.62	87.97



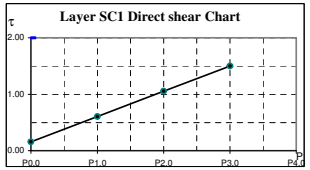
Layer SC2 Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.503				
0.50	0.482	13.67	0.041	36.08	21.65
1.00	0.466	24.65	0.033	44.41	26.65
2.00	0.444	38.96	0.022	67.16	40.30
4.00	0.418	56.60	0.013	106.98	64.19

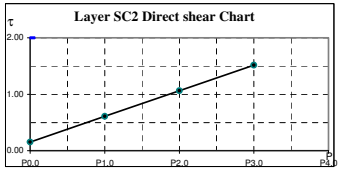


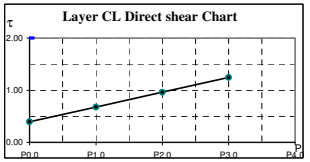
Layer CL Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.733				
0.50	0.714	10.99	0.038	45.01	22.50
1.00	0.698	20.08	0.032	53.91	26.96
2.00	0.673	34.93	0.026	64.95	32.48
4.00	0.632	58.16	0.020	81.11	40.55

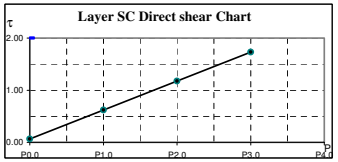


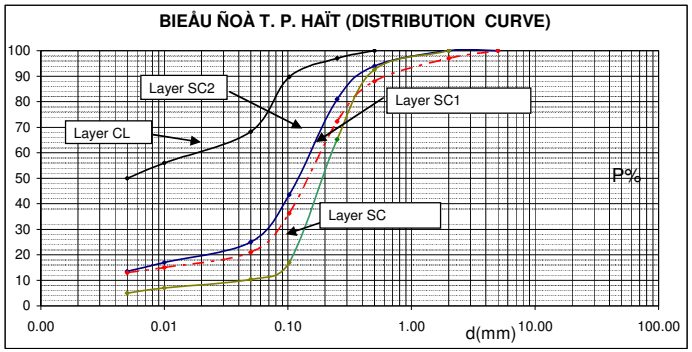
Layer SC Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.537				
0.50	0.527	6.38	0.020	77.81	46.69
1.00	0.518	11.85	0.017	90.38	54.23
2.00	0.507	19.40	0.012	129.90	77.94
4.00	0.492	29.16	0.007	198.91	119.34







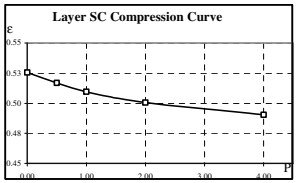




BẢNG TOẢNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT NGUYEÂN DAÏNG - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF UNDISTURBED SAMPLES

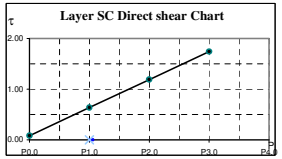
HAÏNG MUÏC: CÖÛA ÑIEÀU KHIEÅN (REGULATOR GATE)

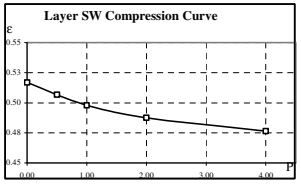
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth tõø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä baõo hoø saturat. G%	Heä soá thaám Coef.perme K(cm/s)	Neùn Luùn (compression test) φo	P0.0 C	P1.0 τ_1	P2.0 τ_2	P3.0 τ_3	P0.0 ε_0	P0.5 ε_1	P1.0 ε_2	P2.0 ε_3	P4.0 ε_4
SC	1	28	T1	0.8 -1.0	8	12	80	0					13.7	1.94	1.71	2.66	35.9	0.559	65.2		28 ° 58 ′	0.08	0.6320	1.1856	1.7392	0.559	0.550	0.542	0.534	0.523
	2	36	T2	11.8 -12.0	8	6	84	2					15.0	2.05	1.78	2.66	33.0	0.492	81.1		28 ° 50 ′	0.09	0.6416	1.1928	1.7440	0.492	0.484	0.477	0.467	0.458
	TOẢNG COÃNG (TOTAL)				16	18	164	2					28.7	3.99		5.32							1.2736	2.3784	3.4832	1.051	1.034	1.019	1.001	0.981
	TRUNG BÌNH (AVERAGE)				8	9	82	1					14.4	2.00	1.74	2.66	34.4	0.525	72.8	2.3X10 $^{-5}$	28 ° 54 ′	0.08	0.6368	1.1892	1.7416	0.526	0.517	0.510	0.501	0.491
SW	1	29	T1	4.3 -4.5	0	6	93	1					13.2	1.91	1.69	2.65	36.3	0.571	61.3		30 ° 17 ′	0.04	0.6240	1.2080	1.7920	0.571	0.561	0.552	0.541	0.530
	2	30	T1	7.2 -7.4	0	4	87	9					12.6	1.99	1.77	2.66	33.6	0.505	66.4		30 45	0.02	0.6176	1.2128	1.8080	0.505	0.496	0.488	0.478	0.468
	3	31	T1	10.0 -10.2	4	4	86	6					13.6	2.02	1.78	2.66	33.2	0.496	72.9	82 * 10 $^{-3}$	30 ° 17 ′	0.06	0.6416	1.2256	1.8096	0.496	0.486	0.478	0.469	0.459
	4	34	T2	6.1 -6.3	0	6	88	6					12.8	1.99	1.76	2.64	33.2	0.496	68.1		30 ° 57 ′	0.04	0.6400	1.2400	1.8400	0.496	0.484	0.474	0.462	0.449
	TOẢNG COÃNG (TOTAL)				4	20	354	22					52.2	7.91		10.61							2.5232	4.8864	7.2496	2.068	2.027	1.992	1.950	1.906
	TRUNG BÌNH (AVERAGE)				1	5	89	5					13.1	1.98	1.75	2.65	34.1	0.516	67.0	2.3X10 $^{-5}$	30 ° 34 ′	0.04	0.6308	1.2216	1.8124	0.517	0.507	0.498	0.488	0.477
CL	1	33	T2	2.8 -3.2	38	26	36		48	25	23	-0.14	21.7	2.00	1.64	2.65	38.0	0.613	93.9		17 ° 34 ′	0.41	0.7232	1.0400	1.3568	0.613	0.598	0.585	0.565	0.534
	2	35	T2	9.3 -9.5	38	16	46		51	27	24	-0.07	25.3	1.97	1.57	2.64	40.4	0.679	98.3	5.15x10 $^{-6}$	15 ° 0 ′	0.32	0.5920	0.8600	1.1280	0.679	0.654	0.632	0.598	0.548
	TOẢNG COÃNG (TOTAL)				76	42	82		99	52			47.0	3.97		5.29							1.3152	1.9000	2.4848	1.292	1.252	1.217	1.163	1.082
	TRUNG BÌNH (AVERAGE)				38	21	41		50	26	24	-0.11	23.5	1.99	1.61	2.65	39.2	0.646	96.3	5,15x10 $^{-6}$	16 ° 17 ′	0.37	0.6576	0.9500	1.2424	0.646	0.626	0.609	0.582	0.541
CG	1	32	T1	14.3 -14.5	10	7	53	30					13.8	2.12	1.86	2.69	30.7	0.444	83.6												
	2	37	T2	16.4 -16.6	6	6	81	7					25.3	1.97	1.57	2.64	40.4	0.679	98.3	5.15x10 $^{-6}$	15 ° 0 ′	0.32	0.5920	0.8600	1.1280	0.679	0.654	0.632	0.598	0.548
	TOẢNG COÃNG (TOTAL)				16	13	134	37					39.1	4.09		5.33							0.5920	0.8600	1.1280	0.679	0.654	0.632	0.598	0.548
	TRUNG BÌNH (AVERAGE)				8	7	67	18					19.6	2.05	1.71	2.67	35.8	0.558	93.4	2.3X10 $^{-5}$	15 ° 0 ′	0.32	0.5920	0.8600	1.1280	0.679	0.654	0.632	0.598	0.548
CL1	1	38	T2	19.3 -19.5	26	14	60		36	20	16	0.13	22.1	2.00	1.64	2.70	39.3	0.648	92.0	2.1x10 $^{-5}$	18 ° 54 ′	0.29	0.6352	0.9776	1.3200	0.648	0.622	0.601	0.572	0.534
	2	39	T2	21.8 -22.0	28	22	50		37	21	16	0.06	22.0	2.03	1.66	2.66	37.4	0.599	97.8	1.01x10 $^{-5}$	19 ° 38 ′	0.30	0.6560	1.0128	1.3696	0.599	0.585	0.573	0.554	0.526
	TOẢNG COÃNG (TOTAL)				54	36	110		73	41			44.1	4.03		5.36							1.2912	1.9904	2.6896	1.247	1.207	1.174	1.126	1.060
	TRUNG BÌNH (AVERAGE)				27	18	55		37	21	16	0.10	22.1	2.02	1.65	2.68	38.4	0.623	94.8	2.3X10 $^{-5}$	19 ° 46 ′	0.30	0.6456	0.9952	1.3448	0.623	0.604	0.587	0.563	0.530



Layer SC Compression Calculating

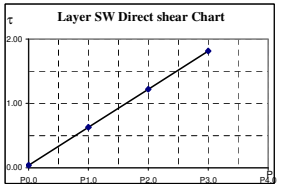
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.526				
0.50	0.517	5.63	0.017	88.33	53.00
1.00	0.510	10.54	0.015	100.63	60.38
2.00	0.501	16.44	0.009	166.72	100.03
4.00	0.491	23.00	0.005	298.10	178.86

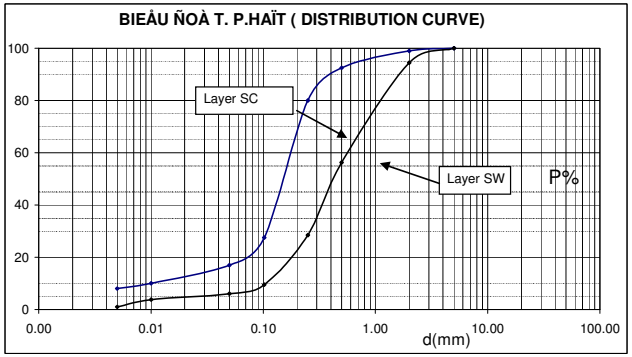


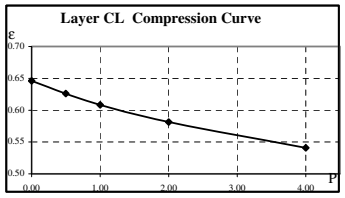


Layer SW Compression Calculating

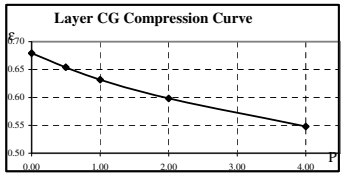
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.517				
0.50	0.507	6.76	0.021	73.42	51.39
1.00	0.498	12.53	0.018	85.60	59.92
2.00	0.488	19.45	0.011	141.67	99.17
4.00	0.477	26.70	0.005	268.45	187.92



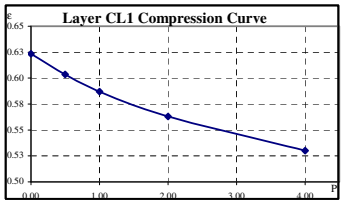




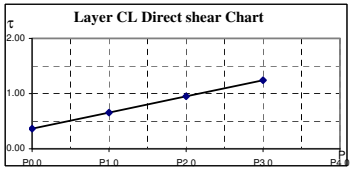
Layer CL Compresstion Calculating					
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.646				
0.50	0.626	12.05	0.040	40.99	20.49
1.00	0.609	22.69	0.035	45.96	22.98
2.00	0.582	39.09	0.027	58.57	29.29
4.00	0.541	63.70	0.020	76.10	38.05

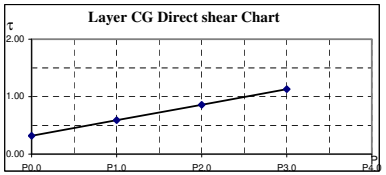


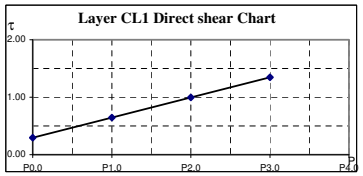
Layer CG Compression Calculating					
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.679				
0.50	0.654	14.98	0.050	32.89	19.73
1.00	0.632	28.08	0.044	37.09	22.25
2.00	0.598	48.33	0.034	47.00	28.20
4.00	0.548	78.10	0.025	61.92	37.15

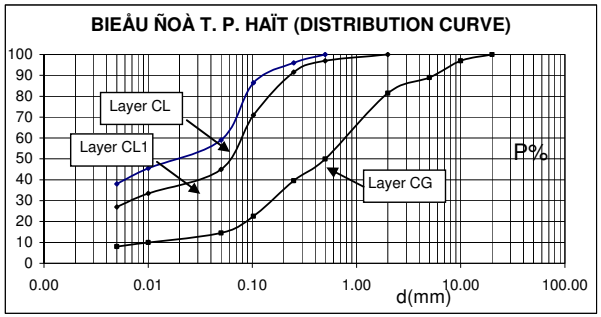


Layer CL1 Compression Calculating					
P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.623				
0.50	0.604	12.31	0.040	40.12	20.06
1.00	0.587	22.47	0.033	48.09	24.05
2.00	0.563	37.26	0.024	65.12	32.56
4.00	0.530	57.58	0.017	92.73	46.36





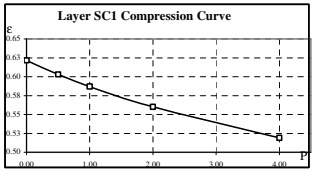




BAÛNG TOÅNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT NGUYEÂN DAÏNG - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF UNDISTURBED SAMPLES

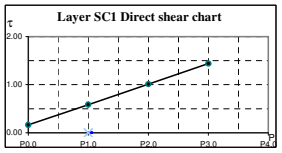
HAÏNG MUÏC: CÖÛA NHAÄN NÖÔÙC (INTAKE GATE)

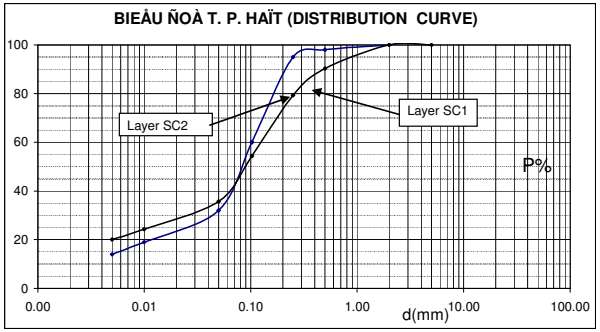
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth töø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Ñoä seät Consist. B	Ñoä aåm Moisture content W %	Unit weights wet (T/m3) γ_w	dry (T/m3) γ_d	Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	Heä soá roãng void rat. ε	Ñoä aõo hoø saturat. G%	Heä soá thaám Coef.perme K(cm/s)	φo	P0.0 C	P1.0 τ_1	P2.0 τ_2	P3.0 τ_3	Neùn Luùn (compression test) P0.0 ε_o	P0.5 ε_1	P1.0 ε_2	P2.0 ε_3	P4.0 ε_4
SC1	1	40	T3	0.3 -0.5	14	18	68		27	15	12	0.22	17.6	1.90	1.62	2.62	38.3	0.622	74.2		23 ° 7 ′	0.16	0.5856	1.0128	1.4400	0.622	0.603	0.587	0.560	0.519
	TOÅNG COÄNG (TOTAL)				14	18	68						17.6	1.90		2.62							0.5856	1.0128	1.4400	0.622	0.603	0.587	0.560	0.519
	TRUNG BÌNH (AVERAGE)				14	18	68						17.6	1.90	1.62	2.62	38.3	0.622	74.2		23 ° 7 ′	0.16	0.5856	1.0128	1.4400	0.622	0.603	0.587	0.560	0.519
SC2	1	42	T3	7.4 -7.6	18	19	63	1	31	16	15	0.04	16.6	2.02	1.73	2.64	34.4	0.524	83.7		22 ° 58 ′	0.23	0.6560	1.0800	1.5040	0.524	0.512	0.502	0.483	0.452
	2	48	T4	5.6 -5.8	22	14	64	0	30	16	14	0.01	16.2	2.03	1.75	2.64	33.8	0.511	83.7		17 19	0.28	0.5920	0.9040	1.2160	0.511	0.490	0.476	0.457	0.433
	3	49	T4	8.8 -9.0	20	14	66	0	30	17	13	0.20	19.6	2.03	1.70	2.67	36.4	0.573	91.3		16 ° 14 ′	0.23	0.5248	0.8160	1.1072	0.573	0.548	0.527	0.497	0.455
	TOÅNG COÄNG (TOTAL)				60	47	193	1	91	49			52.4	6.08		7.95							1.7728	2.8000	3.8272	1.608	1.550	1.505	1.437	1.340
	TRUNG BÌNH (AVERAGE)				20	16	64		30	16	14	0.08	17.5	2.03	1.73	2.65	34.9	0.536	86.4		18 ° 30 ′	0.25	0.5909	0.9333	1.2757	0.536	0.517	0.502	0.479	0.447
CL	1	44	T3	12.6 -12.8	28	18	54		39	23	16	-0.06	22.0	2.03	1.66	2.64	37.0	0.587	99.0	1,79x10 -5	19 ° 47 ′	0.32	0.6800	1.0400	1.4000	0.587	0.569	0.553	0.529	0.494
	2	47	T4	3.6 -3.8	34	20	46		47	26	21	-0.04	25.1	1.99	1.59	2.70	41.1	0.697	97.2	3,58x10 -6	17 37	0.34	0.6608	0.9784	1.2960	0.697	0.682	0.669	0.652	0.628
	3	50	T4	10.7 -10.9	46	14	40		52	28	24	-0.03	27.2	1.95	1.53	2.66	42.4	0.735	98.4	3,97x10 -7	16 ° 54 ′	0.43	0.7360	1.0400	1.3440	0.735	0.714	0.699	0.675	0.641
	4	51	T4	14.5 -14.7	41	15	44		55	30	25	-0.03	29.3	1.94	1.50	2.71	44.6	0.806	98.5	5,75x10 -7	17 14	0.41	0.7200	1.0304	1.3408	0.806	0.788	0.772	0.746	0.703
	TOÅNG COÄNG (TOTAL)				149	67	184		193	107			103.6	7.91		10.71							2.7968	4.0888	5.3808	2.825	2.753	2.693	2.602	2.466
	TRUNG BÌNH (AVERAGE)				37	17	46		48	27	21	-0.04	25.9	1.98	1.57	2.68	41.3	0.705	98.4		17 ° 38 ′	0.38	0.6992	1.0222	1.3452	0.706	0.688	0.673	0.651	0.617
SC	1	41	T3	4.2 -4.4	10	4	81	5					12.5	2.04	1.81	2.65	31.6	0.461	71.8	4,69x10 -4	28 ° 49 ′	0.12	0.6672	1.2176	1.7680	0.461	0.454	0.448	0.438	0.418
	2	43	T3	10.1 -10.3	5	5	89	1					18.2	2.05	1.73	2.66	34.8	0.534	90.7		29 ° 39 ′	0.07	0.6368	1.2064	1.7760	0.534	0.525	0.517	0.507	0.496
	3	45	T3	16.0 -16.2	4	6	90	0					17.6	2.04	1.73	2.66	34.8	0.533	87.8		30 21	0.06	0.6416	1.2272	1.8128	0.533	0.520	0.510	0.498	0.484
	4	46	T3	19.8 -20.0	4	5	91	0					15.4	2.03	1.76	2.65	33.6	0.506	80.6		30 ° 29 ′	0.05	0.6432	1.2320	1.8208	0.506	0.497	0.490	0.480	0.469
	5	52	T4	18.8 -19.0	8	6	86	0					15.7	2.05	1.77	2.66	33.4	0.501	83.3		29 19	0.10	0.6608	1.2224	1.7840	0.501	0.496	0.491	0.483	0.471
	TOÅNG COÄNG (TOTAL)				31	26	437	6					79.4	10.21		13.28							3.2496	6.1056	8.9616	2.536	2.492	2.456	2.406	2.338
	TRUNG BÌNH (AVERAGE)				6	5	88	1					15.9	2.04	1.76	2.66	33.7	0.507	83.2		29 ° 31 ′	0.08	0.6499	1.2211	1.7923	0.507	0.498	0.491	0.481	0.468

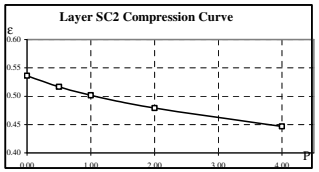


Layer SC1 Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.622				
0.50	0.603	11.50	0.037	42.99	25.80
1.00	0.587	21.36	0.032	49.59	29.76
2.00	0.560	38.01	0.027	57.78	34.67
4.00	0.519	63.30	0.021	74.10	44.46

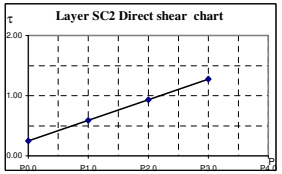


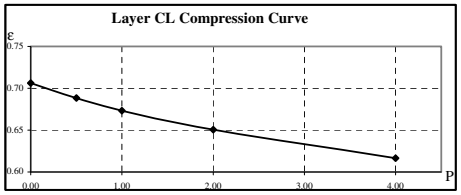




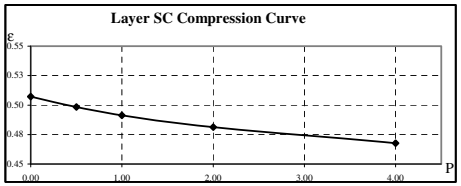
Layer SC2 Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.536				
0.50	0.517	12.61	0.039	39.14	23.49
1.00	0.502	22.38	0.030	50.06	30.03
2.00	0.479	37.13	0.023	65.25	39.15
4.00	0.447	58.18	0.016	89.48	53.69

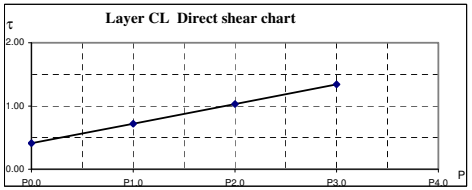


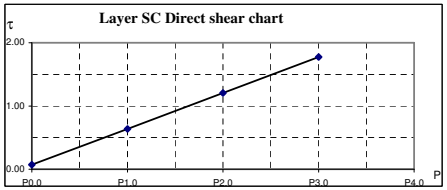


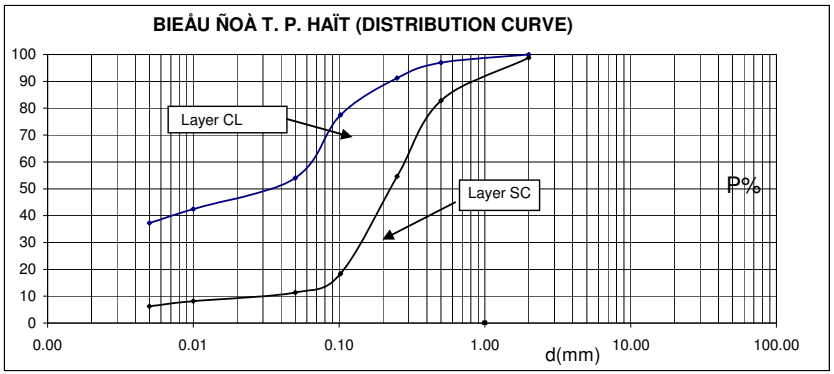
Layer CL Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.706				
0.50	0.688	10.59	0.036	46.72	23.36
1.00	0.673	19.38	0.030	55.77	27.89
2.00	0.651	32.71	0.023	72.55	36.27
4.00	0.617	52.64	0.017	95.09	47.54



Layer SC Compression Calculating					
P	e	ep	a	E	E0
KG/cm2		mm/m	cm2/KG	KG/cm2	KG/cm2
0.00	0.507				
0.50	0.498	5.87	0.018	84.64	50.79
1.00	0.491	10.65	0.014	103.56	62.13
2.00	0.481	17.28	0.010	148.12	88.87
4.00	0.468	26.31	0.007	215.82	129.49



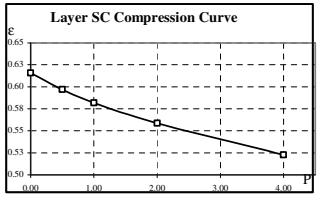




TOÅNG HÔÏP CHÆ TIEÂU CÔ LYÙ ÑAÁT ÑAÀM PROCTOR - CHEÁ BÒ - SUMMARY OF PHISICAL AND MECHANICAL PROPERTIES OF PROCTOR - REMOULD SAMPLES

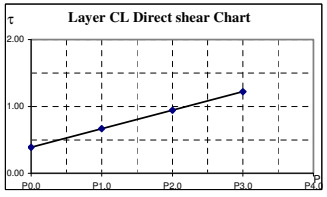
HAÏNG MUÏC : BAÕI VAÄT LIEÄU ÑAÁT(BORROW AREA)

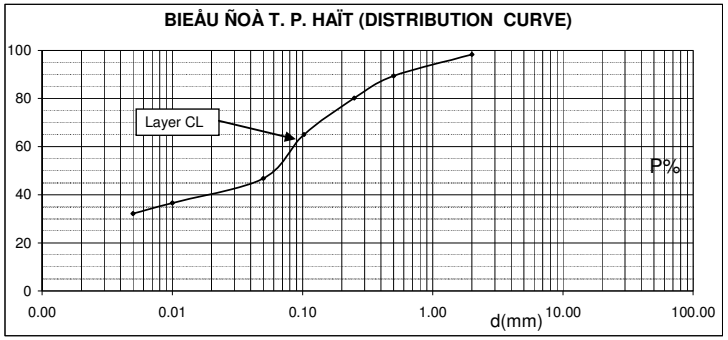
Lôùp ñaát layer	STT N0	Soá TN Num. of tes.	Kyù Hieäu LK Borehole	Ñ.saâu laáy maãu depth töø - ñeán	T.P. HAÏT (GRAIN SIZE) % clay <0.005	silt 0,005 0.05	sand 0,05 2.0	gravel >2 mm	ATTERBERG LIMIT Chaûy Liqu. Li. WL%	Deûo Plas. Li Wp%	Ip	Proctor compac. γ_{dmax} (T/m3)	Wop %	Remo.unit wei. wet (T/m3) γ_w	dry (T/m3) γ_d	Wcb Wremo (%) W	T.troïng Specif. gravity Δ	Ñoä khe hôû Porosity n(%)	l.s.roãn void ratio ε	Ñoä baõo hoøa saturat. G%	φo	P0.0 C	P1.0 τ_1	P2.0 τ_2	P3.0 τ_3	Neùn Luùn (compression tes P0.0 ε_o	P0.5 ε_1	P1.0 ε_2	P2.0 ε_3	hs thaám Coef. P4.0 ε_4
CL	1	65	VL1	1.4 -4.0	32	15	51	2	39	20	19	1.649	16.4	1.925	1.616	19.1	2.70	40.1	0.671	76.9	14 0 37 /	0.41	0.6720	0.9328	1.1936	0.643	0.620	0.594	0.559	4.4x10-6
	2	66	VL2	0.4 -2.6	19	15	65	1	31	17	14	1.754	14.5	2.011	1.719	17.0	2.71	36.6	0.557	79.9	19 38	0.31	0.6672	1.0240	1.3808	0.562	0.551	0.532	0.501	1.9x10-5
	3	67	VL3	0.0 -3.6	32	13	52	3	42	23	19	1.725	17.2	2.020	1.691	19.5	2.72	37.8	0.609	87.1	14 11	0.40	0.6528	0.9056	1.1584	0.590	0.574	0.549	0.509	8.6x10-6
	4	68	VL4	1.4 -1.6	32	12	54	2	35	18	17	1.715	16.2	1.992	1.681	18.5	2.67	37.1	0.589	83.9	14 52	0.45	0.7200	0.9856	1.2512	0.570	0.558	0.540	0.511	8.5x10-6
	5	69	VL5	0.0 -4.0	46	18	36	0	48	25	23	1.671	18.5	1.970	1.638	20.3	2.68	38.9	0.637	85.5	13 45	0.38	0.6256	0.8704	1.1152	0.620	0.606	0.579	0.533	6.5x10-6
	TOÅNG COÄNG (TOTAL)				161	73	258	8	195	103				9.92		94.40	13.5						3.3376	4.7184	6.0992	2.985	2.909	2.794	2.613	
	TRUNG BÌNH (AVERAGE)				32	14	52	2	39	21	18			1.98	1.67	18.9	2.70	38.1	0.616	82.7	15 0 37 /	0.39	0.6675	0.9437	1.1982	0.597	0.582	0.559	0.523	



Layer CL Compression Calculating

P KG/cm2	e	ep mm/m	a cm2/KG	E KG/cm2	E0 KG/cm2
0.00	0.616				
0.50	0.597	11.61	0.038	42.58	21.29
1.00	0.582	21.01	0.030	52.03	26.02
2.00	0.559	35.25	0.023	67.77	33.89
4.00	0.523	57.65	0.018	84.12	42.06





下水処理場の基礎形式の検討

本調査において、処理場予定地の近傍で 1 か所土質調査を実施した。その調査結果を図 3-2-2-5 に示す。

土質柱状図から判断すると、標高 +8.0M から出現する砂質粘土層は、層の上部から N 値７，８，９と粘性土として比較的良好な値を示している。また、写真 3-2-2-1 及び写真 3-2-2-2 に示すように、コアサンプリングの状況も良好な土質であると判断される。

写真 3-2-2-1　GL から 0m～6.0m

写真 3-2-2-2　GL から 6.0m～13.0m

この砂質粘土層を支持地盤とした場合の直接基礎許容支持力を以下に計算する。
直接基礎の支持力算定式は以下のとおりである。

$$qa = 1/3 \cdot (\alpha \cdot c \cdot Nc + \beta \cdot \gamma 1 \cdot B \cdot N\gamma + \gamma 2 \cdot Df \cdot Nq)$$

ここで、qa；長期地盤支持力（t/m^2）
c　；基礎底面下にある地盤の粘着力（t/m^2）
$\gamma 1$；基礎底面下にある地盤の単位体積重量（t/m^3）
地下水位以下にある場合は水中単位体積重量をとる。
$\gamma 2$；基礎底面より上方にある地盤の平均単位体積重量（t/m^3）
地下水位以下にある場合は水中単位体積重量をとる。
α, β ；表-a に示す形状係数
Nc,Nγ,Nq；表-b に示す支持力係数。内部摩擦角ϕの関数
Df；基礎に近接した最低地盤面から基礎底面までの深さ（m）
B　；基礎底面の最小幅（m）。円形の場合は直径

		表-a　形状係数		
基礎底面の形状	連　続	正方形	長　方　形	円　形
α	1.0	1.3	1.0＋0.3･B/L	1.3
β	0.5	0.4	0.5－0.1･B/L	0.3
		（注）	B；長方形の短辺長さ	
			L；長方形の長辺長さ	

	表-b　支持力係数		
φ	Nc	Nγ	Nq
0	5.3	0	3.0
5	5.3	0	3.4
10	5.3	0	3.9
15	6.5	1.2	4.7
20	7.9	2.0	5.9
25	9.9	3.3	7.6
28	11.4	4.4	9.1
32	20.9	10.6	16.1
36	42.2	30.5	33.6
40以上	95.7	114.0	83.2

この砂質粘土層の土質定数は室内試験結果より以下のとおりである。

c ＝1.4　t/m^2、Φ＝26°、γ1＝1.75 t/m^3、γ2＝1.8 t/m^3

○ **水処理施設の場合の計算**

地下水位＝GL-5.20m、Df＝5.50m、B＝10.0m、L＝35.0m、α＝1.09、
β＝0.47、Nc ＝9.9、Nγ＝3.3、Nq ＝7.6

qa ＝1/3×(1.09×1.4×9.9＋0.47×0.75×10.0×3.3＋0.8×5.5×7.6)
＝20.1t/m^2 ＞　水処理荷重 8.5t/ m^2

○ **濃縮槽の場合の計算**

Df＝5.60m、D＝12.20m、α＝1.30、β＝0.30、Nc ＝9.9、Nγ＝3.3、
Nq ＝7.6

qa ＝1/3×(1.30×1.4×9.9＋0.30×0.75×13.0×3.3＋0.8×5.6×7.6)
＝20.1t/m^2 ＞　濃縮槽荷重 6.8t/ m^2

以上より、標高 +8.0M より出現する砂質粘土層には必要な地盤支持力があることが判明した。

土質柱状と施設底盤の高さ関係を図 3-2-2-6 に示す。図から明らかなように大部分の施設底盤は標高 +8.0M 以下となり、支持地盤層に到達している。 支持地盤層に達していない消毒槽、脱水機棟（地下のない部分）、管理棟の各施設は、標高 +8.0M に達するまでの範囲の地盤を改良土し、直接基礎形式とする。

地盤改良は、その掘削深さが最大で 4.2m 程度であることから、この範囲の土砂にセメントを混合し埋め戻す工法が最適であると考える。

以上の検討結果より、本処理場の基礎形式は　**一部地盤改良工法併用　直接基礎形式**とする。

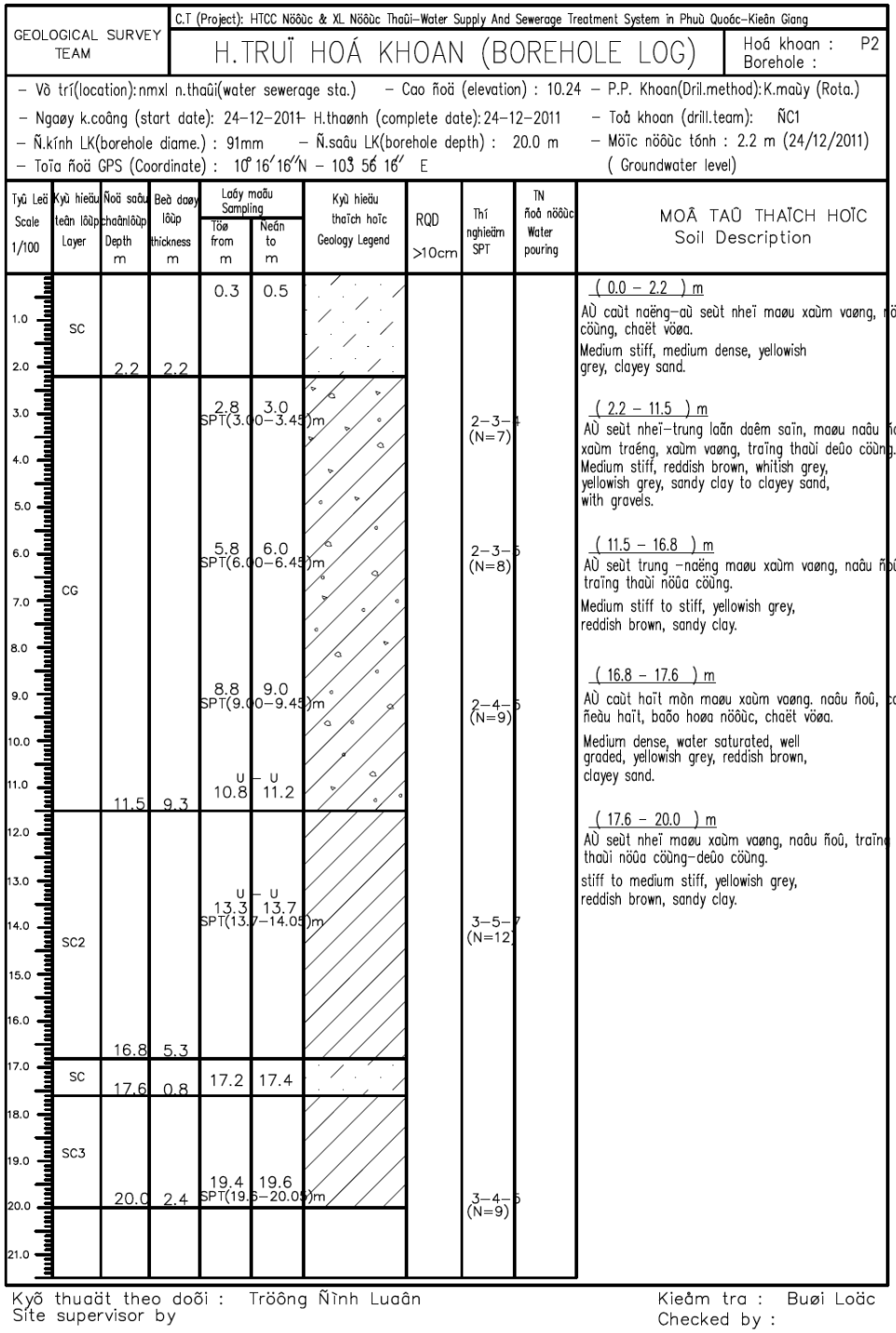


図 3-2-2-5 P-2 土質調査結果（土質柱状図）

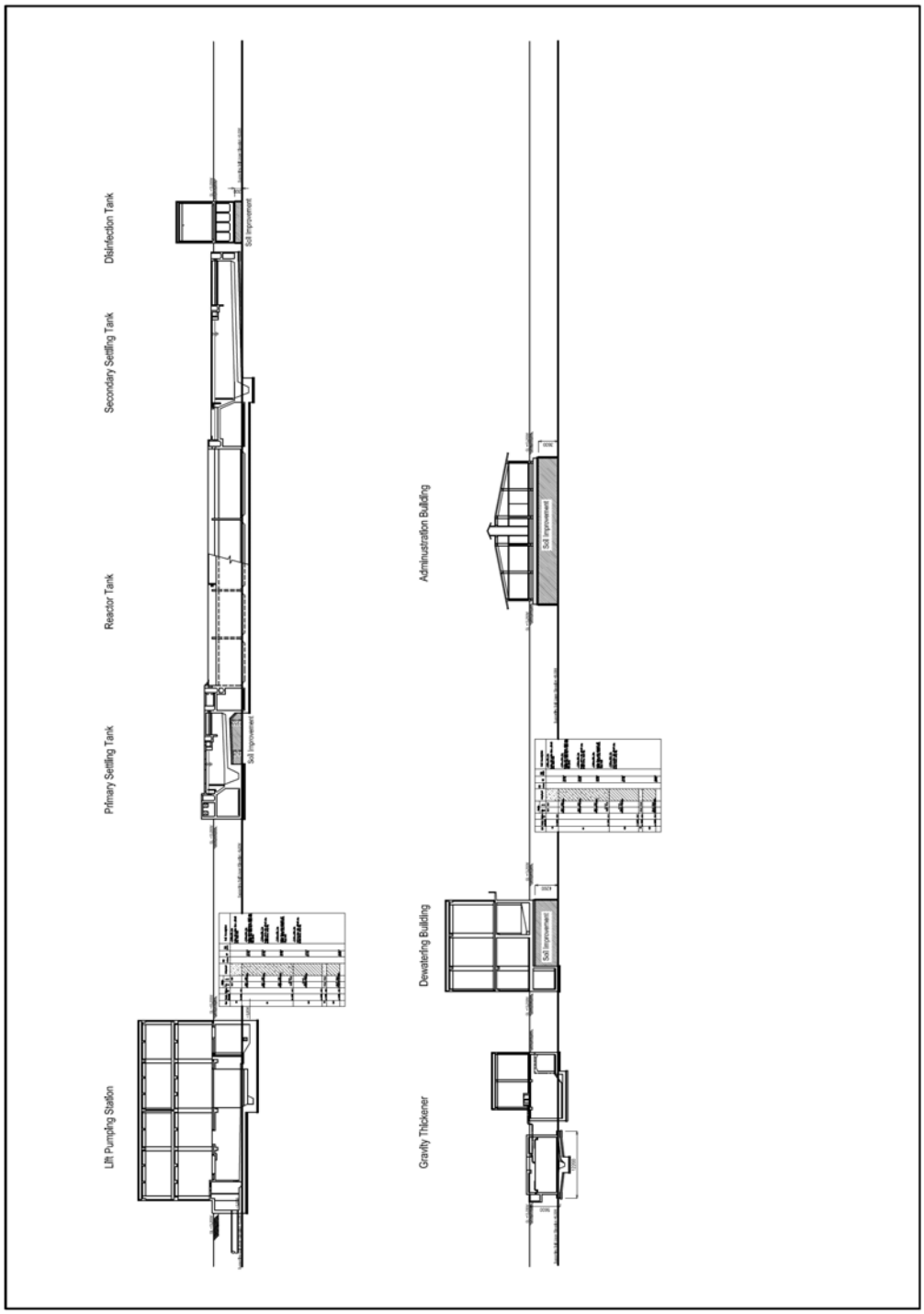


図 3-2-2-6　地盤状況と施設高さの位置関係

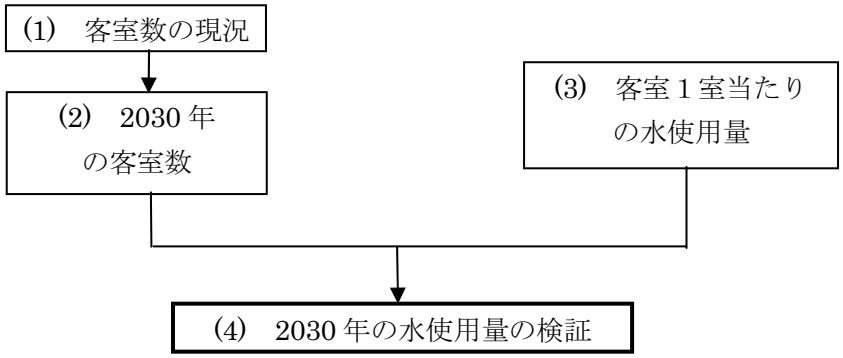
添付資料-4　下水道関係

A-2-1　Duong Dong エリアの観光水使用量の検証

Duong Dong, Duong To エリアの観光水使用量は表 2-2-3-1 で示したとおり、7,216m^3/日と算出された。この水使用量について、他の観光地の水使用量を参考に以下のとおり検証を行う。

（検証の方法）

観光水需要量の検証は、対象エリアの 2030 年の宿泊施設の客室数に客室 1 室当たりの水使用量を乗じて求めるものとする。以下にフローを示す。



(1)　客室数の現況

フーコック島全島及びDuong Dongの下水道対象エリアのホテル客室数はA-2-1-1に示すとおりである。

フーコック島全島では 2,001 の客室があり、その大半の 1,833 の客室が Duong Dong, Duong To の下水道対象エリアにある。

表 A-2-1　下水道対象エリアのホテル客室数

No	位置/ホテル	ホテル数	星数	客室数	
				フーコック島	Duong Dong, Duong To の下水道対象エリア
	Duong Dongの北	**>4**		**92**	
1	Bo Resort		2	30	
2	Mango Bay		2	16	
3	Chen La		4	36	
4	Other*			10	
	Duong Dong セントラル	**>7**		**163**	**163**
5	Hong Tuyet			10	10
6	Aloha Hotel			17	17
7	Hong Hanh			12	12
8	Huynh Tram Guesthouse			16	16
9	Thang Long Beach			26	26
10	Huong Bien Hotel		2	65	65
11	Other*			17	17
	Duong Dong Beach	**>15**		**1,041**	**1,041**
12	Saigo Phu Quoc Resort		4	116	116
13	Sasco Bulue Lagoon		4	75	75
14	Thien Hai Son		3	150	150
15	Duong Dong Hotel			31	31
16	Kim Hoa Resort		3	66	66
17	Kim Nam Phuong			24	24
18	Thanh Quoc Hotel		2	36	36
19	Sea Star Resort		2	37	37
20	Tropicana		3	34	34
21	Cassia Cottage		3	18	18
22	Thanh Kieu Coco Beach Resort		2	51	51
23	Mai House			14	14
24	Novetel Phu Quoc (by end 2010)			200	200
25	La Veranda Resort		4	80	80
26	Other*			109	109
	Duong To	**>12**		**629**	**629**
27	Thousand Stars (Ngan Sao) Resort		3	50	50
28	Island Villa Resort (DT)		3	24	24
29	Charm Phu Quoc		3	69	69
30	Anh Binh Resort		2	36	36
31	Long Beach Ancient Village		5	111	111
32	Beach Club		2	9	9
33	Thai Binh Duong		3	83	83
34	Thanh Quoc Hotel		2	36	36
35	Palace Resort		3	52	52
36	Duong Dong Resort		2	29	29
37	Eden Phu Quoc		4	64	64
38	Other*			66	66
	An Thoiの東	**>3**		**76**	
39	Hoang Doan Binh An		1	30	
40	Cong Doan Binh An		2	38	
41	Other*			8	
	合　計	**>41**		**2,001**	**1,833**

出典：Feasibility Study Report, Phu Quoc Water Supply Sub-Project, Oct. 2010

(2) 2030 年の下水道対象エリアの客室数

観光開発は土地利用計画上の混合観光エリア及びエコロジカル観光エリアを中心に行われる。今後の観光開発は Duong Dong エリア以外の未開発エリアが急速に開発される傾向にある。Duong Dong エリアについては、既にかなりの数のホテルが立地していることから今後のホテル数の伸びは、他の観光エリアに比べ小さいと想定される。

ここでは 2030 年の下水道対象エリアとなる Duong Dong, Duong To エリアの客室数は、現況の２倍と想定する。

【2030 年の下水道対象エリアの Duong Dong, Duong To エリアの客室数】

= 1,833× 2

= 3,666 (客室)

(3) 客室１室当たりの水使用量

客室１室当たりの水使用量のデータはフーコックにないため、日本及び他国のリゾート地の事例を参照して想定する。

表 A-2-2 に日本の沖縄及びインドネシアのバリのリゾートにおける水使用量を示す。

表 A-2-2 リゾートにおける水使用量

国/地域	ホテル	１室当たり 水使用量 (m^3/日室)	備　考
日本/沖縄 *1	K ホテル	2.330	
	M ホテル	2.012	
インドネシア/バリ *2		1.9 ～ 2.5	4-5 星

出典*1：沖縄におけるリゾート開発に伴う水道整備方策に関する調査報告書 平成 4 年 3 月
厚生省、（社）全国上下水道コンサルタント協会

*2：インドネシア国南バリ再生水利用事業準備調査（PPP インフラ事業）ドラフト・ファイナル・レポート 平成 23 年 12 月　JICA、豊田通商㈱、㈱日水コン、メタウォーター㈱

上記に示すように、沖縄では 2.0～2.3 m^3/日室、バリにおいては 1.9～2.5 m^3/日室の水使用量がある。フーコックのホテルの星数は 2-3 が多く、バリのホテルは 4-5 が多い。水使用量は、一般的に星数が多くなるに従い多くなる傾向がある。ここでは客室１室当たりの水使用量を 2.0 m^3/日室と想定するものとする。

客室１室当たりの水使用量：2.0 m^3/日室

(4) 2030 年の Duong Dong エリア観光水使用量の検証

2030 年における観光エリアの水使用量は、下水道対象エリアの客室数に客室 1 室当たりの水使用量を乗じて求める。

すなわち

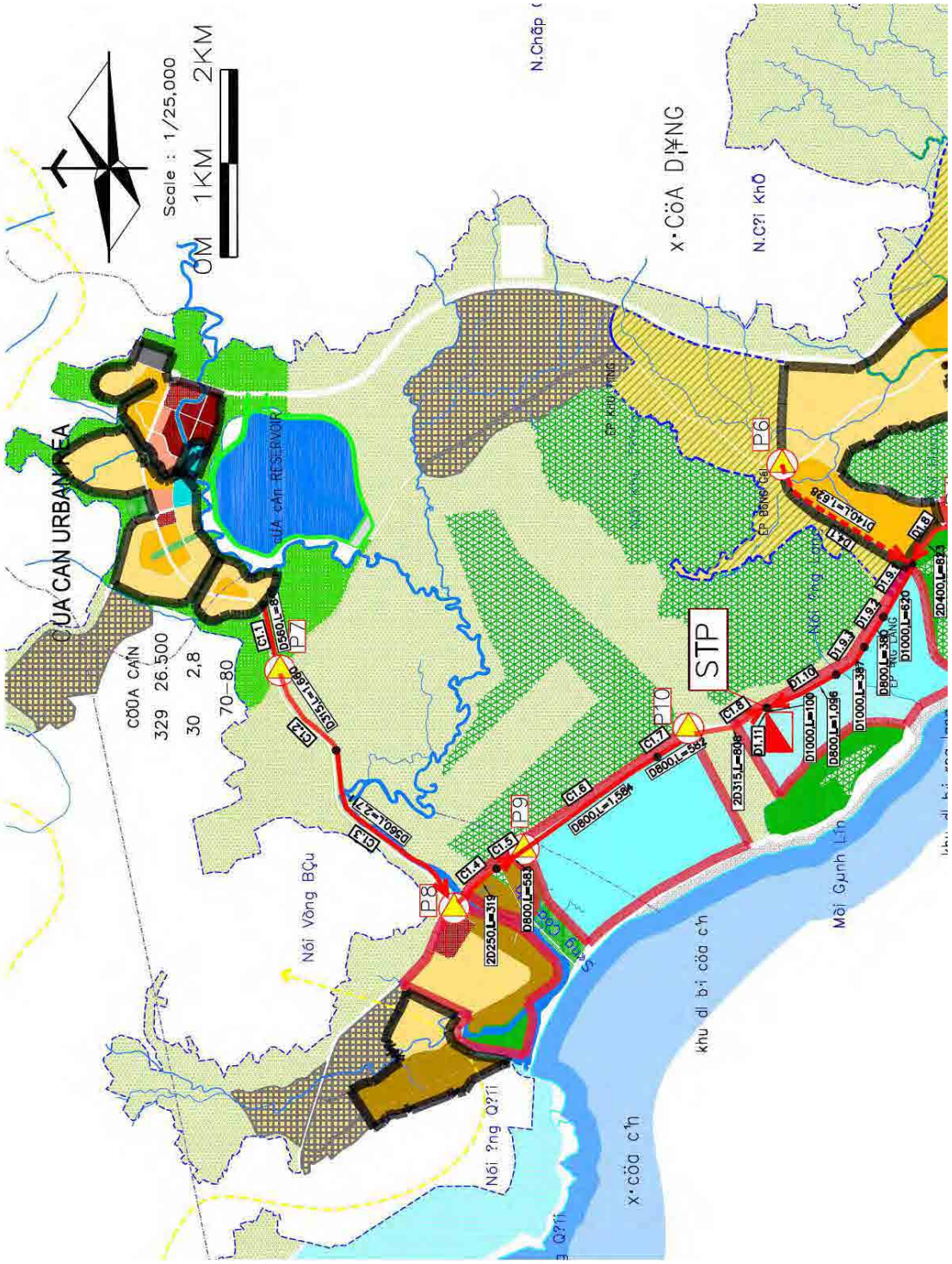
Duong Dong, Duong To エリア観光水使用量

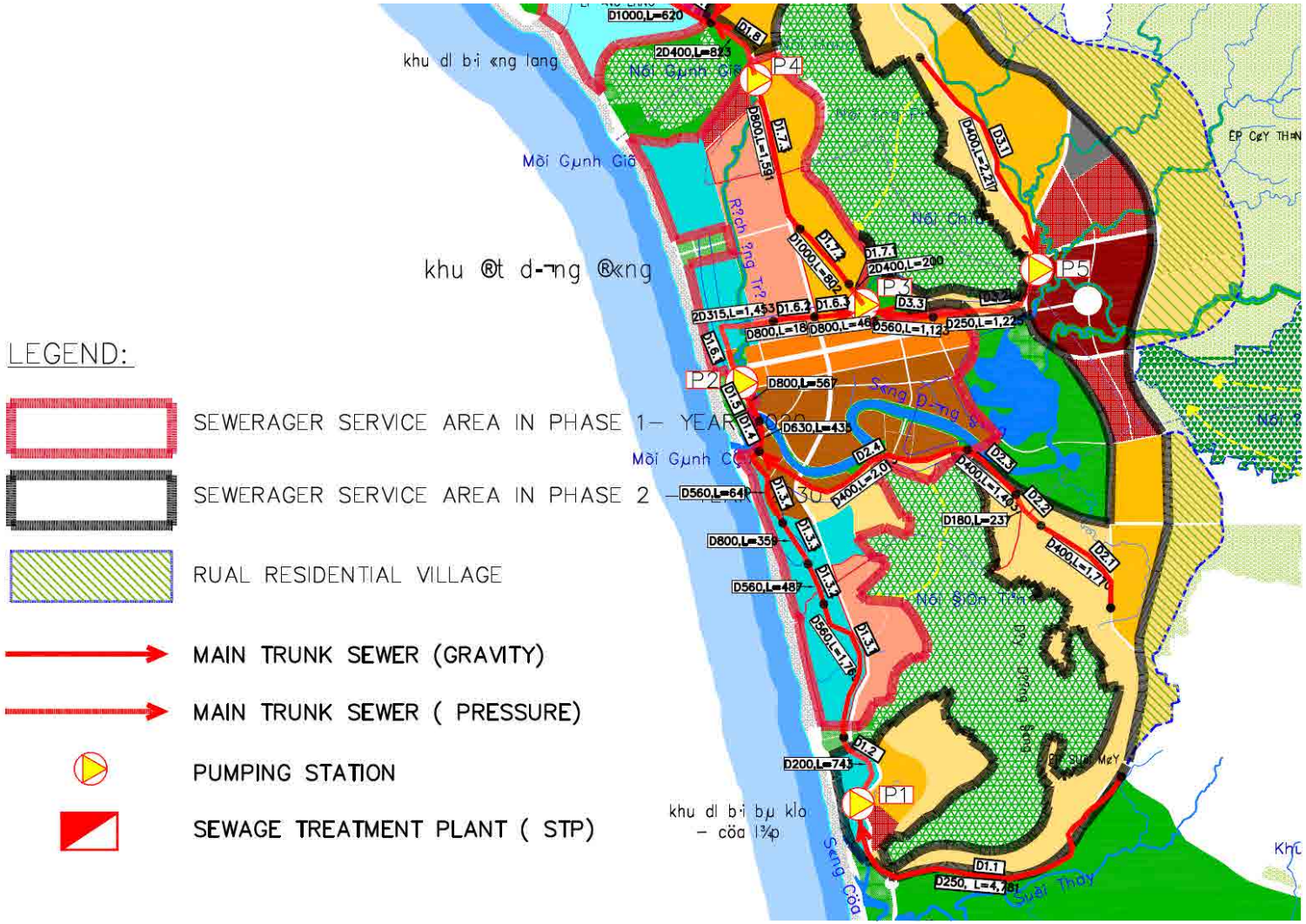
= 3,666 (客室) × 2.0 m^3/日室

= 7,332 m^3/日

この値は世銀レポートを基に求めた 7,216 m^3/日と同等である。本調査において、2030 年の下水道対象エリアにおける Duong Dong, Duong To の観光水使用量は、7,216 m^3/日を採用するものとする。

A-3-1 General Plan of Sewerage System

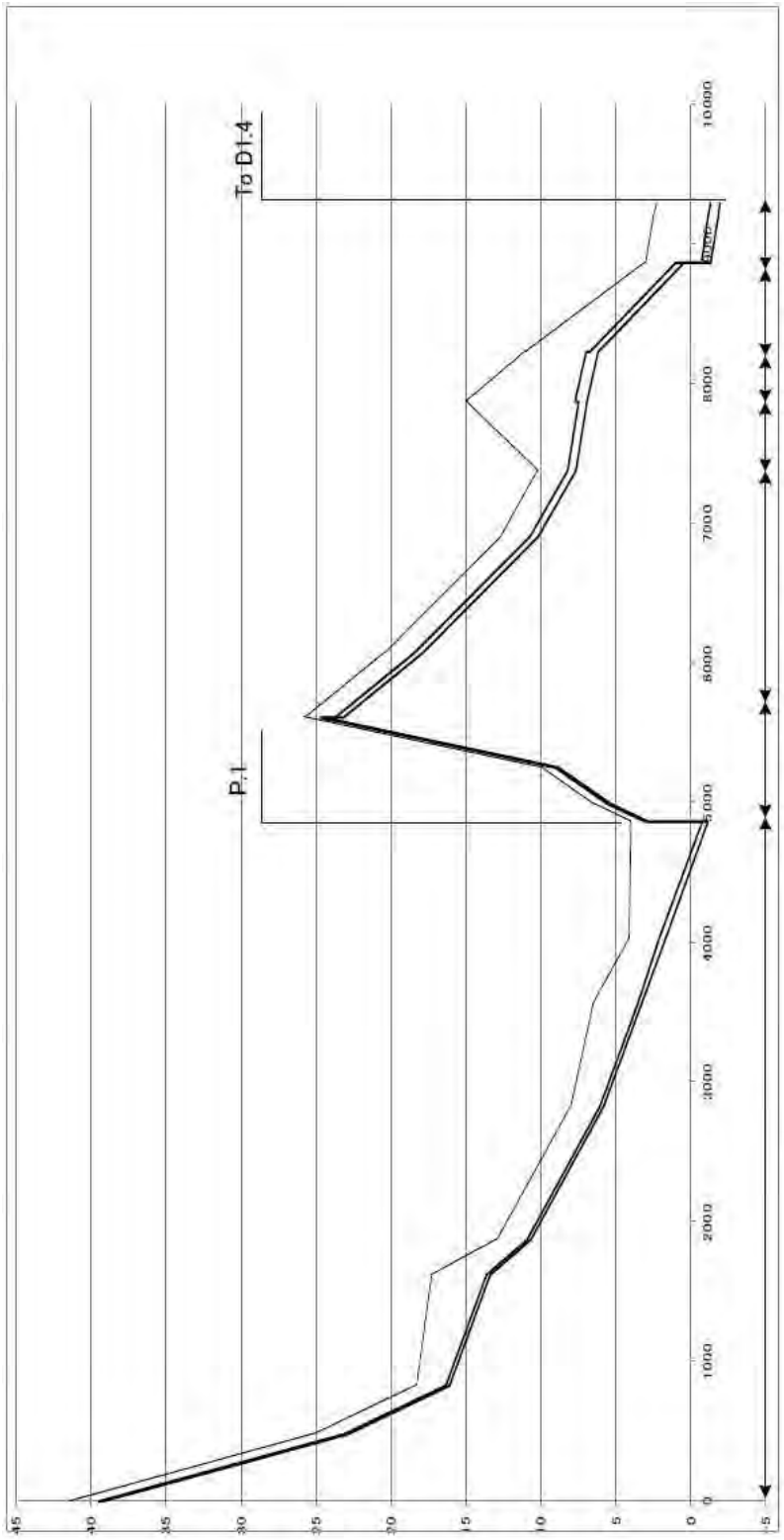



LEGEND:
SEWERAGER SERVICE AREA IN PHASE 1– YEAR 2020
SEWERAGER SERVICE AREA IN PHASE 2 – YEAR 2030
RUAL RESIDENTIAL VILLAGE
MAIN TRUNK SEWER (GRAVITY)
MAIN TRUNK SEWER (PRESSURE)
PUMPING STATION
SEWAGE TREATMENT PLANT (STP)
P1
P2
P3
P4
P5
D1000,L=620
2D400,L=823
D800,L=1,591
D1000,L=802
2D400,L=200
2D315,L=1,453
D800,L=18
D800,L=46
D560,L=1,12
D250,L=1,22
D800,L=56
D630,L=43
D560,L=64
D800,L=35
D560,L=48
D180,L=23
D400,L=1,7
D200,L=743
D250, L=4,761

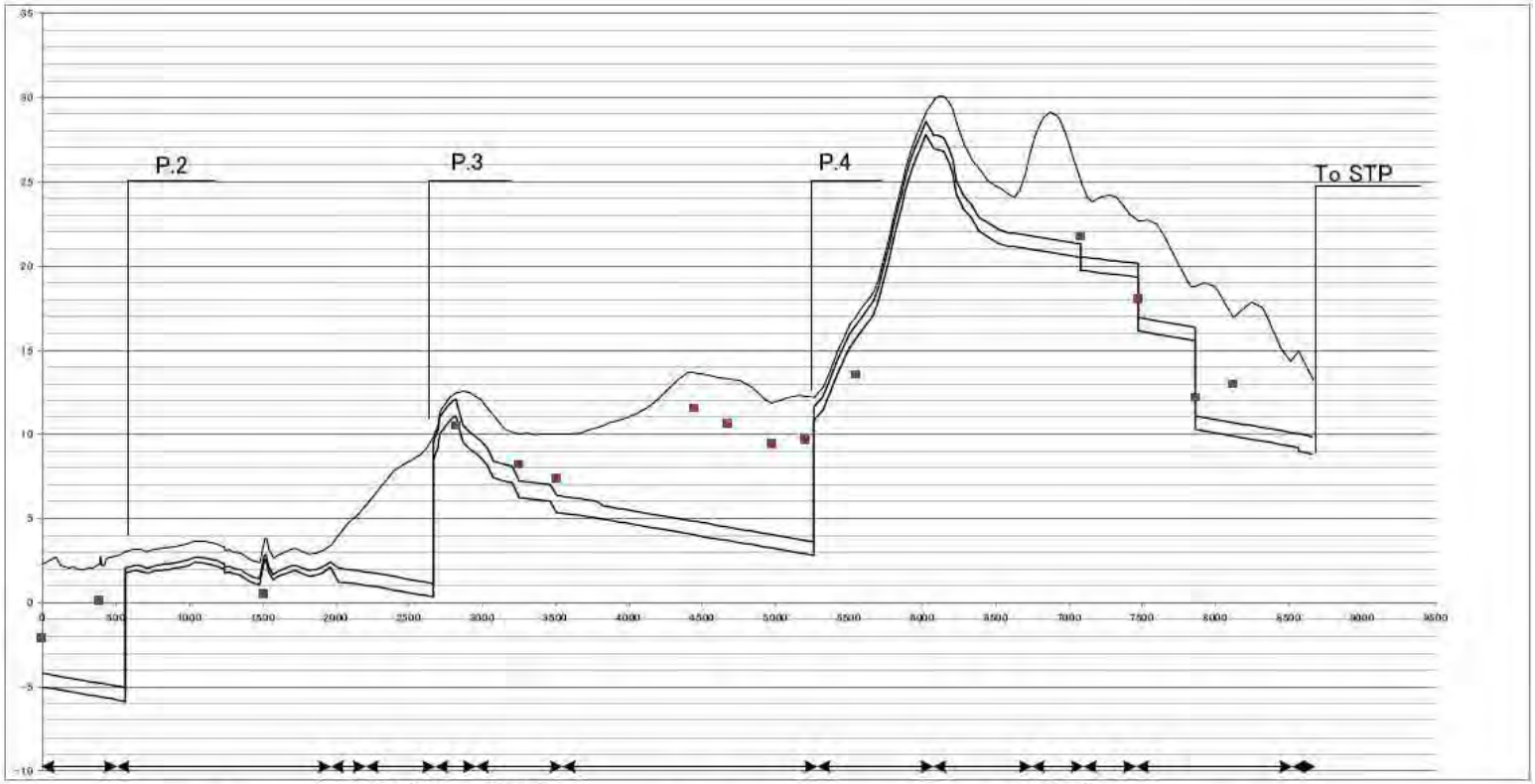
Sewer No.	Length	Catchment Area Size & Sewage Flow									Total	Name of Road Inflow	Sewage Flow				Capacity of Pipe					Ground level		Invert level		Cover depth		Type of Pipe	Pumping Station	Phase
		A	P	C	R	M	H	L	AT	SB			Peak Inflow	Accumulated Qave	Peak factor	Q total	DN	DI	Slope	Velocity	Quantity	Begin	End	Begin	End	Begin	End			
	Unit Flow	0.1058	0.0895	0.0895	0.0650	0.1706	0.1137	0.0395	0.0489	0.0091	(ha)		(l/sec)	(l/sec)		(l/sec)	(mm)	(mm)	(mm)	(m/sec)	m^3/s	(m)	(m)	(m)	(m)	(m)	(m)			
D1.1								103.00			103.00																		
	4,871							4			4			4	2.50	10	250	231	0.0034	0.79	0.033	41.50	4.00	39.250	-1.109	2.00	4.95	PVC		2
D1.2			8.91				30.36	71.23			110.50																		
	743		1				3	3			7	MT1	7	18	1.94	35	200	185	pressure	-		4.00	25.70	2.800	24.500	1.00	1.00	HDPE	P.1	2
D1.3.1						67.02					67.02																		
	1,769					11					11	MT2	28	57	1.69	96	560	517	0.0016	0.93	0.195	25.70	10.20	23.140	7.640	2.00	2.00	HDPE		1
D1.3.2											0.00																		
	467										-			57	1.69	96	560	517	0.0016	0.93	0.195	10.20	15.90	7.640	6.851	2.00	7.58	HDPE		1
D1.3.3											0.00																		
	359										-			57	1.69	96	800	800	0.0020	1.18	0.591	15.00	11.00	6.851	6.143	7.26	3.98	RC(PJ)		1
D1.3.4											0.00																		
	541										-			57	1.69	96	560	517	0.0016	0.93	0.195	11.00	3.00	6.143	0.440	4.30	2.00	HDPE		1
D1.4					14.71						14.71																		
	435				1						1			78	1.66	129	630	582	0.0014	0.94	0.259	3.00	2.28	-1.374	-1.983	3.74	4.61	HDPE		1
D1.5					14.51						14.51																		
	567				1						1			79	1.66	131	800	800	0.0015	1.02	0.512	2.28	3.05	-5.020	-5.670	8.42	8.04	RC(PJ)		1
D1.6.1				48.11	90.78						138.89																		
	1,453			4	6						10	MT3, MT4	25	114	1.60	182	315×2	291	pressure	-	-	3.05	4.02	1.735	2.705	1.00	1.00	HDPE	P.2	1, 2
D1.6.2											0.00																		
	184										-			114	1.60	182	800	800	0.0015	1.02	0.512	4.02	5.74	1.220	1.018	2.09	3.92	HDPE		1
D1.6.3																													
	463															182	800	800	0.0015	1.02	0.512	5.74	9.91	1.018	0.322	3.84	8.71	RC(PJ)		1
D1.7.1						82.29	40.27				122.56																		
	200					11	7				18			184	1.58	291	400×2	369	pressure	-	-	9.91	12.53	8.510	11.130	1.00	1.00	HDPE	P.3	1, 2
D1.7.2											0.00																		
	802										-			184	1.58	291	1000	881	0.0016	1.05	0.639	12.53	10.08	9.530	5.170	2.00	3.91	HDPE		1
D1.7.3																													
	1,591																800	800	0.0015	1.02	0.512	10.08	12.20	5.170	2.784	4.030	6.54	RC(PJ)		1
D1.8			14.79			68.32	89.11				172.22																		
	823		1			12	10				23			207	1.57	325	400×2	369	pressure	-	-	12.20	29.92	10.800	28.520	1.00	1.00	HDPE	P.4	1, 2
D1.9.1											0.00																		
	820										-	T1	12	220	1.57	365	1000	881	0.0016	1.05	0.839	29.92	25.55	21.029	20.458	3.64	3.59	HDPE		1
D1.9.2																													
	380													220	1.57	355	800	800	0.0015	1.02	0.512	25.55	24.93	21.029	20.458	3.64	3.59	RC(PJ)		1
D1.9.3																													
	387													220	1.57	355	1000	881	0.0016	1.05	0.839	24.93	22.68	19.700	19.313	4.23	2.37	HDPE		1
D1.10											0.00																		
	1,096										-			220	1.57	355	800	800	0.0015	1.02	0.512	22.68	14.95	16.110	9.203	5.69	4.87	RC(PJ)		1
D1.11											0.00																		
	100										-			348	1.54	536	1000	1000	0.0020	1.37	1.072	14.95	13.20	9.003	8.803	4.85	3.3	RC(PJ)		1
	To STP																												

Sewer No.	Length	Catchment Area Size & Sewage Flow									Total	Name of	Sewage Flow				Capacity of Pipe					Ground level		Invert level		Cover depth		Type of Pipe	Pumping Station	Phase
		A	P	C	R	M	H	L	AT	SB		Point Inflow	Point Inflow	Accumulate Q'save	Peak factor	Q total	DN	DI	Slope	Velocity	Quantity	Begin	End	Begin	End	Begin	End			
	Unit Flow	0.1056	0.0895	0.0895	0.0650	0.1706	0.1137	0.0395	0.0489	0.0091	(ha)		(l/sec)	(l/sec)		(l/sec)	(mm)	(mm)	m/m	(m/sec)	m^3/s	(m)	(m)	(m)	(m)	(m)	(m)			
D2.1							87.14	152.92			240.06																		
	1,770						10	6			16			16	1.98	32	400	369	0.0021	0.85	0.091	41.50	7.90	39.100	4.184	2.00	2.00	PVC		2
D2.2											0.00																		
	237										-			16	1.98	32	180	166	pressure	-	-	7.90	11.40	6.720	10.220	1.00	1.00	HDPE		2
D2.3											0.00																		
	1,403										-			16	1.98	32	400	369	0.0021	0.85	0.091	11.40	6.60	9.000	4.200	2.00	2.00	PVC		2
D2.4					34.66			46.17			80.83																		
	2,013				2			2			4			20	1.90	38	400	369	0.0021	0.85	0.091	6.60	3.00	4.200	-1.144	2.00	3.74	PVC		1
	To D1.4																													
D2.1							130.74	224.05			354.79																		
	2,217						15	9			24			24	1.87	45	400	369	0.0021	0.85	0.091	12.50	9.00	10.1	2.83	2.00	5.77	PVC		2
D3.2		104.62	110.80	30.50	41.37			21.50		19.07	327.86																		
	1,225	11	10	3	3			1		-	28			52	1.70	88	250	231	pressure	-	-	9.00	12.50	7.75	11.25	1.00	1.00	HDPE	P.5	2
D3.3											0.00																		
	1,123										-			52	1.70	88	560	517	0.0016	0.93	0.195	12.50	11.48	9.940	8.144	2.00	2.76	HDPE		2
	To D1.7.1																													
D4.1							62.17				62.17																		
	1,628						7				7			7	2.30	16	140	126	pressure	-	-	14.70	29.92	13.560	28.780	1.00	1	HDPE	P.6	2
	To D1.9.1																													
C1.1											0.00																		
	846										-	R3	43	43	1.75	75	560	517	0.0016	0.93	0.195	7.60	8.30	5.040	3.686	2.00	4.05	HDPE		2
C1.2											0.00																		
	1,660										-			43	1.75	75	315	291	pressure	-	-	8.30	14.00	6.995	12.685	1.00	1.00	HDPE	P.7	2
C1.3											0.00																		
	2,711										-			43	1.75	75	560	517	0.0016	0.93	0.195	14.00	7.17	11.440	1.563	2.00	5.05	HDPE		2
C1.4									65.29		65.29																		
	319								3		3	R2, T4	22	68	1.66	113	250×2	231	pressure	-	-	7.17	8.58	5.920	5.330	1.00	1.00	HDPE	P.8	1, 2
C1.5											0.00																		
	583										-	R1, T3	43	111	1.60	178	800	705	0.0011	0.95	0.370	6.58	5.97	2.392	0.438	3.39	4.73	HDPE		1
C1.6											0.00																		
	1,584										-			111	1.60	178	800	705	0.0011	0.95	0.370	5.97	6.21	3.170	1.426	2.00	3.98	HDPE	P.9	1
C1.7											0.00																		
	582										-	T2	10	121	1.59	192	800	800	0.0015	1.02	0.512	6.21	6.38	1.426	0.553	3.90	4.95	RC(PJ)		1
C1.8											0.00																		
	808										-			121	1.59	192	315×2	291	pressure	-	-	6.38	14.95	5.065	13.635	1.00	1.00	HDPE	P.10	1, 2
	To D1.11																													
Area Size		104.62	134.50	78.61	156.03	197.63	459.79	618.67	65.29	19.07	1874.41		190																	

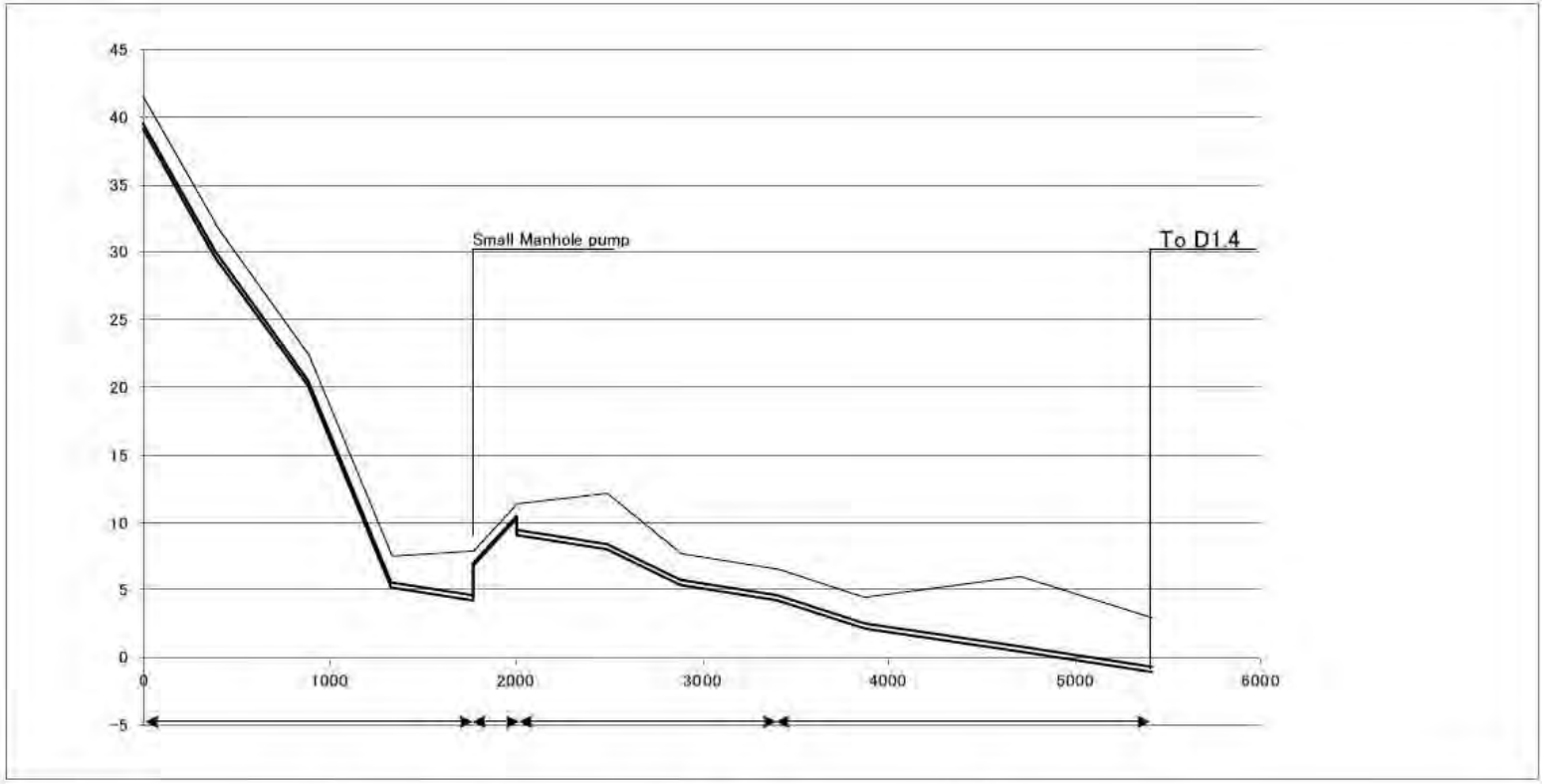
A-3-3 Longitudinal Sections



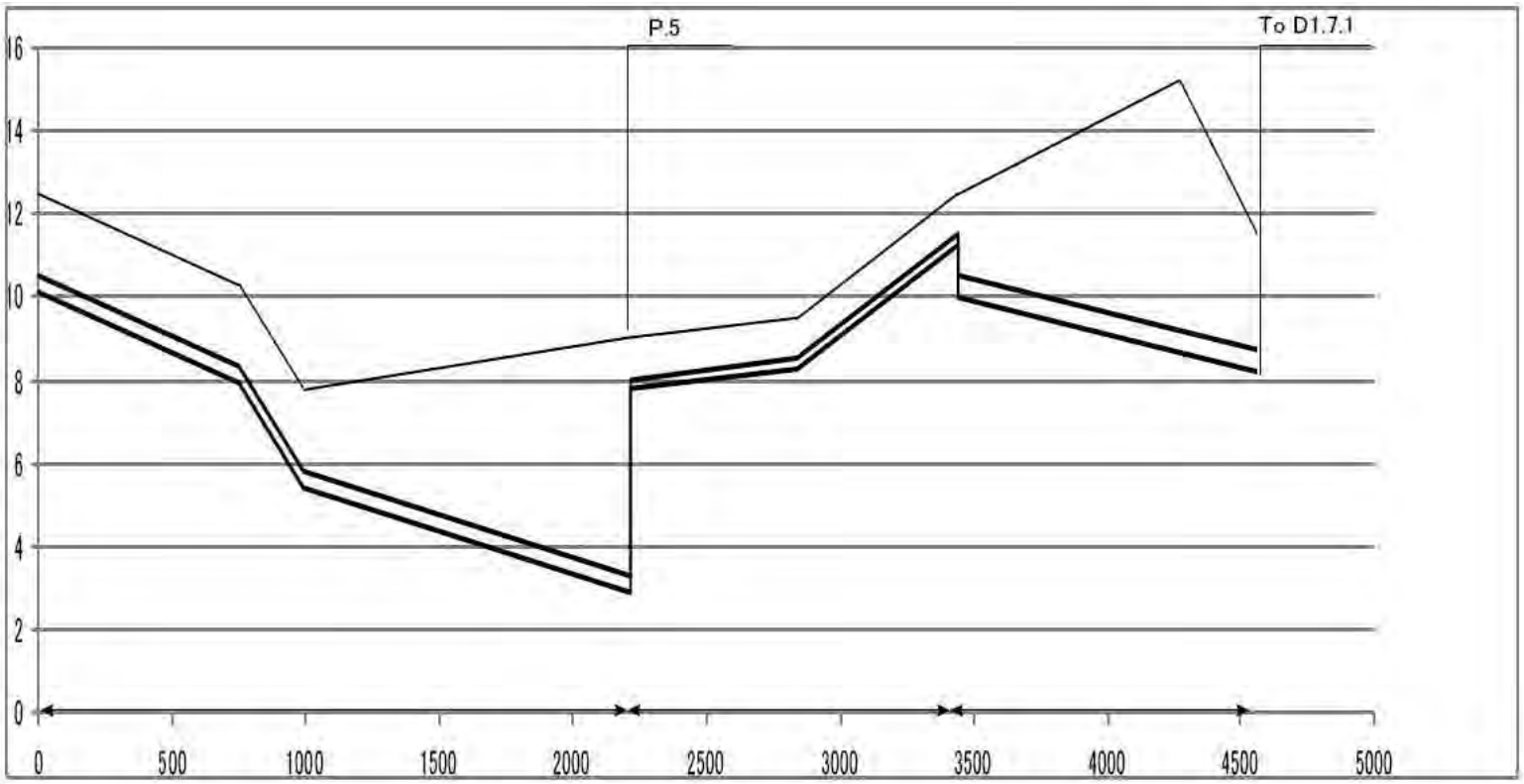
Sewer No.	D1.1	D1.2	D1.3.1	D1.3.2	D1.3.3	D1.3.4	D1.4
Dia. (mm)	D250	D200	D560	D560	D800	D560	D630
Slope(1/1,000)	3.4	pressure	1.6	1.6	2.0	1.6	1.4
Length (m)	4,871	743	1,769	487	359	641	435



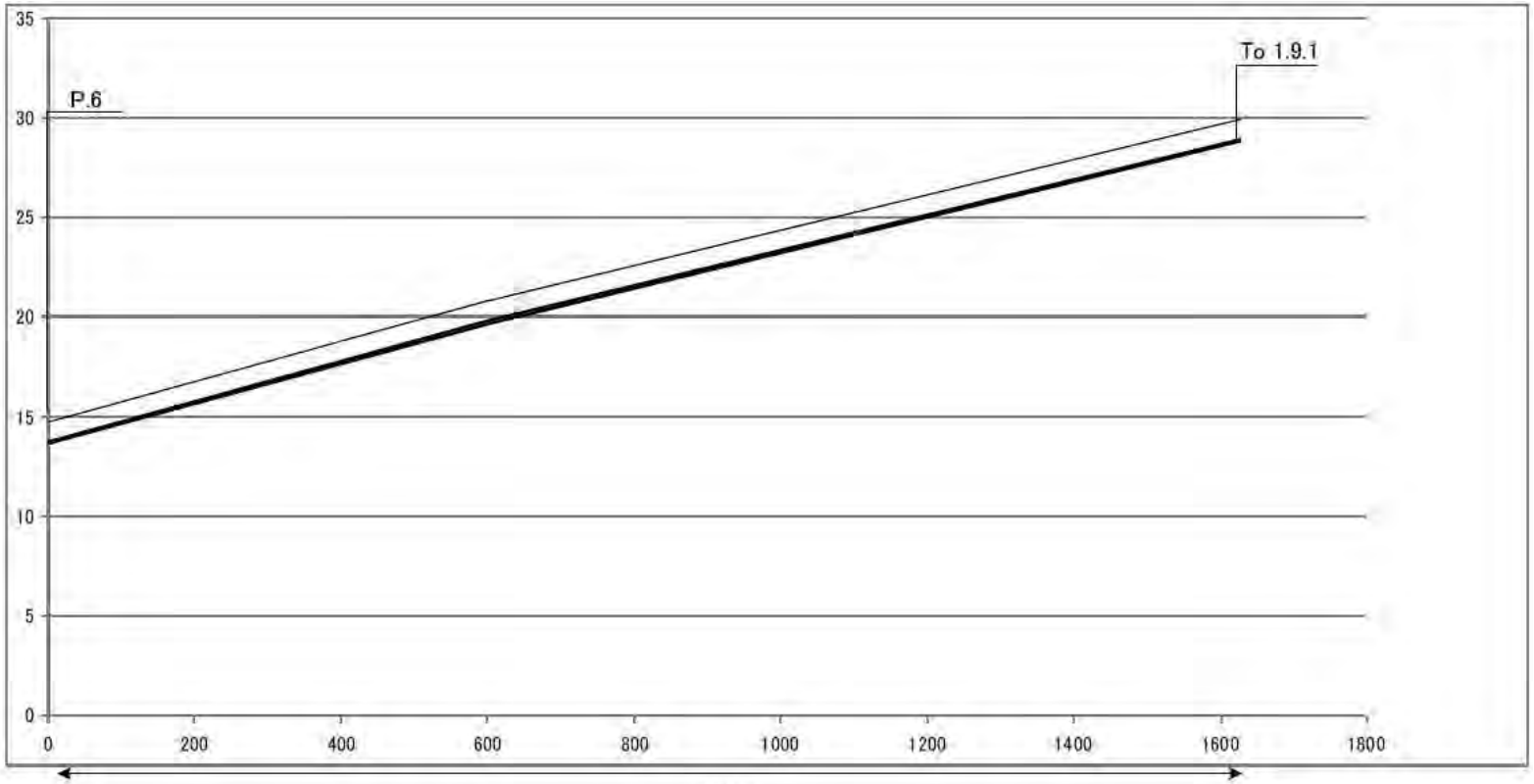
Sewer No	D1.5	D1.6.1	D1.6.2	D1.6.3	D1.7.1	D1.7.2	D1.7.3	D1.8	D1.9.1	D1.9.2	D1.9.3	D1.10	D1.11
Dia. (mm)	D800	2D315	D800	D800	2D400	D1,000	D800	2D400	D1,000	D1,000	D800	D800	D1,000
Slope(1/1,000)	1.5	pressure	1.1	1.5	pressure	1.0	1.5	pressure	1.0	1.5	1.0	1.5	2.0
Length (m)	567	1,453	184	463	200	802	1,591	823	620	380	387	1,096	100



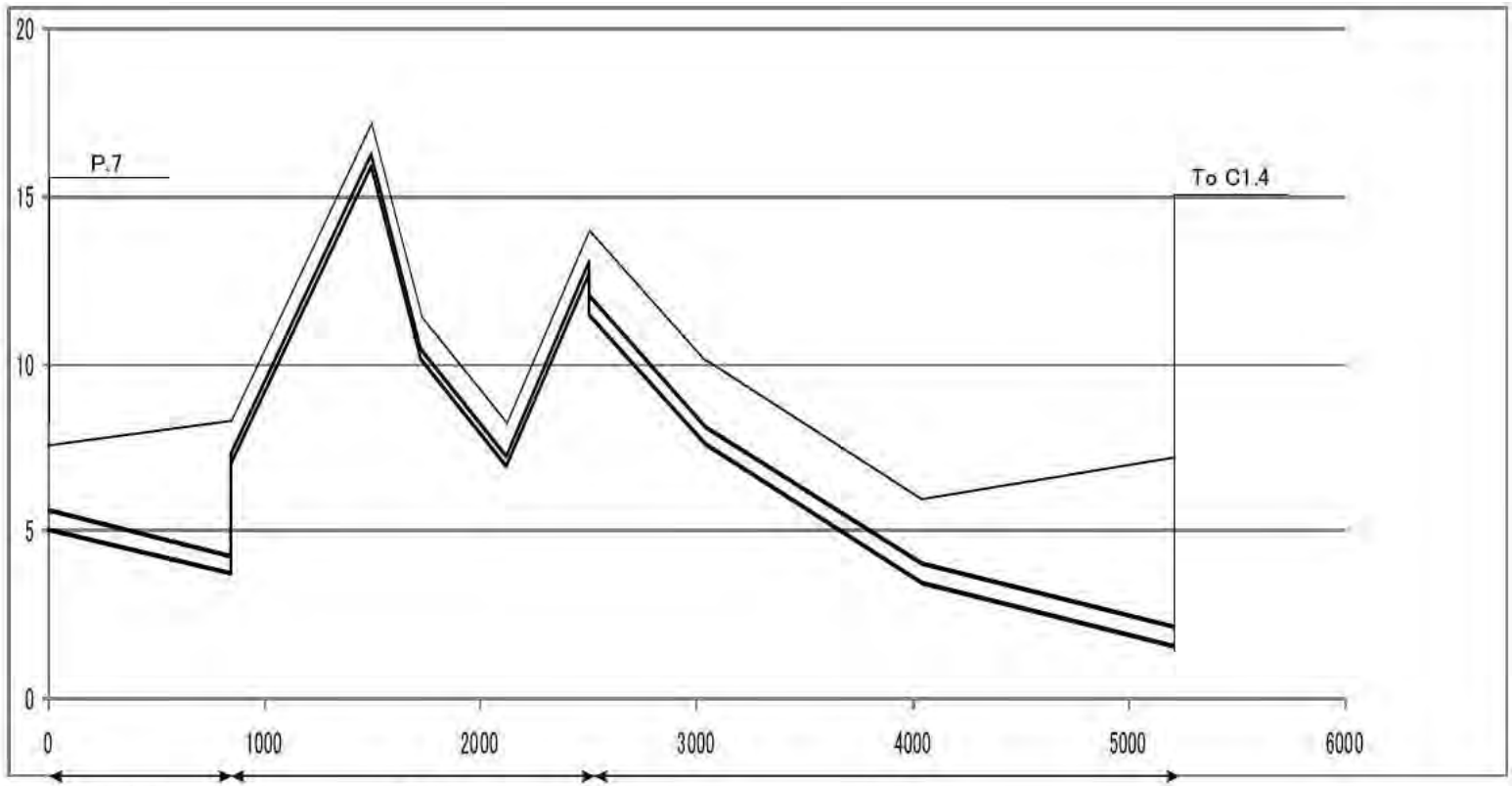
Sewer No	D2.1	D2.2	D2.3	D2.4
Dia. (mm)	D400	D180	D400	D400
Slope(1/1,000)	2.1	pressure	2.1	2.1
Length (m)	1,770	237	1,403	2,013



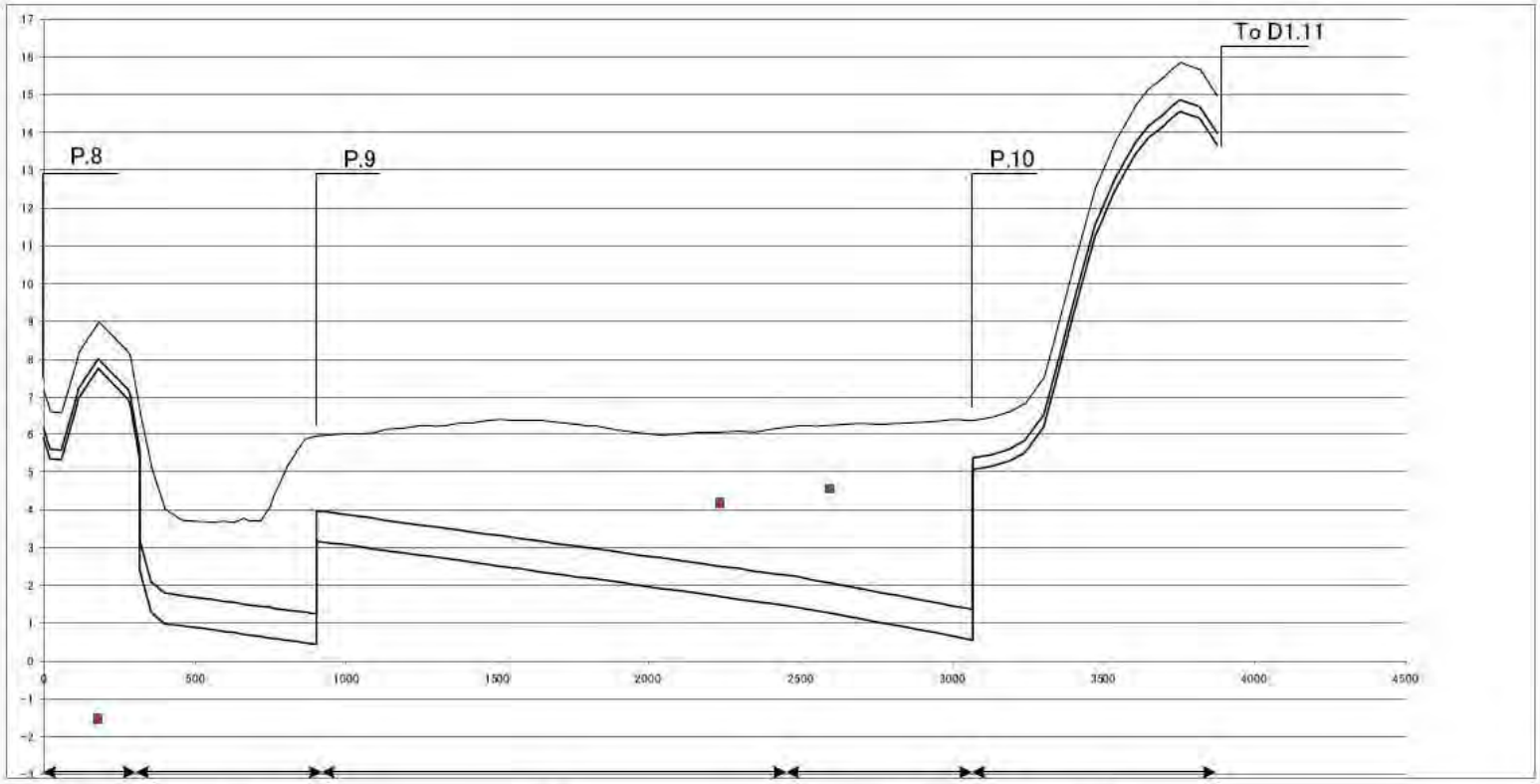
Sewer No	D3.1	D3.2	D3.3
Dia. (mm)	D400	D250	D560
Slope(1/1,000)	2.1	pressure	1.6
Length (m)	2,217	1,225	1,123



Sewer No	D4.1
Dia. (mm)	D140
Slope(1/1,000)	pressure
Length (m)	1,628



Sewer No	C1.1	C1.2	C1.3
Dia. (mm)	D560	D315	D560
Slope(1/1,000)	1.6	pressure	1.6
Length (m)	846	1,660	2,711



Sewer No	C1.4	C1.5	C1.6	C1.7	C1.8
Dia. (mm)	2D250	D800	D800	D800	2D315
Slope(1/1,000)	pressure	1.1	1.1	1.5	pressure
Length (m)	319	583	1,584	582	808

A-3-4 Sewer Lengths

(Unit:m)

Phase	Pipe Material	Diameter	Excavation Depth					PJ *1	Total
			<2.0m	<3.0m	<4.0m	<5.0m	<6.0m		
1	PVC	200	31,365	7,351	2,450	0	0	0	41,166
		400	0	468	0	1,545	0	0	2,013
		Sub-total	31,365	7,819	2,450	1,545	0	0	43,179
	HDPE	140	0	0	0	0	0	0	0
		180	0	0	0	0	0	0	0
		200	0	0	0	0	0	0	0
		250	319	0	0	0	0	0	319
		315	2,261	0	0	0	0	0	2,261
		400	1,023	0	0	0	0	0	1,023
		560	0	1,769	641	0	487	0	2,897
		630	0	0	0	435	0	0	435
		800	0	366	941	1,088	539	0	2,934
		1000	0	0	1,223	585	0	0	1,808
		Sub-total	3,603	2,135	2,805	2,108	1,026	0	11,677
	RC(PJ) *2	800	0	0	0	0	0	4,456	4,456
		1000	0	0	0	0	0	100	100
		Sub-total	0	0	0	0	0	4,556	4,556
	Total		34,968	9,954	5,255	3,653	1,026	4,556	59,412
2	PVC	200	10,240	2,400	800	0	0	0	13,440
		400	0	2,852	1,314	1,224	0	0	5,390
		Sub-total	10,240	5,252	2,114	1,224	0	0	18,830
	HDPE	140	1,628	0	0	0	0	0	1,628
		180	237	0	0	0	0	0	237
		200	743	0	0	0	0	0	743
		250	2,499	2,275	1,641	0	0	0	6,415
		315	3,921	0	0	0	0	0	3,921
		400	1,023	0	0	0	0	0	1,023
		560	0	1,538	846	2,296	0	0	4,680
		630	0	0	0	0	0	0	0
		800	0	0	0	0	0	0	0
		1000	0	0	0	0	0	0	0
		Sub-total	10,051	3,813	2,487	2,296	0	0	18,647
	RC(PJ) *2	800	0	0	0	0	0	0	0
		1000	0	0	0	0	0	0	0
		Sub-total	0	0	0	0	0	0	0
	Total		20,291	9,065	4,601	3,520	0	0	37,477
1+2	PVC	200	41,605	9,751	3,250	0	0	0	54,606
		400	0	3,320	1,314	2,769	0	0	7,403
		Sub-total	41,605	13,071	4,564	2,769	0	0	62,009
	HDPE	140	1,628	0	0	0	0	0	1,628
		180	237	0	0	0	0	0	237
		200	743	0	0	0	0	0	743
		250	2,818	2,275	1,641	0	0	0	6,734
		315	6,182	0	0	0	0	0	6,182
		400	2,046	0	0	0	0	0	2,046
		560	0	3,307	1,487	2,296	487	0	7,577
		630	0	0	0	435	0	0	435
		800	0	366	941	1,088	539	0	2,934
		1000	0	0	1,223	585	0	0	1,808
		Sub-total	13,654	5,948	5,292	4,404	1,026	0	30,324
	RC(PJ) *2	800	0	0	0	0	0	4,456	4,456
		1000	0	0	0	0	0	100	100
		Sub-total	0	0	0	0	0	4,556	4,556
	Total		55,259	19,019	9,856	7,173	1,026	4,556	96,889

添付資料-5　環境社会配慮

ENVIRONMENTAL IMPACT ASSESSMENT

AND

ENVIRONMENTAL MANAGEMENT PLAN

Cua Can Reservoir Sub-Project (provisional title)

For

Water Supply and Sewerage System Project

In

Phu Quoc Island, Vietnam

Table of Contents

Notification for Revision

"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewer system. As for the construction of the reservoir, "Cua Can Reservoir Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project")will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Environmental Impact Assessment (EIA) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This EIA report is prepared to summarize the result of EIA survey complied with JICA GL.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the EA is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

1. Executive Summary

Phu Quoc Master Plan (MP) 2009 was updated to Adjusted MP 2010 and approved by the prime minister as Decision No. 633. Ander the concept of Adjusted MP 2010, preparatory survey for "Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consisting of three major components such as; i) reservoir, ii) water supply system and iii) sewer system had started in September, 2011.

Within the preparatory survey, basic information was collected and described in this report "EIA & EMP" and revised with progress of EIA study by PMU/SPC subsequently. The EIA study was conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This EIA report is prepared to summarize the result of EIA survey complied with JICA GL.

Project Introduction:

MP 2010 describes that water demand will increase in a large extent by tourism development in addition to the potential shortage of water supply in the current situation. On the other hand, There is no sewer treatment system in the island except existing low-effective septic tanks, which causes water pollution to water environment such as Doung Dong River. Thus, water environment faces difficulty even the present and with expectation of increasing visitors, both water supply and sewer system are urgently necessary.

Legal and Policy framework of EIA in accordance of GOV:

- Law on Environmental Protection No. 52/2005/QH11 of 29 November 2005;
- Decree 21/2008/ND-CP of 28 February 2008, Amending and Supplementing Some Articles of Decree 80/2006/ND-CP;
- Decree 80/2006/ND-CP of 9 August 2006, On Detailed Guideline for Implementation of Some Articles of Law on Environmental Protection;
- Circular 05/2008/TT-BTNMT of 8 December 2008, On Guidelines for Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitments.
- Decree 81/2006/NĐ-CP dated 09/8/2006 by Government stipulation on sanctions against administrative violations in environmental protection Environment Protection.
- Decree 149/ND-CP dated 27/07/2004 regulations on permit for exploration, exploitation and use of water resources and discharge into water receiving body.
- Circular 25/2009/TT-BTNMT dated 16/11/2009 promulgating the National Technical Regulation on Environment.
- Circular 16/2009/TT-BTNMT dated 7/10/2010 additional issuance of National Technical Standards on Environment.
- Standards – Technical Code for the Vietnam Environmental Protection:

- TCVN 5576:1991 - Standards for water supply and drainage systems;
- TCVN 6962:2001 - Permissible Vibration and Clash in Construction Activities;
- TCVN 5949:1998 - Permissible Noise Levels in the Residential and Public Areas;
- QCVN 05:2009 - Vietnam Standard on Air Ambient Quality;
- QCVN 01:2009 - Vietnam Standard on Drinking Water Quality;
- QCVN 08:2008 - Vietnam Standard on Surface water Quality;
- QCVN 09:2008 - Vietnam Standard on Ground water Quality;
- QCVN 14:2008 - Vietnam Standard on Domestic Wastewater;

Project Description:

"Cua Can Reservoir Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project") was

designed to impound 15 million m^3 of water for the new WTP to use it as water source. The site for the reservoir is planned in a large-scale agricultural area along Cua Can River which is to be the source of the water. The site area will be approximately 200ha and will be excavated so that it can impound such amount of water. The supply areas are newly designed tourism areas such as Cua Doung, Cua Can and Ganh Dau and possibly Doung Dong area if necessary.

Analysis of Alternatives:

Alternatives for water source for WTP were considered. Alternatives are; i)"without project" situation, ii) ground water, iii) seawater desalination, iv) reservoir construction. As a result of comparison, in terms of feasibility, reservoir construction was adopted.

As for the location of the reservoir, the national park exists in the surrounding area of the current planned site. Acquisition of 15,000,000m^3 area avoiding the national park limits the available site to the current location. Therefore, no alternatives are found along Cua Can River

Base Environment Conditions:

The data based on the current status of environmental conditions in the project area are presented. Thereby, a general assessment of environmental quality in existing project area has been considered. The environmental factors include:

- Land environment
- Water environment
- Air environment
- Ecological environment

Environment Impact Assessment:

EIA study had been conducted based on scoping items which were presented to stakeholders. Scoping items were reevaluated after the study. Items with level A or B for environmental impact are shown in EMP for their mitigation measures.

Environment Management Plan:

The results of the EIA show that the potential impact of the project such as noise and dust focuses during the construction in a short term. Although the site change the land use to large extent irreversibly, the existing vegetation is not a natural forest and the wildlife can be transferred fortunately. The reservoir's only purpose is impounding water as drinking water resource that no discharge is designed and there is less risk than common dams.

Even for short-term construction related impacts, such as common construction-related impacts of dust, noise and construction site waste can be prevented or minimized with standard mitigation measures. The EMP for this Sub-project consists of impact mitigation and monitoring requirements necessary to manage and measure expected and unexpected impacts of the Sub-project. The implementation of the EMP will require support from an environmental consultant (EC), and an independent environmental

consultant (IEC) to audit the EMP.

Public Consultant and Information Disclosure:

In the first stakeholder consultation, explanation of the outline of the project and the scoping draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussions were focused on impacts by the reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, satisfactory answers were given. In addition, anonymous opinions from attendants were collected in order to hear as many people as possible. The contents and countermeasures were distributed to authorities concerned and attendants.

2. Policy and Legal Framework for EIA

2.1 Vietnam

2.1.1 Outline of environmental social consideration related laws and regulations

Institution of EIA in Vietnam is prescribed by Law on Environmental Protection (LEP; No.52/2005/QH11) , Decree No. 80/2006/ND-CP, No. 21/2008/ND-CP and No. 29/2011/ND-CP. LEP was made public by No. 29/2005/L/CTN and came into effect in 2006. It prescribes Strategic Environment Assessment, EIA and Environment conservation pledge.

Decree No. 80/2006/ND-CP, No. 21/2008/ND-CP and No. 29/2011/ND-CP prescribe LEP administrative instruction, EIA target project list, EIA procedure, contents of EIA report and so on. By these decrees, it is prescribed that projects involving reservoirs of 100,000m^3 or more and sewer system of 500m^3/d or more need to prepare EIA reports. It applies to the project components for the reservoir and STP but it does not apply to WTP construction.

EIA report should be prepared within 24 months since the commencement of the project. The procedure to be followed is shown in section 2.1.2.

The approval authorities for the project are Ministry of Natural Resources and Environment (MONRE) or DONRE.

Stakeholder consultation should be held at the stage of EIA report preparation, which is prescribed by Decree No. 29/2011/ND-CP.

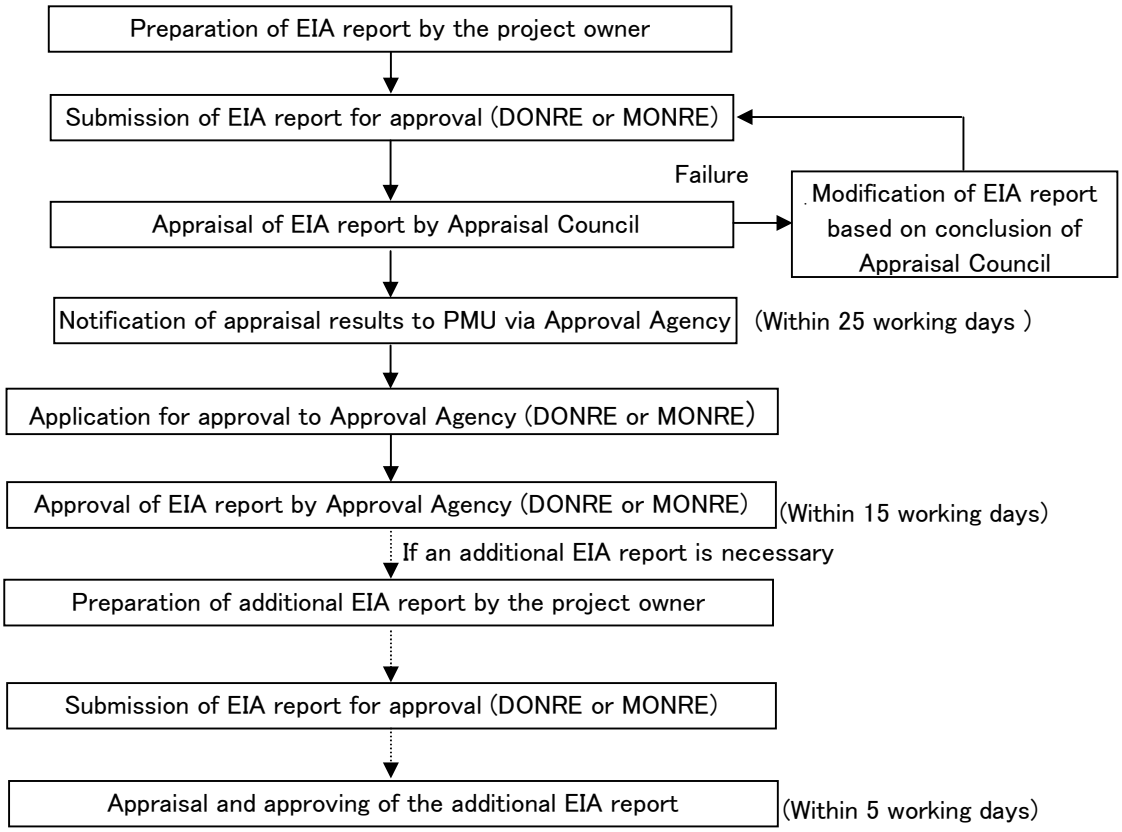
For information disclosure, the decree describes that the authority send the EIA report to the proponent and the environmental departments and the Provincial PC distributes the copies to local PCs.

The GOV EIA system is defined by the following key legal and policy regulations:

• Law on Environmental Protection No. 52/2005/QH11 of 29 November 2005;
• No. 29/2011/ND-CP of April 18, 2011, Providing Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment;
• Decree 21/2008/ND-CP of 28 February 2008, Amending and Supplementing Some Articles of Decree 80/2006/ND-CP;
• Decree 80/2006/ND-CP of 9 August 2006, On Detailed Guideline for Implementation of Some Articles of Law on Environmental Protection;
• Circular 05/2008/TT-BTNMT of 8 December 2008, On Guidelines for Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitments.
• Decree 81/2006/NĐ-CP dated 09/8/2006 by Government stipulation on sanctions against administrative violations in environmental protection Environment Protection.
• Decree 149/ND-CP dated 27/07/2004 regulations on permit for exploration, exploitation and use of water resources and discharge into water receiving body.
• Circular 25/2009/TT-BTNMT dated 16/11/2009 promulgating the National Technical Regulation on Environment.
• Circular 16/2009/TT-BTNMT dated 7/10/2010 additional issuance of National Technical Standards on Environment.
• Standards – Technical Code for the Vietnam Environmental Protection:
- TCVN 5576:1991 - Standards for water supply and drainage systems;
- TCVN 6962:2001 - Permissible Vibration and Clash in Construction Activities;
- TCVN 5949:1998 - Permissible Noise Levels in the Residential and Public Areas;
- QCVN 05:2009 - Vietnam Code on Air Ambient Quality;
- QCVN 01:2009 - Vietnam Code on Drinking Water Quality;
- QCVN 08:2008 - Vietnam Code on Surface water Quality;
- QCVN 09:2008 - Vietnam Code on Ground water Quality;
- QCVN 14:2008 - Vietnam Code on Domestic Wastewater;
- QCVN 03:2008 - Vietnam Code on Heavy Metal in Soil;
- QCVN 24:2009 - Vietnam Code on Industrial Wastewater;
- QCVN 02:2009 - Vietnam Code on Domestic Water Quality

2.1.2 EIA procedure

The procedure for appraisal and approval of the EIA report is shown in **Figure 2-1**.



(Source: JICA Survey Team (by consultation with DONRE))

Figure 2-1 Procedure for Appraisal and Approval of EIA Report

Contents of environmental impact assessment reports are as follows.

Table 2-1 The Impact Assessment Report (GOV) Contents

No.	Description	Reference
1	Enumeration and detailed description of the project's construction components, construction area, time and workload; operational technology for each component and the entire project	3. Project Description
2	Overall assessment of the environmental status at the project site and neighboring areas; the sensitivity and load capacity of the environment.	6. Scoping / 7. EIA measures / 8. Environment Management Plan
3	Detailed assessment of possible environmental impacts when the project is executed and environmental components and socio-economic elements to be impacted by the project; prediction of environmental incidents possibly caused by the project.	6. Scoping / 7. EIA measures / 8. Environment Management Plan
4	Specific measures to minimize bad environmental impacts, prevent and respond to environmental incidents.	8. Environment Management Plan
5	Commitments to take environmental protection measures during project construction and operation.	Annex
6	Lists of project items, the program on management and supervision of environmental issues during project execution.	8.3 Mitigation Plan / 8.4 Environment Monitoring Plan
7	Cost estimates for building environmental protection works within the total cost estimate of the project.	8.5 Estimated Cost for EMP

No.	Description	Reference
8	Opinions of the commune/ward or township People's Committees (hereinafter collectively referred to as commune-level People's Committees) and representatives of population communities in the place where the project is located; opinions against the project location or against environmental protection solutions must be presented in the environmental impact assessment report.	9. Stakeholder consultation
9	Citation of sources of figures and data, assessment methods.	Each chapter

2.2 JICA Guideline

2.2.1 Principle

The following conditions are met in principle:

•When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents etc. must officially finish those procedures and obtain the approval of the government of the host country;

•EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them;

•EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted;

•In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared;

•Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared; and

•It is desirable that EIA reports cover the items enumerated in the following.

2.2.2 Illustrative Environmental Impact Assessment Report

An EIA's scope and level of detail should be determined in accordance with the project's potential impacts. The EIA report should include the following items (not necessarily in the order shown):

Table 2-2 The EIA Report Contents

Contents	Description	Reference
Executive summary	This concisely discusses significant findings and recommended actions.	1. Executive summary
Policy, legal, and administrative framework	This is the framework within which the EIA report is to be carried out.	2. Policy and Legal Framework for EIA
Project description	This describes the proposed project and its geographic, ecological, social and temporal context, including any off-site investments that may be required (e.g. dedicated pipelines, access roads, power plants, water supply, housing, or raw material and product storage facilities). It also	3. Project Description

Contents	Description	Reference
	indicates the need for any resettlement or social development plan. It normally includes a map showing the project site and the area affected by the project.	
Baseline data	This assesses the dimensions of the study area and describes relevant physical, biological, and socio-economic conditions, including all changes anticipated to occur before the project commences. Additionally, it takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project site, design, operation, or mitigation measures, and it is necessary to indicate the accuracy, reliability, and sources of the data.	4.3 Current environment situation in the Sub-project area
Environmental impacts	This predicts and assesses the project's likely positive and negative impacts in quantitative terms, to the extent possible. It identifies mitigation measures and any negative environmental impacts that cannot be mitigated, and explores opportunities for environmental enhancement. It identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and it specifies topics that do not require further attention.	7. EIA measures / 8. Environment Management Plan
Analysis of alternatives	This systematically compares feasible alternatives to the proposed project site, technology, design, and operation including the "without project" situation in terms of the following: the potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, it quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. It also states the basis for selecting the particular proposed project design, and offers justification for recommended emission levels and approaches to pollution prevention and abatement.	5. Alternatives comparison
Environmental Management Plan (EMP)	This describes mitigation, monitoring, and institutional measures to be taken during construction and operation in order to eliminate adverse impacts, offset them, or reduce them to acceptable levels.	8. Environment Management Plan
Consultation	This includes a record of consultation meetings (date, venue, participants, procedures, opinions of major local stakeholders and responses to them, and other items), including consultations for obtaining the informed views of the affected people, local NGOs, and regulatory agencies.	9. Stakeholder consultation

2.3 Overview of Subproject Screening

The Sub-projects were first screened to determine the level of assessment they require based on potential environmental impacts of the projects, and the requirements of the GOV and the JICA Guidelines. In general subprojects which could cause large scale irreversible impacts, affect sensitive and valuable natural habitats, or require significant resettlement which requires the greatest level of assessment. Whereas, projects causing minor impacts or impacts that can be mitigated require less assessment.

2.3.1 GOV Screening

Sub-projects are screened to determine whether an Environmental Impact Assessment (EIA) is required or an Environmental Protection Commitment (EPC) is required using the prescribed quantitative criteria in No. 29/2011/ND-CP. Sub-projects that meet or exceed the quantitative criteria require an EIA. Projects that do not meet the criteria, i.e., are smaller in size and scope, require an

EPC. The Cua Can Reservoir Sub-Project requires preparation of an EIA.

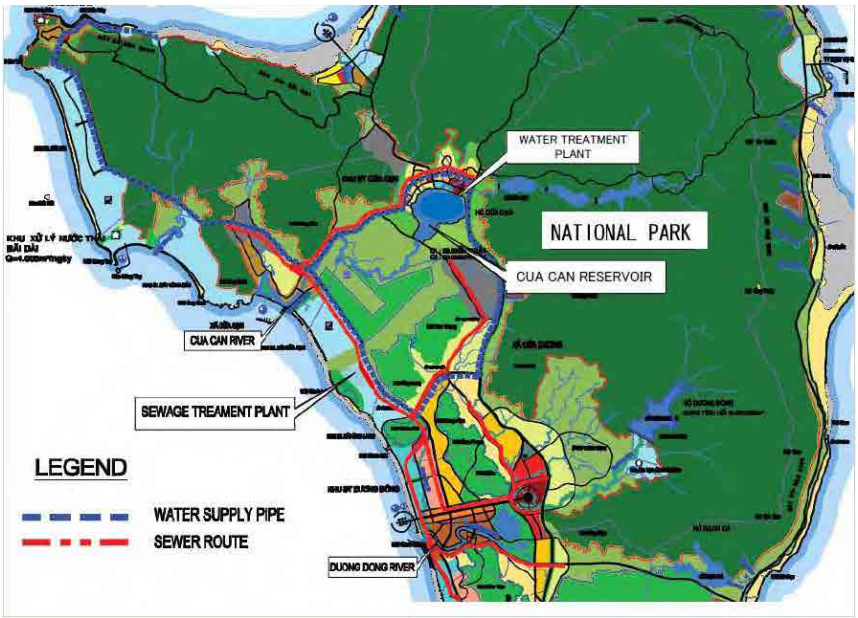
2.3.2 JICA Screening

JICA defines three primary project categories as “Category A”, “Category B” or “Category C” based on more subjective screening of potential environmental risk. Category A projects are normally large and can cause irreversible complex impacts, and thus require the greatest level of assessment. The potential impacts of a Category B are much less adverse, normally not irreversible, and can be mitigated. Category B projects at a minimum require an EMP. Category C projects have minimal or no adverse environmental impacts, and normally do not require environmental assessment beyond screening. A fourth Category is FI. These are projects which are financially supported but not managed by JICA. The Cua Can Reservoir Sub-Project includes building a large-scale impounding reservoir, which requires a Category A EIA/EMP.

3. Project Description

3.1 Outline of project components to affect environmental and social impacts

Main components of the project are; i) reservoir, ii) water supply system and iii) sewer system. The map shown below indicates the project site with the components.



Source: Master plan 2009

Figure 3-1 The project site

Figure 3-2 shows the outline of Cua Can reservoir design. The present design is that Cua Can River will be left as it is and Cua Can reservoir will be constructed on the side. This design avoids impacts to Cua Can River by the construction of Cua Can reservoir. Besides, the method of intake that will withdraw River water only when extra water exists will remain the current River environment in

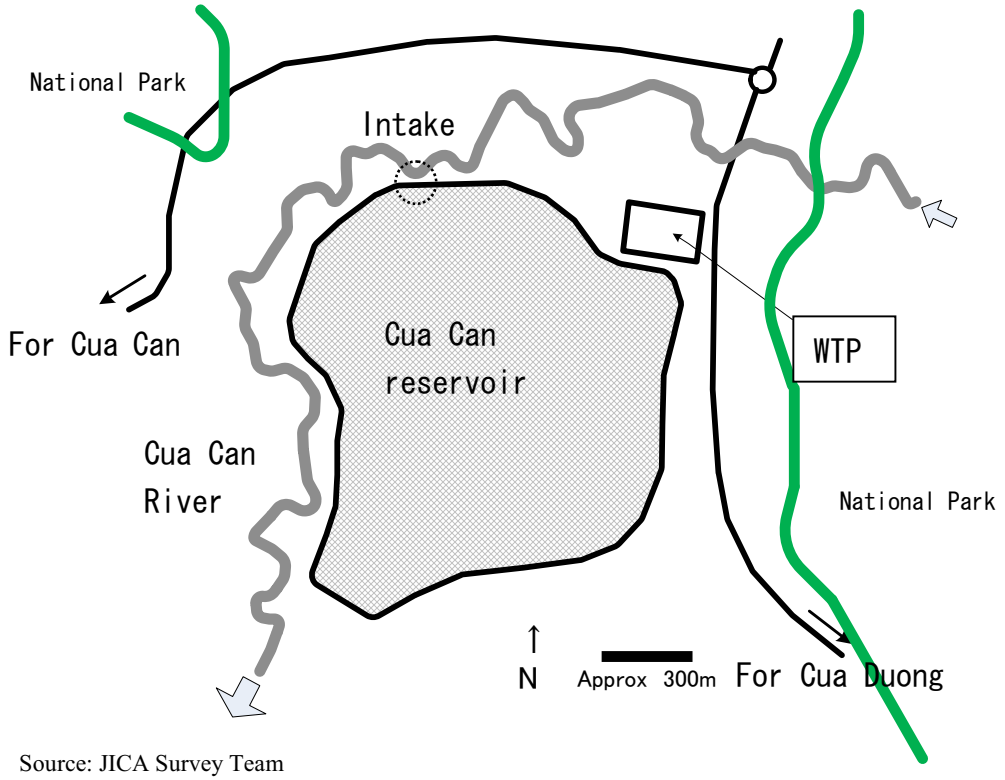
future as well.

In addition, Cua Can reservoir and the WTP planned site are outside of the national park and the closest distance between the project sites and the park will be approximately 300m.

Reservoir construction will produce extraordinary amount of soil because the planned site will be excavated. The authorities concerned said that soil in Phu Quoc or whole Vietnam is in high demand and salable. However, the amount is extremely large and coordination with other development projects is necessary. Thus, consultation with Kien Giang province or GOV will be necessary.

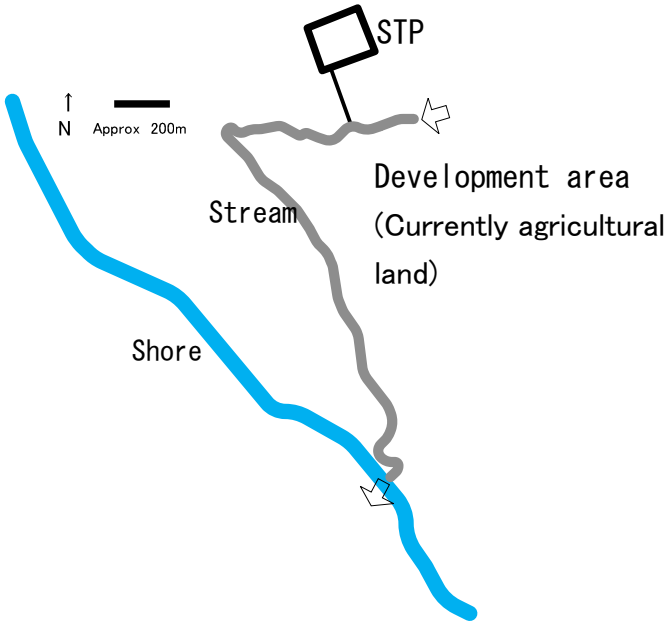
WTP is scheduled to be constructed adjacent to the reservoir, and the site will be approximately 5 to 6ha (**Figure 3-2**).

STP is scheduled to be constructed where is approximately 2km upstream of a stream from the shore and the site will be approximately 4ha. The stream to which the STP will discharge effluent is the depth of about 20cm and the width of 2m in wet season and is dried up in dry season. The environment is not suitable for aquatic organism nor fishery (**Figure 3-2** and **Picture 3-1).**



Source: JICA Survey Team

Figure 3-2 Cua Can reservoir & WTP



Source: JICA Survey Team

Figure 3-3 STP planned site

《Picture 3-1》 The stream to which the STP will discharge effluent (above: wet season, below: dry season)

(by JICA Survey Team)

3.2 Service Area of the Project

Figure 3-1 shows the service area (pipeline routes) of water supply and sewer system.

3.3 Cua Can Reservoir Sub-project

MP 2010 describes that water demand will increase in a large extent by tourism development in addition to the potential shortage of water supply in the current situation and new water supply system is urgently necessary.

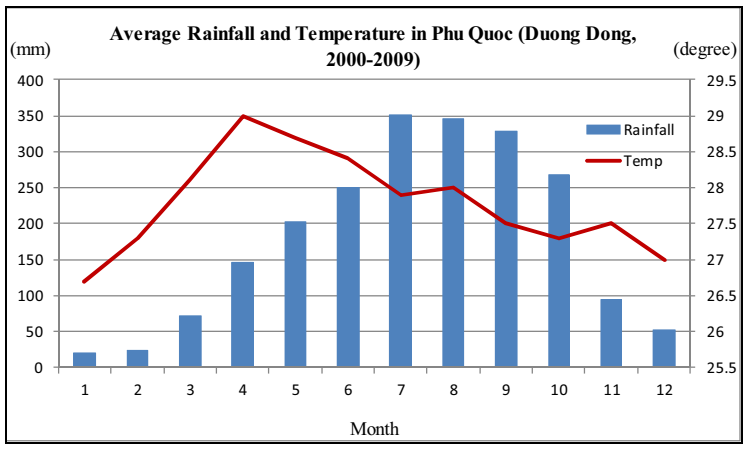
The Sub-project was designed to impound 15 million m^3 of water for the new WTP to use it as water source. The site for the reservoir is planned in a large-scale agricultural area along Cua Can River which is to be the source of the water. The site area will be approximately 200ha and will be excavated so that it can impound such amount of water. The supply areas are newly designed tourism areas such as Cua Doung, Cua Can and Ganh Dau and possibly Doung Dong area if necessary.

4. Current environmental condition

4.1 Nature conditions

4.1.1 Meteorological phenomenon

Phu Quoc Island has tropical climate with monsoon which is divided into two clear seasons: the rain season lasts from May to November, dry season lasts from December to April of the next year with average temperature of 27 deg C; average rainfall of 2,879 mm. Average rainfall and temperature in Duong Dong, Phu Quoc is shown in **Figure 4-1.**



Source: JICA Survey Team

Figure 4-1 Average rainfall and temperature

4.1.2 Geography

Phu Quoc Island (Phú Quốc) is located in the Thailand gulf with the area of 560km² (largest island in Vietnam). It is located 40km away from Vietnam mainland. In the south of the island are small islands of An Thoi. In the North-east of the island, there is a border with islands of Cambodia. Cua Can River and Duong Dong River start from forests in the north-east part of the island and reach to the west

shore. Alongside the shore Long Beach and Sao Beach stretch out. The Long Beach is located on the west side with the length of 20km.

4.1.3 Water regime

Phu Quoc has a dense river system with a density of 0.42 km/km^2 with many big rivers and canals. Ground water source is limited, water from the weathered rocks, a supplementary source to ground water is rainy water absorbing and kept in broken and chapped rock. Therefore, it is necessary to provide water storage solutions in the dry season and limit ground water over-exploitation to avoid brackish ground water.

Sources causing surface water and ground water pollution:

- Affected from the salt contamination: its cause is dryness, high tide and northeast wind. The salt contamination impacts significantly on water environment, directly affect the people's living and activities as well as production.
- Affected from the illegal ground water exploitation: the illegal ground water exploitation will not be controlled on area, capacity, yield, groundwater reserve in the region, also risks to contaminate the aquifers and groundwater source is degraded. Ground water reserve is over-exploited, which causes salt contamination, drought reserve, desertification by low drawdown, ground surface subsidence, etc.
- Affected from the domestic wastewater: Domestic wastewater not managed, collected and treated appropriately, will cause risks and adverse impacts on water environment including organic pollution, nutrition pollution and biological pollution. Domestic wastewater is one of the causes of significant pollution to the water environment and easy to spread epidemic diseases to a large extent.

(Source: Environmental Assessment and Environmental Management Plan for Phu Quoc water supply sub-project, 2011, KIWACO)

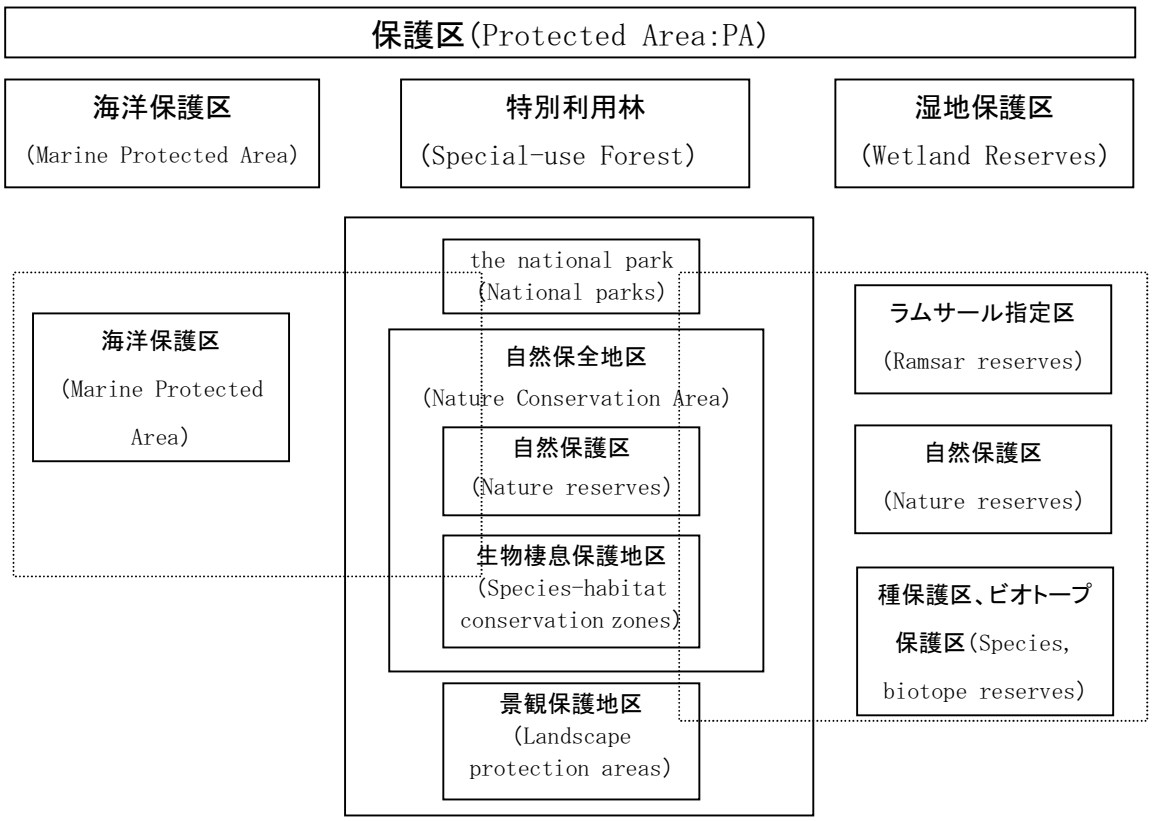
4.1.4 Protected area

The national park occupies 56% of Phu Quoc Island in area. The national park is shown in deep green in **Figure 3-1** and vasts in the northern part of Phu Quoc Island. The project sites are outside of the national park and the closest distance will be approximately 300m.

The national park belongs to Special-use forest. For usage of Special-use forests, followings should be maintained; (i) conservation of biodiversity of forests and habitats of endangered species / rare species, (ii) fauna and flora valuable in terms of science, education, tourism and economy, (iii) Values in terms of scenery, culture, history and environment.

Diagram of Protected area is shown in **Figure 4-2** and related laws and regulations are shown in **Table 4-1.**

Protective forest area shown in **Figure 4-3** is different from the Protected area. It is described in **4.2.3 Land use**.



Related laws and regulations

National MPA System Plan	No.29/2004/QH11 Decree No. 23/2006/ND-CP	No.109/2003/ND-CP No.109/2003/ND-CP No.18/2004/TT-BTNMT

(Source: JICA)

Figure 4-2 Diagram of Protected area

Table 4-1 Main laws and regulations of Special-use forest management

Laws and regulations	Date
Decree 58/LCT/HDNN	1991/08/19
Decision No. 327/CT	1992/09/15
Decree No. 14/CT	1992/12/05
Directive No. 130/TTg	1993/3/27
Decree No. 77/CP	1996/11/29
Directive 286/TTg	1997/5/2
Decision 661/1998/QD-TTg	1998/7/29
Decision 245/QD-TTg	1998/12/21
Decision 34/1999/QD-BNN-TCCB	1999/2/12
Circular 56/1999/TT-BNN-KL	1999/3/30
Decree 163/ND-CP	1999/11/16
Decision No. 08/QD-TTg	2001/01/11
Decree No. 139/2004/ND-CP	2004/01/25
No. 29/2004/Q11	2004/12/14
Decision No. 61/2005/QD-BNN	2005/10/12
Decision No. 62/2005/QD-BNN	2005/10/12
Decree No. 23/2006/ND-CP	2006/03/03

(Source: Review of the Protected Area System of Vietnam (ASEAN Regional Centre for Biodiversity Conservation))

Buffer Zone was designated in the surrounding area of the National Park (Core Zone) in accordance with the idea of Biosphere Reserve. In the Buffer Zone (shown in red in the following map), fire-prevention campaign was held for the inhabitants. However, the division that was in charge of the

management of the zone category was closed in 2005 and the status of the category has been uncertain for the time being.

Development projects in the Buffer Zone area are admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.

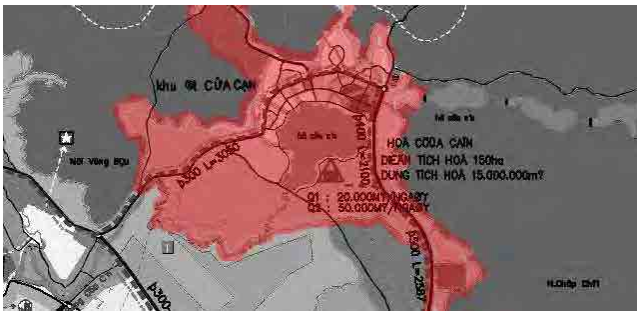


Figure 4-3 Buffer Zone related to the Project sites

4.1.5 Fauna

In the fauna and flora study by the University of Agriculture and Forestry in 2005 targeting the Phu Quoc national park, total number of wildlife species confirmed was 206 in 75 families, 24 orders, 4 classes. 35 species are designated as rare or restricted for hunting. 15 species are from IUCN red book (2004). 24 species are from Vietnam red book (2000). 22 species are from Decree 32/2006/ND-CP. (**Table 4-2**). The study describes followings as commonly seen wildlife.

- Mammals: classes of wild pig, deer, bat, monkey, otter, marten, squirrel, etc.
- Birds: classes of duck, swallow, goosey, hornbill, heronry, pelican, robin, owl, pigeon, wagtail, woodpecker, etc.
- Reptile / Amphibian: classes of snake, crocodile, turtle, lizard, flog, etc.
- Fin: not described

Table 4-2 Rare or restricted species in the Phu Quoc National Park

Classification	No.	Scientific name	IUCN (2004)	SDVN (2000)	ND32 (2006)
Mammal	1	*Nycticebus coucang* *Nycticebus bengalensis*	DD	V	IB
	2	*Nycticebus pygmaeus*	VU	V	IB
	3	*Trachypithecus germaini*	DD		IB
	4	*Aonyx cinerea*	LR/nt	V	IB
	5	*Callosciurus finlaysoni harmandi*		R	
Bird	1	*Buceros bicornis*	T	NT	IIB
	2	*Ichthyophaga ichthyaetus*		NT	
	3	*Halcyon capensis*	T		
	4	*Polihierax insignis*		NT	IIB
	5	*Ketupa flavipes*			IIB
	6	*Copsychus malabaricus*			IIB
	7	*Gracula religiosa*			IIB
	8	*Tyto alba*			IIB
Amphibian / Reptile	1.	*Gekko gecko*		T	
	2.	*Physignathus cocincinus*		V	
	3.	*Varanus bengalensis*		V	IIB

Classification	No.	Scientific name	IUCN (2004)	SDVN (2000)	ND32 (2006)
	4.	*Varanus salvator*		V	IIB
	5.	*Python molurus*	LR/nt	V	IIB
	6.	*Python reticulatus*		V	IIB
	7.	*Elaphe prasina*		T	
	8.	*Elaphe radiata*			IIB
	9.	*Ptyas korros*		T	
	10.	*Ptyas mucosus*		V	IIB
	11.	*Bungarus candidus*			IIB
	12.	*Bungarus fasciatus*		T	IIB
	13.	*Naja atra*		T	IIB
	14.	*Ophiophagus hannah*		E	IB
	15	*Dermochelys coriacea*	CR	E	
	16.	*Chelonia mydas*	EN	E	
	17.	*Eretmochelys imbricata*	CR	E	
	18.	*Lepidochelys olivacea*	EN	V	
	19.	*Hieremys annandalii*	EN	V	IIB
	20.	*Malayemys subtrijuga*	VU		
	21.	*Amyda cartilaginea*	VU		
	22.	*Crocodylus siamensis*	CR	E	IIB

【Legend】
・IUCN (IUCN red book)
- Critically Endangered (CR) - Endangered (EN) - Vulnerable (VU) - Lower Risk / Near Threatened (LR/nt)
- Data Deficiency (DD)
・SDVN (Vietnam red book)
- Endangered: E - Vulnerable: V - Rare: R - Threatened: T
・ND32 (Decree 32/2006/ND-CP)
- IB (Wildlife species that are strictly prohibited to any hunting and use) - IIB (Wildlife species that can be limitedly hunted and used under strict control)

(Source: Ecotourism Development Strategy of The Phu Quoc National Park（University of Agriculture and Forestry,2006）

The study exempt fin as a target but the Department of Kien Giang Natural Resources and Environment (DONRE) which is planning environment study in Cua Can River says it is assumed that only few kinds of fish inhabit. Cua Can Commune's Peoples Committee in whose area Cua Can River exists says that only few kinds of fish inhabit and no fishery is conducted in the river. Phu Quoc National Park Management Board says rare wildlife should inhabit only in the national park.

4.1.6 Flora

The study mentioned in (5) categorize flora such as; i) Mangrove, ii) Melaleuca Forest, iii) Brushland with Oncosperma tigillaria, iv) Dry forest, v) Open Dipterocarp forest, vi) Imperata grassland, vii) Secondary forests and viii) Primary Dipterocarp Forest. The project site is scheduled to be in the Secondary forests.

Table 4-3 shows major flora system in the national park summarized by the study. Rare flora is not mentioned by the study and Phu Quoc Forestry Agent who attended a site visit by JICA Survey Team in October, 2011 says no rare flora species exist in the planned site.

Table 4-3 Geo-botanical Elements in the Flora of Phu Quoc Island

Flora system	Typical elements		Number of Taxa
Malayano-Indonesian	-	Dipterocarpaceae	6 genera / 16 species
Hymalayano-Yunnan	Gymnospermae:	Podocarpaceae	2 genera / 4 species

		Gnetaceae	1 genera / 1 species
	Angiospermae:	Ulmaceae	1 genera / 1 species
		Oleaceae	3 genera / 3 species
		Aceraceae	10 genera / 12 species
		Rosaceae	1 genera / 1 species
		Fagaceae	2 genera / 4 species
		Lauraceae	6 genera / 8 species
Indo-Mianma	-	Combretaceae	5 genera / 7 species
		Lythraceae	1 genera / 3 species
		Bombaceae	2 genera / 2 species

(Source: Ecotourism Development Strategy of The Phu Quoc National Park（University of Agriculture and Forestry,2006）

4.2 Current social condition

4.2.1 Population

Phu Quoc Island consists of 2 towns and 8 villages. The whole population of the island is approximately ninety thousand. **Table 4-4** shows shifts of the population.

Table 4-4 The shifts of the population

Town/Commune		Y2005	Y2006	Y2007	Y2008	Y2009
Town	Duong Dong	28,370	30,074	31,053	31,811	31,940
	An Thoi	17,854	18,927	19,531	20,292	19,880
Commune	Cua Can	3,058	3,241	3,345	3,429	3,394
	Cua Duong	7,213	7,655	7,899	8,096	7,789
	Ham Ninh	6,706	7,108	7,336	7,519	7,573
	Duong To	6,069	6,434	6,640	6,806	7,204
	Bai Thom	4,632	4,909	5,066	5,193	4,404
	Ganh Dau	3,904	4,138	4,271	4,378	4,294
	Hon Thom	2,697	2,859	2,950	3,024	2,438
	Tho Chau	1,480	1,563	1,612	1,652	1,755
Total		81,983	86,908	89,703	92,200	90,671

(Source: Phu Quoc Census Book 2009)

4.2.2 Social economic condition

Major economic activities in Phu Quoc Island are fishery, black pepper and fish sauce (Nuoc Mam). **Table 4-5** shows the population for occupations in the island.

Table 4-6 shows important infrastructure such as educational and medical institutions. They do not exist within 2km from the project site.

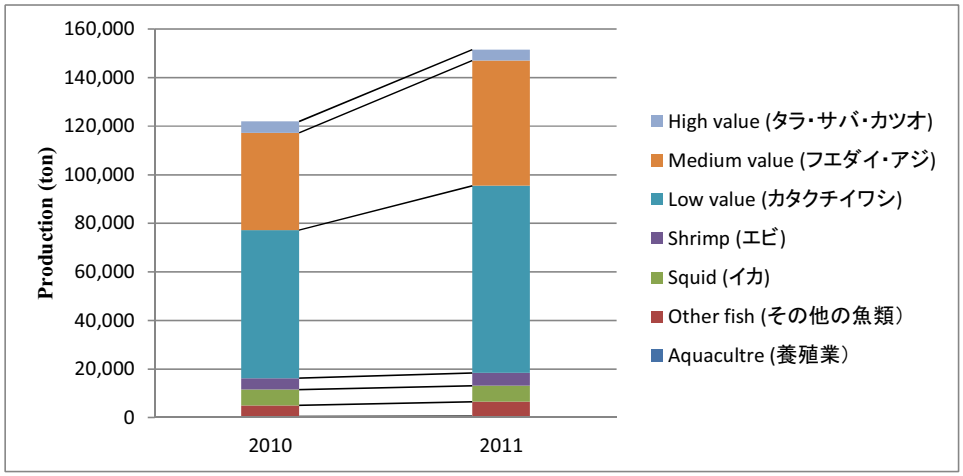
The breakdowns of production of the two major industries (fishery and agriculture) in Phu Quoc are shown in **Figure 4-5** and **4-6**.

Table 4-5 Population for occupations

No.	Occupation	Population (2009)	Rate (%)
1	Aquatic product	13,546	14.94%
2	Agricultural production	7,446	8.21%
3	Commerce, Vehicle's Motor and Engine Repair	3,552	3.92%
4	Food Process Industry	3,146	3.47%
5	State Management , The National Defense Security, etc.	2,616	2.89%
6	Restaurants, Hotel	2,486	2.74%

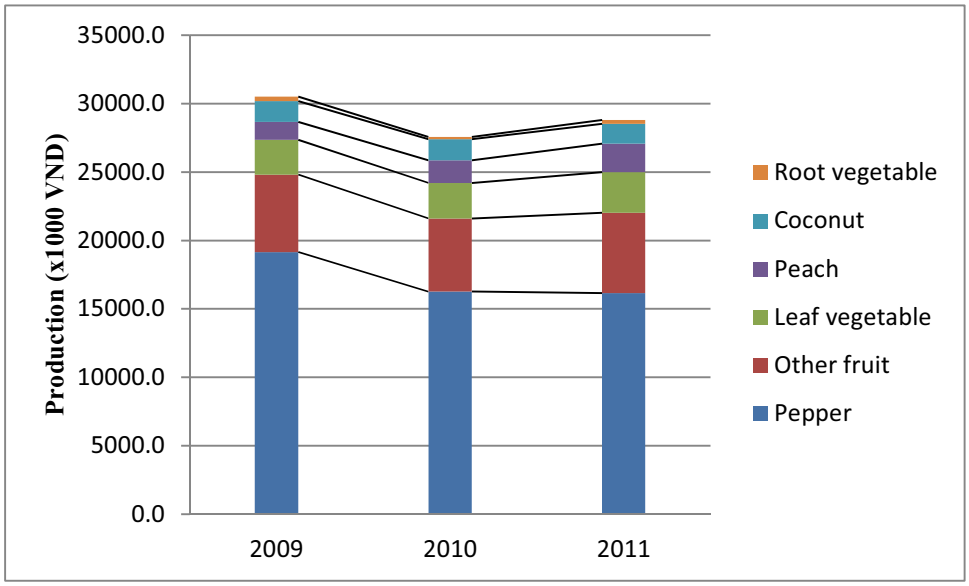
7	Transportation, Warehouse, etc.	2,430	2.68%
8	Education and Training	970	1.07%
9	Construction	857	0.95%
10	Other	2,410	2.66%
-	Total	39,459	43.52%
Not working		51,212	56.48%

(Source: Phu Quoc Census Book 2009)



(Source: Phu Quoc Statistic Bureau)

Figure 4-5 Buffer Zone related to the Project sites



(Source: Phu Quoc Statistic Bureau)

Figure 4-6 Buffer Zone related to the Project sites

Table 4-6 Important infrastructure

No	Important infrastructure	Number
	Educational	
1	Primary School	11
2	Primary+ Secondary School	7
3	Secondary School	6
	Medical	

No	Important infrastructure	Number
1	Hospital	1
2	Regional General Surgery Room	1
3	Town, Commune Medical Care Station	43

(Source: Phu Quoc Census Book 2009)

4.2.3 Tourism

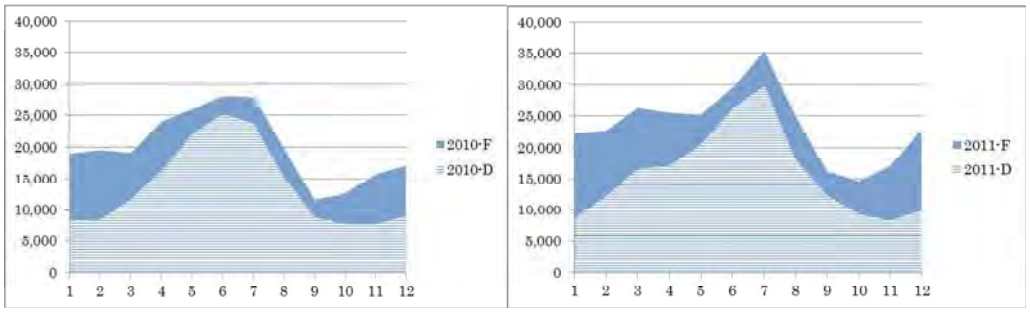
Tourists visiting Phu Quoc Island increase in recent years as shown in **Table 4-7**. The shifts of monthly population of tourists are also shown in **Figure 4-7**. Domestic tourists are as twice as foreigners. Foreign tourists increase in the dry season (Dec.-Apr.) while the whole tourist population increases from May to July which is a major holiday season in Vietnam.

According to the 2009 M/P, two million tourists in 2020 and 5 million in 2030 are estimated but the grounds for estimation are not described and it is assumed that the numbers are nonbinding targets.

Table 4-7 Yearly tourist population in Phu Quoc

Year	2005	2006	2007	2008	2009	2010	2011
Tourist	130,400	148,200	160,200	184,100	220,350	239,794	282,270

(Source: Phu Quoc Census Book 2009 and JICA Survey Team)



Legend : F(foreign)/D(domestic) (Source: Phu Quoc Statistic Bureau)

Figure 4-7 Monthly tourist population in Phu Quoc

4.2.4 Land use

Approximately 70% area of Phu Quoc Island is forest area and 20% is agricultural land. The project site is scheduled in agricultural lands. Reservoir planned site will be in the land with miscellaneous trees where logging and pepper and livestock firming take place. In accordance with the design, it can include protective forest area. WTP planned site will be in the land with miscellaneous trees where no activity is seen and grassland where livestock firming takes place. STP planned site will be in the land with miscellaneous trees where no activity is seen.

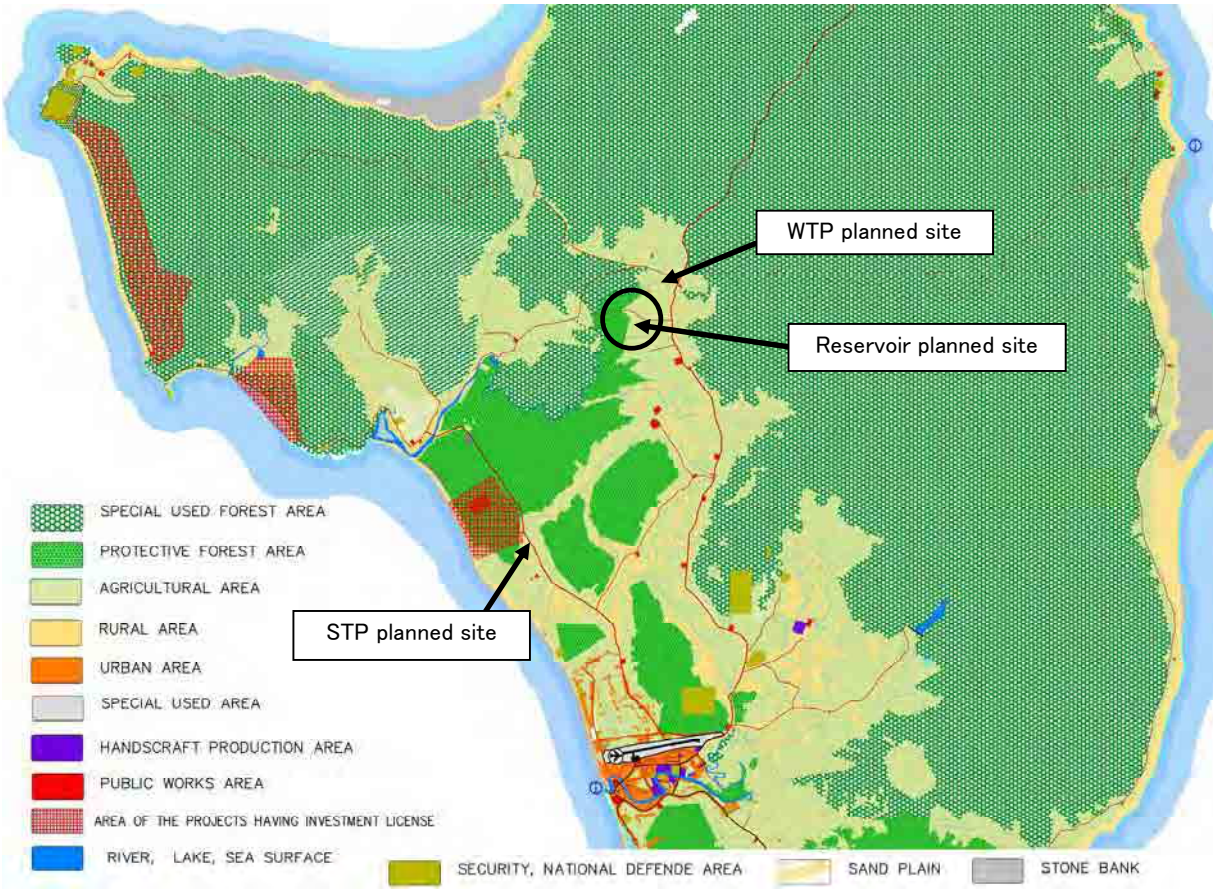
Protective forest area is different from Protected area of Special-use forest mentioned in **(4)**. Protective forest area can be designated to other land category where productive activities are allowed. It is possible due to a certain procedure by the provincial People's Committee and no major problem is found for the project land use.

Land use condition as of 2007 is shown in **Table 4-8** and **Figure 4-8**.

Table 4-8 Land use condition in Phu Quoc Island (2007)

No.	land use	Area(ha)	Rate
1	Urban area	872	1.5%
2	Touristic area	243	0.4%
3	Sporting facility, etc.	179	0.3%
4	Park / Green space	309	0.5%
5	Airport / Port site	969	1.6%
6	Agriculture	11,351	19.3%
7	Military related site	1,880	3.2%
8	Forest	41,757	70.9%
9	Other	1,355	2.3%
Total		58,915	100.0%

(Source: Phu Quoc Census Book 2009)



(Source: Master plan 2009)

Figure 4-8 Land use map of Phu Quoc Island

4.2.5 Water use

In Cua Can River which is located downstream area of the reservoir, no irrigation nor fishery were seen when site visits were conducted by JICA Survey Team in October, 2011. DONRE, in charge of the river, says that no water use is applied in the area. Cua Can Commune People's Committee, located in the area, says that no fishery activities are conducted. Also in the stream near STP planned site, no water use is conducted.

4.3 Current environment situation in the Sub-project area

4.3.1 Land environment

(1) Soil

Soil investigation held from December, 2011 to January, 2012 shows that the soil is not likely to surface corrosion or sliding even the soil is used for the reservoir bank.

(2) Topological features

Refer to the Final report for the current and planned topological features in the site.

4.3.2 Water environment

a. Water quality

Water quality measured in the wet season (October, 2011) and the dry season (March, 2012) is shown in **Table 4-9**, which indicates that both water quality values are similar and it resembles rain water with low pH and low concentration in hardness, dissolved solids and Cl^- while harmful materials such as heavy metals are not found.

Table 4-9 Cua Can River water quality (to be withdrawn into Cua Can reservoir)

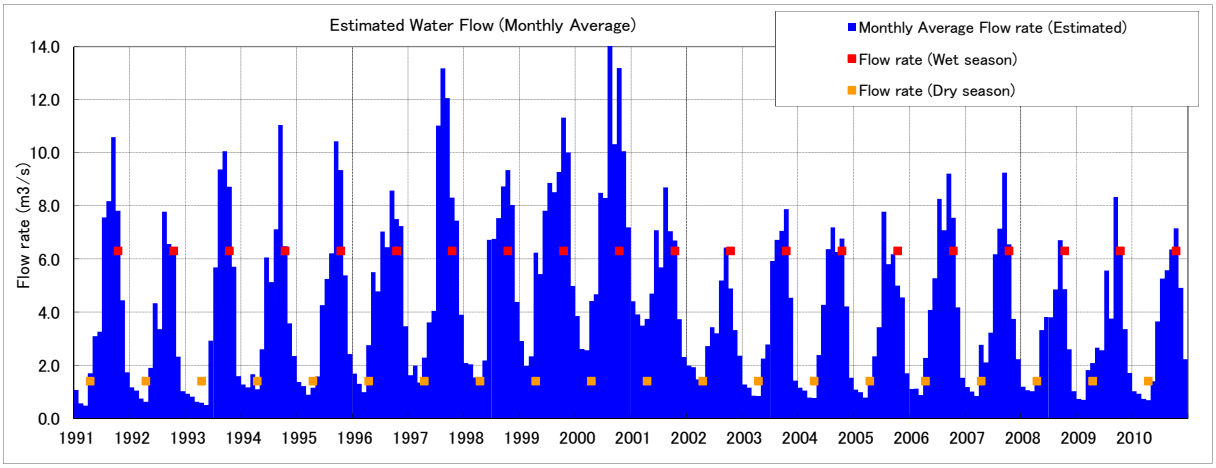
Wet season (Oct. 2011)					
General item			Heavy metals, etc.		
Item	Result	Unit	Item	Result	Unit
Temperature	27,5	Deg C	Sb	Not detected	mg/L (<0.001)
Odor	None	-	As	Not detected	mg/L (<0.0005)
Color	10	TCU	Cd	Not detected	mg/L (<0.0005)
Turbidity	2.8	NTU	Cr	Not detected	mg/L (<0.005)
pH	5.3	-	Hg	Not detected	mg/L (<0.0001)
Hardness	6	mg/L	Se	Not detected	mg/L (<0.001)
Dissolved solid	36	mg/L	Ni	Not detected	mg/L (<0.005)
Alkalinity	6	mg/L	Fe	1.2	mg/L
Cl^-	8	mg/L	Mn	Not detected	mg/L (<0.005)
e-coli	45	Unit/100mL	Cyanide	Not detected	mg/L (<0.05)
Dry season (Mar. 2012)					
General item			Heavy metals, etc.		
Item	Result	Unit	Item	Result	Unit
Temperature	28.5	Deg C	Sb	Not detected	mg/L (<0.001)
Odor	None	-	As	Not detected	mg/L (<0.0005)
Color	12	TCU	Cd	Not detected	mg/L (<0.0005)
Turbidity	3.0	NTU	Cr	Not detected	mg/L (<0.005)
pH	5.2	-	Hg	Not detected	mg/L (<0.0001)
Hardness	8	mg/L	Se	Not detected	mg/L (<0.001)
Dissolved solid	12	mg/L	Ni	Not detected	mg/L (<0.005)
Alkalinity	6	mg/L	Fe	1.8	mg/L
Cl^-	8	mg/L	Mn	Not detected	mg/L (<0.005)
e-coli	4	Unit/100mL	Cyanide	Not detected	mg/L (<0.05)

Source：JICA Survey Team

b. Water flow

Flow rate of Cua Can River that is estimated from rainfall in the catchment area for 20 years is shown

in the figure below. Increase in the wet seasons from the dry seasons is 5-10 m^3/s on average.
The reservoir will not take water from the river for 5 months in the dry season which means that it has to take enough water for one year within the other 7 months. In that case, 0.4 m^3/s (on average) of water will be necessary to be taken from the river for the WTP with the capacity of 20,000 m^3/day and 1 m^3/s (on average) of water will be necessary for the WTP with the capacity of 50,000 m^3/day.
Thus, it is explained that in the intake plan, no water will be taken from the river in the dry season and only small rate of water will be taken in the wet season. In other words, the impact on the river by the intake plan is small enough and no significant difference should be produced between before and after.
Flow rate of Cua Can River at the station adjacent to the reservoir planned site was 6.3 m^3/s in the wet season and 1.4 m^3/s in the dry season by the simple measurement studies by JICA Survey Team. These results show that there are no significant difference between flow rates and estimated flow rates.



Source：JICA Survey Team

Figure 4-9　Cua Can River Flow-rate (measured and estimated)

4.3.3 Air environment

(1) Air quality

The air quality in the site before construction is shown in **Table 4-10**.
(Description)

Table 4-10 (1)　Baseline Air Quality at Station-A

Item	Value	Standard value TCVN5937	Unit	Method
SO_2				
CO				
NO_x				
O_3				
TSP (Dust)				
PM_{10}				
Pb				

Table 4-10 (2) Baseline Air Quality at Station-B

Item	Value	Standard value TCVN5937	Unit	Method
SO_2				
CO				
NO_x				
O_3				
TSP (Dust)				
PM_{10}				
Pb				

(2) Noise

The noise in the site before construction is shown in Table 4-10.

(Description)

Table 4-11 Baseline Noise

Station	Value	Classification of district area	Standard value TCVN5949
A			
B			
C			

4.3.4 Ecological environment

(1) Fauna

(Description of the fauna investigation)

(2) Vegetation

(Description of the flora investigation)

Table 4- Result of the Flora Investigation

No.	Name of plants	Area (ha)	Area (%)	Possible uses of plant	Protection law / regulation (if any)
Ex.	Eucalyptus		30%	Construction	None
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

5. Alternatives comparison (including the "without project" situation)

5.1 Result of alternatives comparison (water source for WTP)

Alternatives for water source for WTP were considered. Alternatives are; i)"without project" situation), ii) ground water, iii) seawater desalination, iv) reservoir construction. The result of comparison is shown in **Table 5-1**. In terms of feasibility, reservoir construction was adopted.

Table 5-1 Alternatives comparison (water source for WTP)

	Without project	Ground water	Seawater desalination	Reservoir construction
Benefit to Phu Quoc Island's water supply	×	○	○	○
Supply amount	—	— (relatively small)	○	◎
Exploitation restriction	—	×	—	—
Construction cost	—	— (relatively small)	×	▲
OM cost	—	▲	×	▲
Increase of employment opportunity	—	○	○	◎
Impact to ground water	—	×	—	—
Flood prevention	—	—	—	○
Fire control	—	—	—	○
Scenery	—	—	—	○
Ecosystem	—	—	—	▲
Land use	—	—	—	×
Air pollution	—	—	×	—
Water pollution	—	—	×	—
Waste	—	—	×	▲
Noise and vibration	—	▲	▲	▲
Geographical features	—	—	—	▲
Global warming	—	▲	×	▲
Involuntary resettlement	—	—	—	▲
Result of comparison	Rejected	Rejected	Rejected	Adopted
Conclusive aspect	Shortage of water supply	Shortage of water supply / ground water depletion	High cost	Feasibility

【Legend】 — : No impact, × : Large adverse impact, ▲ : Adverse impact, ○ : Positive effect, ◎ : Significant positive effect

(Evaluation includes consideration for the future)

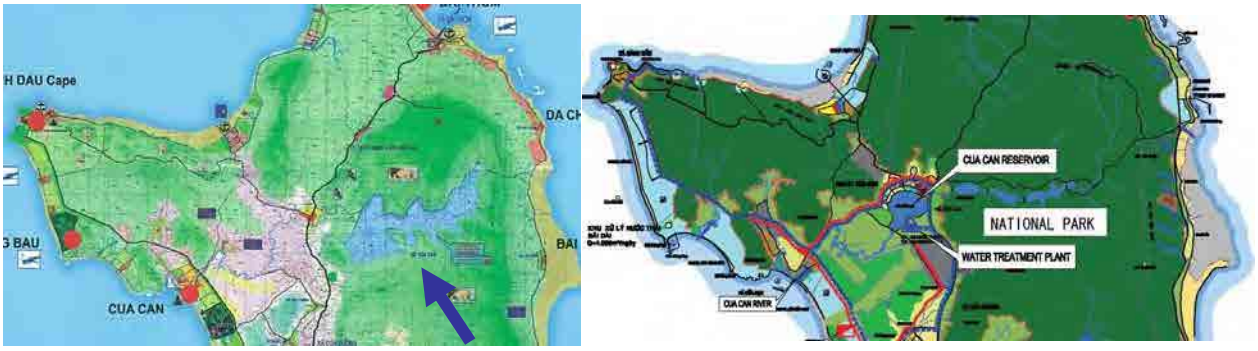
5.2 Result of alternatives comparison (reservoir)

a. Scale

In the first vision of the reservoir, it was large-scale plan as shown in 2004 MP. Subsequently, In 2009 MP, it was divided into 5 smaller reservoirs including Cua Can Reservoir.

Cua Can Reservoir in 2009 MP consisted of 3 ponds inside the National Park and one pond outside. In the current survey, it was suggested to adopt only one pond outside the National Park in order to avoid building ponds inside the Park because it was confirmed that it is possible to impound adequate

amount of water in the outside pond.



2004 MP	→	2009 MP（2010 Adjusted MP）
Large-scale Reservoir	→	Scattered into 5 smaller ponds in the Island

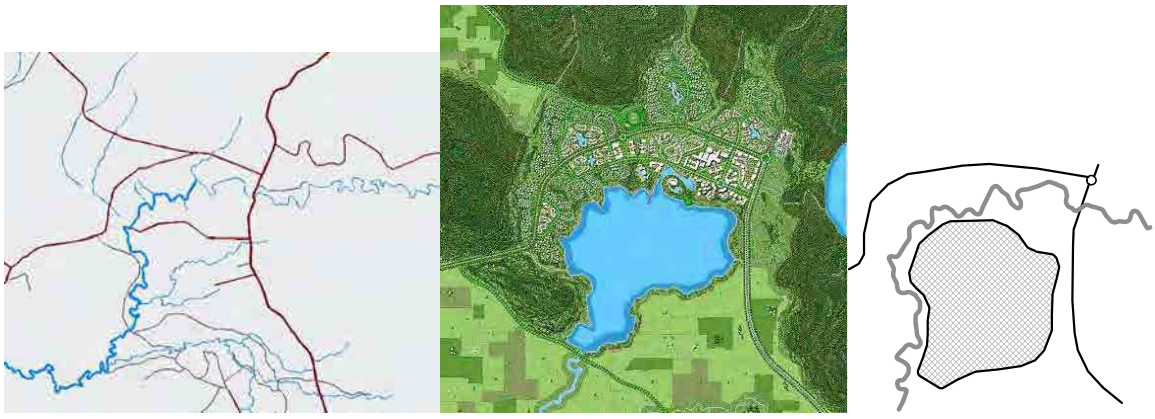
Figure 5-1 Shift of views of building reservoirs

b. Location

As for the location of the reservoir, the national park exists in the surrounding area of the current planned site. Acquisition of 15,000,000m^3 area avoiding the national park limits the available site. Thus, the current location the current planned site was chosen.

c. Methodology

The planned site is the area alongside Cua Can River as shown in (i) below. In 2009 MP, a reservoir to be built by excavating the Southern Eastern land of the river (ii). On the other hand, in the current survey, in light of minimizing the impact to the river and of river control, River-Reservoir individual type is suggested.



(i) Present (ii) 2009 MP (iii) JICA Survey Team

Figure 5-2 Methodology of building reservoirs

6. Scoping

Scoping of the reservoir and associated facilities is shown in **Table 6-1**. The components are the reservoir, intake facility and raw water transmission.

Table 6-1 Scoping – evaluation and the reason (Reservoir)

Item	Evaluation	Reason
1 Air pollution	B	Due to dust according to earthwork
2 Water pollution	B	Due to possibility of high-turbidity of Cua Can river
3 Soil pollution	D	No adverse impacts are expected
4 Waste	B	Due to producing soil waste
5 Noise and vibrations	B	Due to Noise and vibration according to earthwork and transfer
6 Ground subsidence	B	Impact is unknown so boring investigation is ongoing
7 Offensive odors	B	Due to Eutrophication and Rottenness of fish
8 Geographical features	A	Large-scale topographical change will take place. Impact to ground water may occur.
9 Bottom sediment	B	In case of eutrophication, sediment will be produced
10 Biota and ecosystems	B	Due to forced transfer to the animals
11 Water usage	B	Due to impact on ground water
12 Accidents	B	Due to accidents during construction and accidents along the reservoir
13 Global warming	B	Due to pump usage for intake and transmission
14 Involuntary resettlement	B	Due to and acquisition of 180ha or more and resettlement of residents
15 Local economies	A	Impact to worker depending on the site may occur
16 Land use	A	
17 Social institutions	D	No adverse impacts are expected
18 Existing social infrastructures and services	C	Impact is unknown so consideration should be done
19 Poor, indigenous, or ethnic people	C	
20 Misdistribution of benefits and damages	C	
21 Local conflicts of interest	D	No adverse impacts are expected
22 Gender	D	
23 Children's rights	D	
24 Cultural heritage	D	
25 Infectious diseases such as HIV/AIDS	C	Impact is unknown so consideration should be done

【Evaluation】 A: Large adverse impact is expected, B: Some adverse impact is expected,
C: An adverse impact is indistinct, D: No adverse impact is expected

7. EIA measures

7.1 Purpose of EIA study

The purpose is to predict and assess the contents and scale of possible impacts to natural and social environment by the Sub-project.

7.2 Items to be targeted in the study and evaluation

In principle, items with A, B and C in evaluation in **6. Scoping** should be studied and evaluated. In addition, other items that are assumed to be considered as the survey proceeds should also be targets.

7.3 Target areas

Target areas are construction planned site and the surrounding areas of the project facilities. In addition, in case that access roads are necessary, they and the surrounding areas should also be targeted.

7.4 Target periods

Target periods are the stages of planning and executing of the project.

7.5 Contents and methods of EIA study

7.5.1 Acquisition of information

The contents and methods of the study are shown in **Table 7-1**.

Table 7-1 The study and countermeasure associated with the reservoir

Eval-uation	No.	Item	Study / Mitigation	Method
A	8	Geographical features	・ Geological study	・ Boring study
			・Ground water countermeasure	・ Excavation of land can effect ground water but the boring study result indicates low possibility of it.
	15 16	Local economies / Land use	・ RAP preparation	・ Countermeasure for workers depending on the reservoir construction planned site should be considered in a draft abbreviated RAP
			・ Secondary forest use study	・ Acquisition of information at the authorities concerned (Phu Quoc Forestry Agency, Cua Duong PC, etc.)
B	1	Air pollution	・Pollution countermeasure	・ Suggestion on prevention of spreads of soil according to large-scale excavation
	2	Water pollution	・Pollution countermeasure	・ Water quality analysis of the river water before construction
				・ Suggestion on prevention of overflow of soil according to the construction
	4	Waste	・Waste countermeasure	・ Estimate of soil produced and used
				・ Confirmation on waste dumping sites and reception facilities
				・ Consideration on coordination with other development projects
				・ Suggestion on clearance of temporary facilities by the constructor at the end of the construction
				・ Consultation on treatment methods of construction wastes, general wastes and human wastes with the authorities concerned (DONRE, etc.)
	5	Noise and vibrations	・Noise survey	・ Suggestion on noise measurement before construction, prediction and countermeasure
			・Noise and vibration countermeasure	・ Suggestion on countermeasure such as reduce noise and vibration of transport of construction materials and so on
	7	Offensive	・Odor	・ Suggestion on countermeasure for offensive odor prevention

Eval-uation	No.	Item	Study / Mitigation	Method
		odors	countermeasure	
	9	Bottom sediment	・Turbidiness overflow prevention	・ Suggestion on countermeasure for adverse impacts (e.g. soil overflow)
	10	Biota and ecosystems	・ Flora survey	・ Document investigation / Acquisition of information from the authorities concerned
				・ Site survey (frequency and contents will be suggested according to consultation with associated authorities)
			・ Fauna survey	・ Document investigation / Acquisition of information from the authorities concerned
				・ Suggestion from specialists
				・ Site survey (frequency and contents will be suggested according to consultation with associated authorities) in and around the planned sites. e.g. Surveys for mammal, bird, reptile, amphibian and insects
	12	Accidents	・Safety measure	・ Suggestion on safety measures during construction
				・ Confirmation on the structural safety of the intake facility and the reservoir in design
	13	Global warming	・Energy-saving strategy	・ Consideration on energy-saving pumps for the intake facility
	14	Involuntary resettlement	・RAP preparation	・ Preparation of a draft abbreviated RAP
C	18	Existing social infrastructures and services	・Socioeconomic survey	・ Consultation with PCs
	19	Poor, indigenous or ethnic people	・Socioeconomic survey	・ Hearings on the existence of poor people with PCs / Initial baseline survey of RAP preparation
	20	Misdistribution of benefits and damages	・Socioeconomic survey	・ Consultation with labor-related authorities
	25	Infectious diseases such as HIV/AIDS	・Sanitation	・ Consultation with associated authorities (Department of Health) and related organization (Women's Union)

7.5.2 Prediction and evaluation of the impacts by the project

Prediction and evaluation of the impacts which may be caused by the project should be conducted concerning on items evaluated as A, B or C in **6. Scoping**.

First of all, each item should be re-evaluated as the survey proceeds and update the scoping result. Subsequently, items with A and B after the update shall be evaluated in terms of the scale.

7.5.3 Consideration on the Environment Management Plan (EMP) and the monitoring plan

In case that unavoidable environment impacts by the project are expected to take place, EMP to mitigate the extent of impacts and the monitoring plan to grasp the condition should be prepared in accordance with results of the survey and consultation with the authorities concerned. For both EMP and the monitoring plan, consideration on executing item, frequency, organization, necessary reinforcement of the organization and budget should be included.

7.5.4 Stakeholder consultation

The results of Environmental and Social Consideration mentioned above shall be presented in stakeholder consultation and the stakeholders' opinions shall be collected.

8. Environment Management Plan

8.1 Overall

The environmental management plan (EMP) for the Cua Can Reservoir Sub-project has been developed from the results of the environmental impact assessment. The EMP identifies the impact mitigations and environmental monitoring requirements that must be implemented to prevent or minimize any adverse impacts of the Sub-project on the natural environment. The management of social impacts associated with resettlement and compensation are addressed separately by the Abbreviated RAP prepared for the Sub-project.

The EMP also specifies the responsibilities for the implementation of the EMP, and any capacity development or training required by the responsible parties to ensure successful implementation of the EMP. The purpose of the EMP is to ensure that unnecessary adverse environmental or social impacts of the Sub-project do not occur, and that the natural and social environments are protected. The EMP consists of the following three main components:

1) Mitigation plan;
2) Monitoring plan; and
3) Institutional responsibilities and capacity needs.

Other aspects of the EMP include EMP budget, and reporting requirements. The EMP provided herein focuses on the management of environmental impacts of the subproject.

8.2 Prediction and Evaluation

As a result of EIA study by measures shown in **Table 7-1**, Evaluation of Scoping shown in **Table 6-1** was updated. The results of the prediction and evaluation and the mitigation measures are revealed (**Table 8-1**). Many of them are described in EMP or Abbreviated Resettlement Plan (ARP).

Table 8-1 Result of Prediction and Evaluation

Items	Scoping	Evaluation result	Reason / Mitigation measure
1 Air pollution	B	B	Due to dust according to earthwork
	EMP		e.g. watering
2 Water pollution	B	B	Due to possibility of high-turbidity of Cua Can river
	EMP		Water quality monitoring
4 Waste	B	B	Due to production of logged woods, soil, waste material of used temporary facilities, common waste and human waste
	Consult		1. Woods are sellable.

	ation		2. Soil is also sellable but amount is extraordinary so coordination by KGPPC or GOV is necessary. The amount can be adjusted by the design. Currently, several options are presented. 3. Other wastes can be accepted by the existing waste dumping site.
5 Noise and vibrations	B	B	Due to Noise and vibration according to earthwork and transfer
	EMP		Noise and vibration measure before construction, prediction and consideration of mitigation / Adoption of low-vibration and low-noise machineries / Slowing down construction vehicles
6 Ground subsidence	B	D	Designing to prevent ground subsidence or corruption according to results of boring investigation
7 Offensive odors	B	D	Prevention of water quality deterioration by introduction of sewer system to catchment area
8 Geographical features	A	B	Monitoring is necessary because the reservoir is going to be built by large-scale excavation.
	EMP		Monitoring of abnormal change caused by excavation
9 Bottom sediment	B	B	In case of outflow of sludge, sediment will be produced
	EMP		Monitoring of water quality
10 Biota and ecosystems	B	B	The site is mainly agricultural land and no trees for protection are expected. No rare species are also expected but site studies should be conducted. Species such as Vietnam native lizards possibly exist in the site and mitigation should be considered.
	Field study		・Flora study (Invention study of existing vegetation with location) ・Fauna study (Refer to following / consider in and around the site) ○Mammal (Field sign study / Trap method) ○Bird (Line-census study) ○Reptile/Amphibian (Random check / collection) ○Insect (Random check & collection / Trap method)
	EMP		Trap & Release / Publicity and education to workers / Phase-to-phase construction
11 Water usage	B	B	Due to possible impact on ground water
	EMP		Monitoring of abnormal change caused by excavation
12 Accidents	B	B	Due to accidents during construction
	EMP		Safety management
13 Global warming	B	D	Consideration on saving energy for pumping facilities was conducted.
14 Involuntary resettlement	B	B	Due to resettlement of approximately 50 people
	ARP		Resettlement and compensation
15 Local economies	A	B	Due to large-scale agricultural lands
	ARP		Appropriate compensation
16 Land use	A	B	Due to vegetation removal
	EMP		e.g. watering / collection and treatment of high-turbidity water, coagulation and sedimentation
18 Existing social infrastructures and services	C	D	No possible adverse impacts are expected.
19 Poor, indigenous, or ethnic people	C	D	No poor people inhabit in the site. One lady from ethnic people, “Khome” inhabits but she immigrated from other region and possesses no traditional / ethnic valuable assets in the site.
20 Misdistribution of benefits and damages	C	B	Misdistribution is likely to occur according to resettlement and careful consideration must be done.
	ARP		Appropriate compensation
25 Infectious diseases such as HIV/AIDS	C	B	External workers are expected for a long period.
	EMP		Utilization of sanitary program / Consultation with local health authority

【Evaluation】 A：Large adverse impact is expected, B：Some adverse impact is expected,

C：An adverse impact is indistinct, D：No adverse impact is expected

8.3 Mitigation Plan

The mitigation plan for The Sub-project is provided in the following Table. Mitigation measures are defined for the key impacts identified in the impact assessment including the comments received during the stakeholder meetings.

The table links mitigation measures to project activities and impacts for the three phases defined by pre-construction, construction, and operational phase.

Table 8-2 Mitigation Plan for Cua Can Reservoir Sub-project

No.	Activities	Negative impacts	Mitigation measures	Cost estimate	Implementation Unit	Supervision Unit
I	**Preparation phase**					
1	Land acquisition	Loss of vegetation, building and land	Replace or compensate lost assets according to current regulations of GOV and PQDPC	Resettlement and compensation cost	Center of Land Fund Development	PQDPC
2	Environmental background	Air-pollution / Dust	Recognize potential data to examine the impact by the project.	Monitoring cost	Contractor / PMU / Environmental Consultant	Environmental Consultant
3		Noise / Vibration				
4		Surface water quality				
5		Ground water quality				
II	**Construction phase**					
1	Construction and transfer of necessity and waste	Exhausted air pollutants	Maintain equipment and vehicles in good working order / Monitoring impact possibilities	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant
2		Noise / Vibration	Drive construction vehicles slowly for transfer of the soil. Maximize use of low-vibration & low-noise machineries. Prevent or minimize operation of heavy equipment at night / Monitoring impact possibilities			
3		Dust	Use watering agents to prevent or reduce dust. Drive construction vehicles slowly with load covers / Monitoring impact possibilities			
4		Polluted water	Monitoring impact possibilities			
5		Surface water quality				
6		Ground water quality				
7		Soil quality				

No.	Activities	Negative impacts	Mitigation measures	Cost estimate	Implementation Unit	Supervision Unit
8		Land usage	Watering / collection and treatment of high-turbidity water, coagulation and sedimentation			
9		Any abnormal change by the land use	Monitoring impact possibilities in appearance and wells nearby			
10		Worker & public injury	Follow workplace health and safety regulations of MoLISA / DoLISA. Utilize sanitary programs. Consultation with local health authority Use sufficient signage and fencing at construction sites	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	PQDPC (Division of health) / PMU / Consultant
11	Construction worker presence, and camp operation	Solid waste and domestic waste pollution	Institute regular solids waste collection and disposal program including placement of disposal bins throughout camp and at all construction sites. Ensure adequate number of latrines at camp cleaned regularly. Temporary latrines maintained at construction sites.	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant
12		Worker and public health problems	Ensure proper hygiene in worker camps. Workers should be tested for communicable disease. Locate worker camp away from residential areas	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	PQDPC (Division of health) / PMU / Consultant
13		Worker & public safety	Follow workplace health and safety regulations of MoLISA / DoLISA. Sufficient signage and			

No.	Activities	Negative impacts	Mitigation measures	Cost estimate	Implementation Unit	Supervision Unit
			fencing at construction sites			
14	General construction activities	Production of solid wastes,and waste construction fluids (e.g., oils) causing soil and surface water pollution	Implement solid waste collection and disposal program. Contain waste liquids for regular disposal with solid wastes in designated landfill.	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant
15	Wildlife protection	Minimization of impacts to wildlife	Educate construction workers about wildlife protection. Trap or catch wildlife and release out of the site. Construct in a phased manner to keep escape area for wildlife	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC (Division of natural resources and environment) / PQNPMB / PMU / Consultant
III	**Operation phase**					
1	Operation of the reservoir	Any abnormal change by the land use	Monitoring impact possibilities in appearance and wells nearby	Monitoring cost	PMU	DONRE / PQDPC

8.4 Environment Monitoring Plan

The monitoring plan outlines the information from the affected environment in and around the Sub-project target area that must be collected to determine how well the impact mitigations of the EMP are working, and to identify any unexpected environmental impacts of the project.

Monitoring activities focus on the pre-construction, construction and operational phases of the project and includes social impacts associated with construction-related disturbances and issues such as noise, dust, traffic, and public health. Monitoring for the effectiveness of the RAP for resettlement and compensation is evaluated separately as part of the RAP.

The monitoring plan is structured into a table that links monitoring requirements to impacts and mitigation measures for the construction and operational phases of the subproject. Monitoring requirements listed in the table combine measurements for the effectiveness of impact mitigation measures with general environmental information needed to determine whether unexpected impacts of the Sub-project occur. For efficiency and ease of implementation common monitoring requirements are grouped for similar impact/mitigation measures, and distinguished by factors such as location, frequency and reporting requirements as necessary.

Project Management Unit will be responsible for monitoring contractor compliance in implementing the EMP throughout the construction process of the project items

8.5 Estimated Cost for EMP

8.5.1 Estimated cost of Environment Monitoring

The costs of the EMP stem primarily from the costs of environmental monitoring. The costs of mitigation measures are included with the overall construction costs. The costs of monitoring are estimated using the cost norms outlined in the Circular 83/2002/TT-BTC. However, the costs of monitoring must also include the cost for the environmental consultants to assist the PMU to implement the EMP and the independent environmental consultant to audit the implementation of the EMP during the construction phase and during at least the first year of operational phase. The estimated costs of monitoring are summarized in the following Table.

Table 8-3 Estimated Costs of Environmental Monitoring (Example)

Item	Unit price per sample or time (VND)*)	Number of samples or times*)	Amount (VND)
Pre-Construction stage			
M-1: Air quality		(inside 5 + outside 5)*2	
M-2: Noise		outside 5*2	
M-3: Surface water		2st. *2	
M-4: Groundwater		10hh. *2	
Construction stage			
M-5: Air quality		(inside 5 + outside 5)*3year *4	
M-6: Noise		(inside 5 + outside 5)*3year *4	
M-7: Solid wastes		10st. *3year *4	
M-8: Polluted water quality		10st. *3year *4	
M-9: Surface water quality		2st. *3year *24	
M-10: Groundwater quality		10hh. *3year *4	
M-11: Abnormal change by the land use		10st. *3year *4	
M-12: Soil quality		5st. *3year *4	
M-13: Worker & public		10st. *3year *4	
M-14: Worker & public		10st. *3year *4	
M-15: Wildlife protection		10st. *3year *4	
Total cost (VND)			
Operation stage			
M-16: Groundwater quality		10hh. *4	/ year
M-17: Abnormal change by the land use		10st. *4	/ year

*) Unit price and number of samples should be updated in accordance with the progress of the project

8.5.2 Estimated cost of Environment Audit

The environment consultant will be assigned to support the implementation of PMU to conduct the environment audit with estimated total period of 40 months.

Scope of work includes 12 site inspections at the Sub-project area with one previous inspection trip before construction, 10 trips during the construction phase and one final inspection.

For the assignment mentioned above, the environmental consultant shall dispatch experts specializing in audit and environmental monitoring, with the requirements shown in the following table.

(Numbers indicated here should be updated in accordance with the progress of the project)

Table 8-4 Required Environment Audit Consultants (Example)

Expert	General requirement	Specific requirements	Regional experience/Language
Team Leader	University degree; At least 5-year experience on environmental management.	At least 8-year experience in the environmental field. Experience in audit or environmental monitoring projects financed by international experience is required.	Experience in Vietnam, understanding the project area is preferred, with knowledge of the culture, administrative system and local government organizations. Speaks and writes English well.
Environment Auditor/ Supervison	University degree; At least 05 years experience on environment management.	At least 5 year experience in the environmental field. Experience inaudit or environmental monitoring projects financed by international experience is required.	Experience in Vietnam, understanding the project area is preferred, with knowledge of the culture, administrative system and local government organizations.

			Speak and write English well.

Environmental consultancy costs are calculated in **Table 8-5**.

Table 8-5 The Environment Audit (Example)

No.	Expert	Qty	Trip	Unit cost (USD)	Cost (USD)
I	**Staff cost**				
1	Team leader	1	12		
2	Environment Auditor / Supervision	2	12		
II	**Other cost (equivalent to 20% of Staff cost)**				
III	**Total**				

Estimated costs vary depending on the scope of work required by the EMP. Estimated costs for environmental audit will be approximately XXX USD.

Table 8-6 Monitoring Plan for Kien Giang Subproject (Example)

Summary of Impact / Mitigation	Monitoring Indicators	Location	Frequency	Environmental Standard	Responsibility Supervision / Implementation	Reporting
Pre-Construction Phase						
Resettlement & physical asset loss / Resettlement Plan	See Abbreviated Resettlement Plan (ARP)	See ARP	See ARP	See ARP	See ARP	See ARP
M-1: Air-pollution / Dust	SO2 / CO / NOx / O3 / TSP (Dust) / PM10 / Pb	Areas in and around the site (5+5st.)	2 times with an interval for more than 2 months	TCVN 5937: 2005	PMU / Environmental Consultant	Monitoring reports prepared quarterly for PQDPC(Division of natural resources and environment)
M-2: Noise / Vibration	Decibel (dBa) levels	Areas around the site (5st.)	As above	TCVN 6962: 2001	As above	As above
M-3: Surface water quality	TSS	Up and downstream stations of CC River along the site	As above	QCVN 08:2008 /BTNMT	As above	As above
M-4: Ground water quality	pH / TSS / TS / Cl- / E-coli	Surrounding areas (10st.)	As above	QCVN 08 / 09:2008/BTNMT	As above	As above
Construction Phase						
M-5: Air-pollution / Dust	SO2 / CO / NOx / O3 / TSP (Dust) / PM10 / Pb	Areas in and around the site (5+5st.)	Quarterly	TCVN 5937: 2005	PMU / Environmental Consultant	As above
M-6: Noise / Vibration	Decibel (dBa) levels	As above	As above	TCVN 5949: 1998	As above	As above
M-7: Solid waste pollution /	Amount of solid waste	All	As above	N/A	As above	As above

Regular waste collection & disposal, placement of disposal bins throughout construction sites.	uncontained & littering construction areas and worker camp	construction areas (10st.)				
M-8: Polluted water / Light-polluted water such as hand-washed water should be stored for watering and should be monitored. Heavy-polluted water used for washing or cooking and containing organic materials should be disposed with solid waste	pH, DO, TSS, COD, BOD5, NH4+, Cl-, NO2, NO3, PO4 3-, Fe, total oil & grease, fecal coliform	Inside the reservoir (10st.)	As above	QCVN 08:2008/BTNMT	As above	As above
M-9: Surface water quality	TSS	Up and downstream stations of CC River along the site	2 times / month	QCVN 08:2008 /BTNMT	As above	As above
M-10: Ground water quality	pH / TSS / TS / Cl- / E-coli	Surrounding areas (10st.)	quarterly	QCVN 08 / 09:2008/BTNMT	As above	As above
M-11: Any abnormal change by the land use	Appearance	Surrounding areas (10st.)	As above	N/A	As above	As above
M-12: Soil quality pollution / Implement solid waste collection and disposal program. Contain waste liquids for regular disposal with solid wastes in designated landfill.	As, Cd, Cu, Pb, Zn	Excavated and reused soil (5smpl)	As above	QCVN 03:2008/BTNMT	As above	As above
M-13: Worker & public	Number of worker and	All	As above	Decree	As above	Monitoring reports

safety / Follow workplace health and safety regulations of MoLISA / DoLISA. Sufficient signage and fencing at construction sites	public injuries	construction areas (10st.)		06/1995, Decree 10/2002/ ND-CP		prepared quarterly for MoLISA / DoLISA
M-14: Worker and public health problems / Ensure proper hygiene in worker camps. Workers should be tested for communicable disease. Locate worker camp away from residential areas	Incidence of sexually transmitted & other communicable diseases	Worker camp and nearby community (10st.)	As above	N/A	As above	Monitoring reports prepared quarterly for PQDPC(Division of health)
M-15: Wildlife protection	Outline (kinds & numbers) of Trap or Catch % Release result	All construction site locations (10st.)	As above	N/A	As above	Monitoring reports prepared quarterly for PQDPC(Division of natural resources and environment)
Operation Phase						
M-16: Ground water quality	pH / TSS / TS / Cl- / E-coli	Surrounding areas (10st.)	quarterly	QCVN 08 / 09:2008/BTN MT	As above	As above
M-17: Any abnormal change by the land use	Appearance	Surrounding areas (10st.)	As above	N/A	As above	As above

8.6 Management Responsibilities and Training Needs

8.6.1 Management Responsibilities

Environmental Consultant; is to supervise activities for Mitigation Plan such as Environmental background, Construction and transfer of necessity and waste, Construction worker presence and camp operation, General construction activities and Wildlife protection. It also is in charge of the most activities for Monitoring Plan.

DONRE and the subsidiary organizations; are to supervise activities for Mitigation Plan such as Construction and transfer of necessity and waste, Construction worker presence and camp operation, General construction activities, Wildlife protection and Operation of the reservoir. They are also most likely in charge of receiving reports for the activities for Monitoring Plan.

PQDPC and CPCs concerned; are to supervise activities for Mitigation Plan such as Land acquisition, Construction and transfer of necessity and waste, Construction worker presence and camp operation, General construction activities, Wildlife protection and Operation of the reservoir. They are also most likely in charge of receiving reports for the activities for Monitoring Plan.

8.6.2 Training Needs

Center of Land Fund Development; is to implement Land acquisition. It is organized for dedicated purposes including land acquisition and no trainings should be necessary.

PMU; will be organized with specialists of the area from GOV, KGPPC, Professional Engineers and Consultants. It can be both of an Implementation Unit and Supervision Unit. It is a team composed of experts, so they should be available for the assignments. However, it is a temporary unit and can be supervised or trained by other management authorities when necessary.

Contractor (Constructor); is to implement activities for Mitigation Plan such as Environmental background, Construction and transfer of necessity and waste, Construction worker presence and camp operation, General construction activities and Wildlife protection. For each activity, special lecture is necessary. PMU should be in charge of lectures or trainings generally but the authorities should supervise technical trainings for areas such as wildlife protection and infectious disease prevention.

9. Stakeholder consultation and Information Disclosure

9.1 Stakeholder consultation

The survey is categorized as Category A for JICA's environmental and social consideration. Thus, a stakeholder consultation for scoping draft was conducted. In addition, the second consultation will be held at the stage of the draft final report of the survey. In accordance with the progress of the

Sub-project, subsequent consultation should be conducted if necessary. The outline is shown in **Table 9-1**.

Table 9-1 The outline of stakeholder consultations

	The first	The second (scheduled)
Purpose	Consultation on the scoping draft	Consultation on the survey result / EIA contents and methods
Date	16/12/2011	July, 2012
Venue	Phu Quoc District PC, Kien Giang province	Phu Quoc Island, Kien Giang province
Theme	- Project outline - Scoping draft	- Survey results - EIA contents / methods
Stakeholder	**Table 9-2**	**Table 9-2**, etc.

Table 9-2 The 1st Stakeholder consultation attendants

Affiliation	No.
District PC	3
Inhabitants	3
Central Government South-western Steering Board	1
Construction Department	1
KIWACO	3
KGPPC	4
DONRE	5
DARD	1
Phu Quoc National Park	1
Phu Quoc Military Service	1
Associated organization	2
NGO (PQ women's Association)	1
Mass media (television / radio station)	2
Construction consultant	3
Kobelco Eco-Solutions Vietnam	3
JICA Survey Team	10
Total	44

In the first stakeholder consultation, explanation of the outline of the project and the scoping draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussions were focused on impacts by the reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, it was explained that; i) the reservoir would be located outside the national park, ii) the reservoir would give no impacts on downstream area, iii) the location of the STP was decided after detailed consideration and consultation. See details in **Table 9-3**.

Table 9-3 Record of Stakeholder Consultations

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
1	The location of STP is very important.	South-West Department of the Central government	【Answer】(Survey Team) Location of STP is decided on the Decision No. 633. The study team decided the location in a tourist area which has Ong long resort in the south and golf courses in the north after careful considerations. Based on the Decision No.633 and the detail plan of Ong resort, the STP is located in the northern part of
2	Please consider the buffer zone for the residential areas which might have odor problems of sewage treatment.		

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
3	The location of STP seems to be close to Duong Dong district.		Ong resort because hotels and houses are planned in the southern part. The land size of STP is only 4 ha in the park which is located in the 247 ha resort area. Also, the STP is located far away from the residential area and there are golf courses in the north. Moreover, another reason of location is that treated water of STP is available to trees and golf courses.
4	Does the sewerage catchment area cover necessary areas?		【Answer】(was conducted at a later date) Since urban areas of year 2030 land use in the master plan are covered through phase I and II, it is appropriate at present stage. of the master plan
5	Is there any relation among Cua Can reservoir, other facilities, and the national park?	Phu Quoc National Park	【Answer】(Survey Team) Since the reservoir is adjacent to the national park, mitigation measures to reduce the negative impacts on national park have been studied. This is the land use map of adjusted master plan based on Decision No.633. Based on this map, the reservoir of this project is located outside the national park.
6	Are Cua Can reservoir and other reservoirs which will be constructed in the national park investigated at the same time?		【Answer】(Survey Team) Although three small reservoirs in the national park are described in the land use map of the master plan, these are not in the scope of our study.
7	It is necessary to consider the impacts on water cycle including groundwater and water stored in the forest since Cua Can river in the national park dries up in 6 months of dry season. Also, impacts on the water flow, and the ecosystem in the river and the river bank should be studied.		【Answer】(Survey Team) There is no negative impact on water flow because the rain water accumulated in the river is taken in rainy season and water is not taken in dry season. Therefore, water flow in dry season does not change. 【Additional explanations】(was conducted at a later date) The intake of water in rainy season is considered to have a positive impact on the flood prevention because the water flow is normalized by the intake of excess water in rainy season. Also, since reservoir is constructed far away from the river, the negative impact on ecosystem is not expected. 【Actions to be taken in the future】 Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation in the permeable layer is planned, additional measures will be studied in this survey.
8	We would like to ask the survey team to identify how much area is necessary for the reservoir in the forest area.	Kien Giang Agriculture and Rural Development Department	【Answer】(Survey Team) 180 ha land is necessary in our plan. To reduce area, the depth should be deeper to keep necessary water volume. 【Actions to be taken in the future】 The dimension of reservoir will be determined later in this survey.
9	An irrigation engineering consultant mentioned us that a small reservoir is necessary before a big reservoir.		【Actions to be taken in the future】 Problems at the construction stage will be examined later in this survey.

In addition, anonymous opinions from attendants were collected in order to hear as many people as possible. The contents and countermeasures were distributed to authorities concerned and attendants. See details in **Table 9-4**.

Table 9-4 Anonymous Comments submitted after Stakeholder Consultations

Component	Comments	Actions to respond to Comments in the survey
Reservoir	It is necessary to make proper scenarios for the evaluation of impacts to the national park during the construction and the operation of the reservoir.	All project sites are outside the national park.
Reservoir	The area of the national park to be used in the project should be determined. The impacts and countermeasures should be evaluated. In my opinion, the huge impacts on organic resources are expected.	
Reservoir	The impacts on the national park should be studied.	
Reservoir	Reservoir construction will have negative impacts on the forest. It is necessary to conduct a detail study and the evaluation of impact for construction. Also, the labor management for workers impacting the forest is required. Therefore, construction is a very important issue.	This issue will be studied in section 10-5 Forest (Flora) survey. Although there is the forest of the national park around the reservoir, the impact on the forest is not expected because the reservoir is far away from the national park.
Reservoir	It is necessary to study ecosystems and resources around the project sites as well as the project sites.	Impacts on the areas around the project sites will be considered in ecosystem survey.
Reservoir	Since a large volume of water runs from the upstream during rainy season, a dam to keep water should be considered for mitigating the damages of water on embankment of reservoir and residential areas around the reservoir.	The purpose of the reservoir is the storage of water during rainy season for use in dry season. Therefore, the reservoir mitigates the flood. Also, because only structures for intake and transmission of water are built, the dimension of river will be almost same as before the construction and impacts on surrounding area will be minimized. On discharge of water during the construction, supernatant water is discharged by using sedimentation ponds in which muddy water is separated into water and sludge. After being in service, the discharge from the reservoir is not conducted. The reservoir will be built away from the river. The plan maintains the river and does not reduce flow ability. Also, the 25 to 200m buffer zone between the river and the reservoir is secured to minimize impacts on surrounding areas.
Reservoir	Planned site of the reservoir performs the function as a sluice gate for Cua Can river, and a large volume of water with high velocity flows to the planned site (about 2m water level occurs three or four times a year). Therefore, the appropriate discharge during the construction and operation, and the impacts of flood (on residents around the planned site, embankments, and ecosystem) should be investigated in detail.	
Reservoir	Impacts on the way of water use should be evaluated if the reservoir is constructed by damming up the present Cua Can river.	The construction of the reservoir is not related to Cua Can river, and does not need to dam up.

Component	Comments	Actions to respond to Comments in the survey
Reservoir	A proper drainage to Cua Can river should be considered. Currently, the bottom of Cua Can river near the mouth consists of (settled) soils and mud. During January to April (the second half of rainy season), sediments are flushed out by rain water in the upstream. (Because there are above phenomenon,) negative impacts on Cua Can river might occur when the balance of water flow is changed by the discharge from the reservoir.	There is no discharge to Cua Can river, and current natural conditions of the river are not changed.
Reservoir	As for the construction of the reservoir, problems (such as drought of well water) might occur when the water balance between the used (of water taken from ground water) and the available volume (of water in ground) is changed. Discharge measures to control water volume of the reservoir should be modified if the impacts on people living around the reservoir are expected. Water level of the reservoir should be carefully considered.	There is no discharge to Cua Can river. Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	The accidents due to the deformation of ground by the increase of high water level should be considered.	Since the storage of water is conducted by pump, high water level is managed by pump. Therefore, high water level does not exceed the design high water level.
Reservoir	A geographical evaluation and an earthquake study should be conducted because of large water storage.	Geographical evaluation is conducted on the results of soil investigation. As for the relation between the water depth of the reservoir and earthquake, now there is no scientific evidence. Therefore, no impact is expected. As for measures of earthquake, structures are designed on the Vietnamese seismic standards for withstanding earthquakes.
Reservoir	The increase of groundwater level should be considered.	Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	Collapses of the reservoir and the surrounding areas, and the erosion of embankment should be considered.	Construction methods to prevent collapses and erosions are selected based on the results of soil investigation.
Reservoir	Accidents on slope failures and erosions under construction should be considered.	
Reservoir	To avoid any social adverse effect during the construction, proper labor management should be conducted.	Socio-economic survey and hygiene measures are studied sufficiently in section 10-5.
Water Distribution	Please consider to construct a distribution tank in Cua Can commune because water supply system has been built in Duoung Dong town. This tank is useful to distribute water to Cua Can, Ganh Dau communes and its environs.	Water supply to Cua Can and Ganh Dau must be conducted. A distribution tank is not directly related to whether water is distributed or not.
Sewerage	Please reconsider the location (of sewage treatment plant). The planned location is still close to residential areas and resorts of Duong Dong town and Cua Can.	As for nuisances on STP, odor might be a main problem. In this plan the location is decided by taking consideration of odor. The STP is planned to be built between golf courses and (50ha) forest of resort. This location also is good for the reuse of reclaimed water in terms of water conservation.
Sewerage	Please consider the location of STP because of many resorts and houses.	

Component	Comments	Actions to respond to Comments in the survey
Others	Since construction has impacts on environment, appropriate environmental considerations should be taken when the project components are constructed.	Evaluations on environmental impacts are carried out properly based on the scoping.
Others	The execution of projects has impacts on flora and fauna. Therefore, the investigation should be conducted to protect them at project sites.	Considerations of flora and fauna protection are carried out properly based on the scoping.
Others	Evaluation of the impact of workers on the National Park. One of mitigation measures is to obtain the permission before the worker starts the investigation in the national park and to present ID card when he enters the project sites.	All project sites are located outside the national park.
Others	Total project area is 190ha (including reservoir, WTP and STP). Does this project use the national park? If use the national park, how much area of the national park is necessary for the project? Impacts of the project on Phu Quoc and especially impacts on ecosystem of the national park should be considered.	All project sites are located outside the national park. Evaluation of impacts on ecology is carried out based on the scoping.

9.2 Information Disclosure

The project information should be widely publicized to people in and around the project area, so that the community can access these information and having better understanding of the possible impacts directly to daily lives caused by the project.

Final EMP documents (in Vietnamese) will be released to local communities in the process of project preparation. Simultaneously environment report will be sent to the Vietnam Information Center for Development (VDIC) for information and storage. The announcement of the environmental assessment report must be conducted before implementing the project construction. Environmental Impact Assessment Documents for the project will be conducted as follows:

· They will be exhibited publicly at the office of Phu Quoc District PC at Duong Dong and Cua Doung Commune PC: (1) Draft documents (presented XX/XX/ 20XX); (2) The official documents (presented XX/XX/ 20XX).

· They will be stored at PMU office (address: XXX) and presented to the public space so that the community can access.

· They will be published (uploaded) on the website: http:// www.XXX .

ENVIRONMENTAL IMPACT ASSESSMENT

AND

ENVIRONMENTAL MANAGEMENT PLAN

Sewerage System Sub-Project (provisional title)

For

Water Supply and Sewerage System Project

In

Phu Quoc Island, Vietnam

Table of Contents

Notification for Revision

"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewerage system. As for the construction of the sewerage system, "Sewerage System Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project") will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Environmental Impact Assessment (EIA) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This EIA report is prepared to summarize the result of EIA survey complied with JICA GL.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the EA is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

1. Executive Summary

Phu Quoc Master Plan (MP) 2009 was updated to Adjusted MP 2010 and approved by the prime minister as Decision No. 633. Ander the concept of Adjusted MP 2010, preparatory survey for "Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consisting of three major components such as; i) reservoir, ii) water supply system and iii) sewer system had started in September, 2011.

Within the preparatory survey, basic information was collected and described in this report "EIA & EMP" and revised with progress of EIA study by PMU/SPC subsequently. The EIA study was conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This EIA report is prepared to summarize the result of EIA survey complied with JICA GL.

Project Introduction:

MP 2010 describes that water demand will increase in a large extent by tourism development in addition to the potential shortage of water supply in the current situation. On the other hand, There is no sewer treatment system in the island except existing low-effective septic tanks, which causes water pollution to water environment such as Doung Dong River. Thus, water environment faces difficulty even the present and with expectation of increasing visitors, both water supply and sewer system are urgently necessary.

Legal and Policy framework of EIA in accordance of GOV:

- Law on Environmental Protection No. 52/2005/QH11 of 29 November 2005;
- Decree 21/2008/ND-CP of 28 February 2008, Amending and Supplementing Some Articles of Decree 80/2006/ND-CP;
- Decree 80/2006/ND-CP of 9 August 2006, On Detailed Guideline for Implementation of Some Articles of Law on Environmental Protection;
- Circular 05/2008/TT-BTNMT of 8 December 2008, On Guidelines for Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitments.
- Decree 81/2006/NĐ-CP dated 09/8/2006 by Government stipulation on sanctions against administrative violations in environmental protection Environment Protection.
- Decree 149/ND-CP dated 27/07/2004 regulations on permit for exploration, exploitation and use of water resources and discharge into water receiving body.
- Circular 25/2009/TT-BTNMT dated 16/11/2009 promulgating the National Technical Regulation on Environment.
- Circular 16/2009/TT-BTNMT dated 7/10/2010 additional issuance of National Technical Standards on Environment.
- Standards – Technical Code for the Vietnam Environmental Protection:

- TCVN 5576:1991 - Standards for water supply and drainage systems;
- TCVN 6962:2001 - Permissible Vibration and Clash in Construction Activities;
- TCVN 5949:1998 - Permissible Noise Levels in the Residential and Public Areas;
- QCVN 05:2009 - Vietnam Standard on Air Ambient Quality;
- QCVN 01:2009 - Vietnam Standard on Drinking Water Quality;
- QCVN 08:2008 - Vietnam Standard on Surface water Quality;
- QCVN 09:2008 - Vietnam Standard on Ground water Quality;
- QCVN 14:2008 - Vietnam Standard on Domestic Wastewater;

Project Description:

"Sewerage System Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project") was

designed to as following.

(1) Planning Target Year

The selected planning horizons are consistent with Article 13 of Vietnamese DECREE 88 on Drainage and Sewerage for Urban Areas and Industrial Zones dated 28 May, 2007 which states that "Drainage/sewerage plans shall be prepared for short-term phases of 10 years; long-term phases of 20 years and longer.

Also, Planning population, land use plan, water supply plan, and sewerage plan, etc. in 2020 and 2030 are described in adjusted master plan.

This survey has adopted the following planning target year:

Phase	Target Year
・Phase 1	2020
・Phase 2	2030

(2) Sewerage Service Area

The service area of in this survey is adopted the urban area in 2030 of Duong area on the adjusted master plan.

Analysis of Alternatives:

As alternatives, "without project" situation, collective system and individual systems are compared. One of the advantages of collective system is stable water quality control. On the other hand, the cost is generally expected to be lower for the individual systems. As a result of study, collective system is selected. There are two methods to collect sewage such as combined and separate sewer systems. For the project, separate sewer system is selected.

Base Environment Conditions:

The data based on the current status of environmental conditions in the project area are presented. Thereby, a general assessment of environmental quality in existing project area has been considered. The environmental factors include:

- Land environment
- Water environment
- Air environment
- Ecological environment

Environment Impact Assessment:

EIA study had been conducted based on scoping items which were presented to stakeholders. Scoping items were reevaluated after the study. Items with level A or B for environmental impact are shown in EMP for their mitigation measures.

Environment Management Plan:

The results of the EIA show that the potential impact of the project such as noise and dust focuses during the construction in a short term. Although the site changes the land use to large extent irreversibly, the existing vegetation is not a natural forest and the wildlife can be transferred fortunately.
Even for short-term construction related impacts, such as common construction-related impacts of dust, noise and construction site waste can be prevented or minimized with standard mitigation measures. The EMP for this Sub-project consists of impact mitigation and monitoring requirements necessary to manage and measure expected and unexpected impacts of the Sub-project. The implementation of the EMP will require support from an environmental consultant (EC), and an independent environmental consultant (IEC) to audit the EMP.

Public Consultant and Information Disclosure:
In the first stakeholder consultation, explanation of the outline of the project and the scoping draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussions were focused on impacts by the reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, satisfactory answers were given. In addition, anonymous opinions from attendants were collected in order to hear as many people as possible. The contents and countermeasures were distributed to authorities concerned and attendants.

2. Policy and Legal Framework for EIA

2.1 Vietnam

2.1.1 Outline of environmental social consideration related laws and regulations

Institution of EIA in Vietnam is prescribed by Law on Environmental Protection (LEP; No.52/2005/QH11) , Decree No. 80/2006/ND-CP, No. 21/2008/ND-CP and No. 29/2011/ND-CP. LEP was made public by No. 29/2005/L/CTN and came into effect in 2006. It prescribes Strategic Environment Assessment, EIA and Environment conservation pledge.

Decree No. 80/2006/ND-CP, No. 21/2008/ND-CP and No. 29/2011/ND-CP prescribe LEP administrative instruction, EIA target project list, EIA procedure, contents of EIA report and so on. By these decrees, it is prescribed that projects involving reservoirs of 100,000m^3 or more and sewer system of 500m^3/d or more need to prepare EIA reports. It applies to the project components for the reservoir and STP but it does not apply to WTP construction.

EIA report should be prepared within 24 months since the commencement of the project. The procedure to be followed is shown in section 2.1.2.

The approval authorities for the project are Ministry of Natural Resources and Environment

(MONRE) or DONRE.

Stakeholder consultation should be held at the stage of EIA report preparation, which is prescribed by Decree No. 29/2011/ND-CP.

For information disclosure, the decree describes that the authority send the EIA report to the proponent and the environmental departments and the Provincial PC distributes the copies to local PCs.

The GOV EIA system is defined by the following key legal and policy regulations:

• Law on Environmental Protection No. 52/2005/QH11 of 29 November 2005;
• No. 29/2011/ND-CP of April 18, 2011, Providing Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment;
• Decree 21/2008/ND-CP of 28 February 2008, Amending and Supplementing Some Articles of Decree 80/2006/ND-CP;
• Decree 80/2006/ND-CP of 9 August 2006, On Detailed Guideline for Implementation of Some Articles of Law on Environmental Protection;
• Circular 05/2008/TT-BTNMT of 8 December 2008, On Guidelines for Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitments.
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• Circular 16/2009/TT-BTNMT dated 7/10/2010 additional issuance of National Technical Standards on Environment.
• Standards – Technical Code for the Vietnam Environmental Protection:
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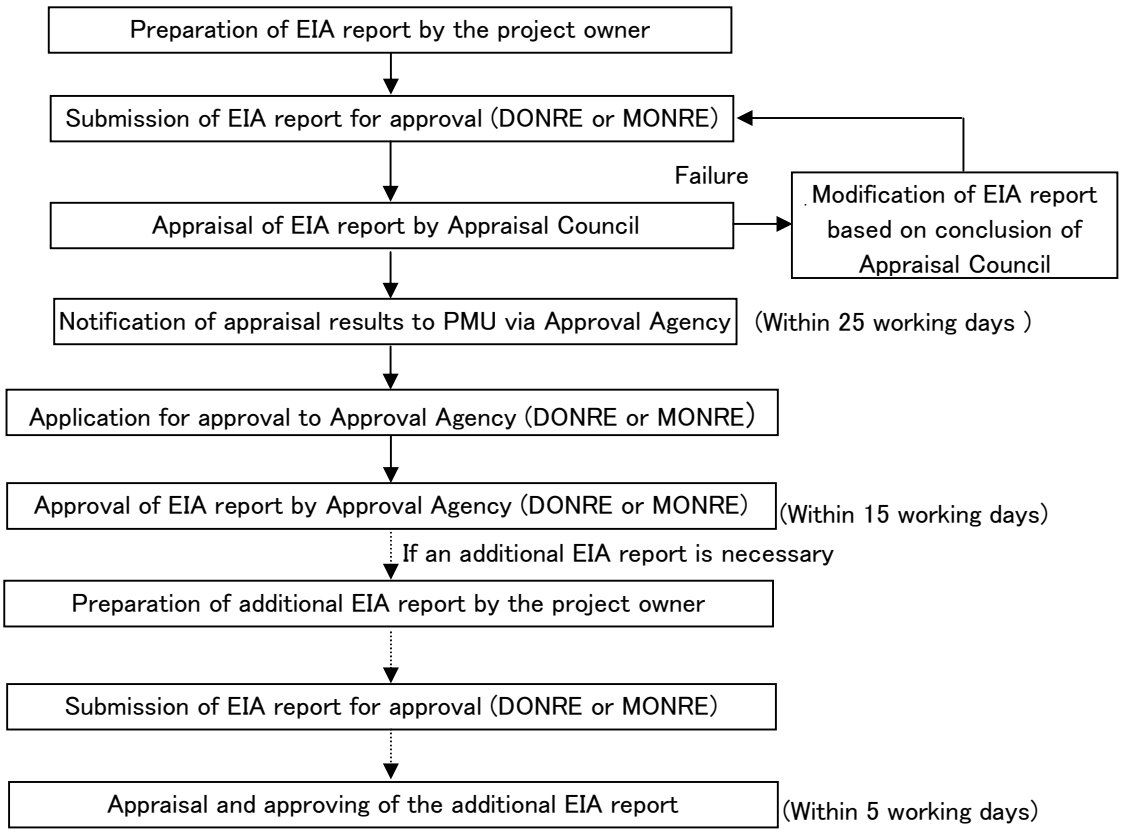
- QCVN 05:2009 - Vietnam Code on Air Ambient Quality;
- QCVN 01:2009 - Vietnam Code on Drinking Water Quality;
- QCVN 08:2008 - Vietnam Code on Surface water Quality;
- QCVN 09:2008 - Vietnam Code on Ground water Quality;
- QCVN 14:2008 - Vietnam Code on Domestic Wastewater;
- QCVN 03:2008 - Vietnam Code on Heavy Metal in Soil;
- QCVN 24:2009 - Vietnam Code on Industrial Wastewater;
- QCVN 02:2009 - Vietnam Code on Domestic Water Quality

2.1.2 EIA procedure

The procedure for appraisal and approval of the EIA report is shown in **Figure 2-1**.



(Source: JICA Survey Team (by consultation with DONRE))

Figure 2-1 Procedure for Appraisal and Approval of EIA Report

Contents of environmental impact assessment reports are as follows.

Table 2-1 The Impact Assessment Report (GOV) Contents

No.	Description	Reference
1	Enumeration and detailed description of the project's construction components, construction area, time and workload; operational technology for each component and the entire project	3. Project Description
2	Overall assessment of the environmental status at the project site and neighboring areas; the sensitivity and load capacity of the environment.	6. Scoping / 7. EIA measures / 8. Environment Management Plan
3	Detailed assessment of possible environmental impacts when the project is executed and environmental components and socio-economic elements to be impacted by the project; prediction of environmental incidents possibly caused by the project.	6. Scoping / 7. EIA measures / 8. Environment Management Plan
4	Specific measures to minimize bad environmental impacts, prevent and respond to environmental incidents.	8. Environment Management Plan
5	Commitments to take environmental protection measures during project construction and operation.	Annex

No.	Description	Reference
6	Lists of project items, the program on management and supervision of environmental issues during project execution.	8.3 Mitigation Plan / 8.4 Environment Monitoring Plan
7	Cost estimates for building environmental protection works within the total cost estimate of the project.	8.5 Estimated Cost for EMP
8	Opinions of the commune/ward or township People's Committees (hereinafter collectively referred to as commune-level People's Committees) and representatives of population communities in the place where the project is located; opinions against the project location or against environmental protection solutions must be presented in the environmental impact assessment report.	9. Stakeholder consultation
9	Citation of sources of figures and data, assessment methods.	Each chapter

2.2 JICA Guideline

2.2.1 Principle

The following conditions are met in principle:

•When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents etc. must officially finish those procedures and obtain the approval of the government of the host country;

•EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them;

•EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted;

•In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared;

•Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared; and

•It is desirable that EIA reports cover the items enumerated in the following.

2.2.2 Illustrative Environmental Impact Assessment Report

An EIA's scope and level of detail should be determined in accordance with the project's potential impacts. The EIA report should include the following items (not necessarily in the order shown):

Table 2-2 The EIA Report Contents

Contents	Description	Reference
Executive summary	This concisely discusses significant findings and recommended actions.	1. Executive summary
Policy, legal, and administrative	This is the framework within which the EIA report is to be carried out.	2. Policy and Legal Framework for EIA

Contents	Description	Reference
framework		
Project description	This describes the proposed project and its geographic, ecological, social and temporal context, including any off-site investments that may be required (e.g. dedicated pipelines, access roads, power plants, water supply, housing, or raw material and product storage facilities). It also indicates the need for any resettlement or social development plan. It normally includes a map showing the project site and the area affected by the project.	3. Project Description
Baseline data	This assesses the dimensions of the study area and describes relevant physical, biological, and socio-economic conditions, including all changes anticipated to occur before the project commences. Additionally, it takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project site, design, operation, or mitigation measures, and it is necessary to indicate the accuracy, reliability, and sources of the data.	4.3 Current environment situation in the Sub-project area
Environmental impacts	This predicts and assesses the project's likely positive and negative impacts in quantitative terms, to the extent possible. It identifies mitigation measures and any negative environmental impacts that cannot be mitigated, and explores opportunities for environmental enhancement. It identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and it specifies topics that do not require further attention.	7. EIA measures / 8. Environment Management Plan
Analysis of alternatives	This systematically compares feasible alternatives to the proposed project site, technology, design, and operation including the "without project" situation in terms of the following: the potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, it quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. It also states the basis for selecting the particular proposed project design, and offers justification for recommended emission levels and approaches to pollution prevention and abatement.	5. Alternatives comparison
Environmental Management Plan (EMP)	This describes mitigation, monitoring, and institutional measures to be taken during construction and operation in order to eliminate adverse impacts, offset them, or reduce them to acceptable levels.	8. Environment Management Plan
Consultation	This includes a record of consultation meetings (date, venue, participants, procedures, opinions of major local stakeholders and responses to them, and other items), including consultations for obtaining the informed views of the affected people, local NGOs, and regulatory agencies.	9. Stakeholder consultation

2.3 Overview of Subproject Screening

The Sub-projects were first screened to determine the level of assessment they require based on potential environmental impacts of the projects, and the requirements of the GOV and the JICA Guidelines. In general subprojects which could cause large scale irreversible impacts, affect sensitive and valuable natural habitats, or require significant resettlement which requires the greatest level of assessment. Whereas, projects causing minor impacts or impacts that can be mitigated require less assessment.

2.3.1 GOV Screening

Sub-projects are screened to determine whether an Environmental Impact Assessment (EIA) is required or an Environmental Protection Commitment (EPC) is required using the prescribed criteria in No. 29/2011/ND-CP. Sub-projects that meet or exceed the quantitative criteria require an EIA. Projects that do not meet the criteria, i.e., are smaller in size and scope, require an EPC. The Sewerage System Sub-Project requires preparation of an EIA.

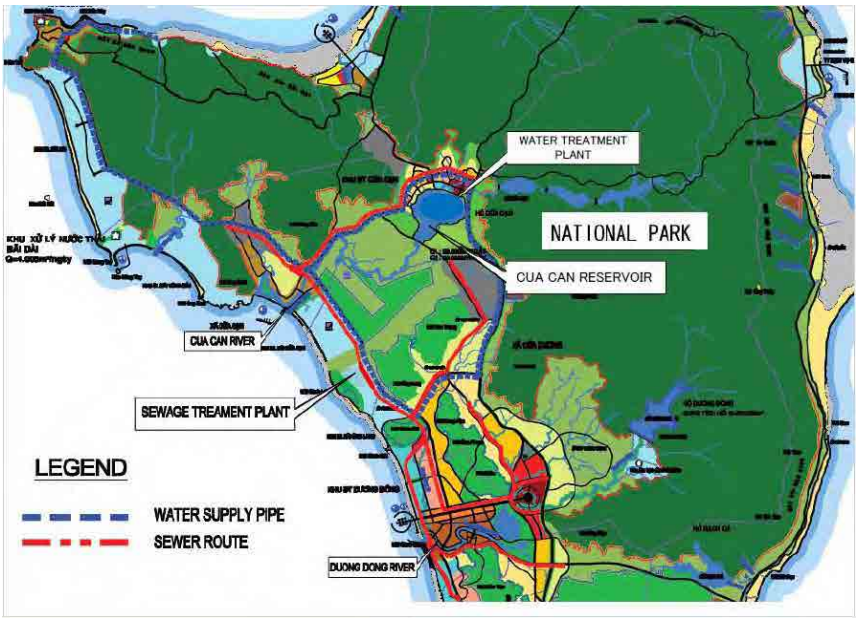
2.3.2 JICA Screening

JICA defines three primary project categories as “Category A”, “Category B” or “Category C” based on more subjective screening of potential environmental risk. Category A projects are normally large and can cause irreversible complex impacts, and thus require the greatest level of assessment. The potential impacts of a Category B are much less adverse, normally not irreversible, and can be mitigated. Category B projects at a minimum require an EMP. Category C projects have minimal or no adverse environmental impacts, and normally do not require environmental assessment beyond screening. A fourth Category is FI. These are projects which are financially supported but not managed by JICA. The Cua Can Reservoir Sub-Project includes building a large-scale impounding reservoir, which requires a Category A EIA/EMP.

3. Project Description

3.1 Outline of project components to affect environmental and social impacts

Main components of the project are; i) reservoir, ii) water supply system and iii) sewer system. The map shown below indicates the project site with the components.



Source: Master plan 2009

Figure 3-1 The project site

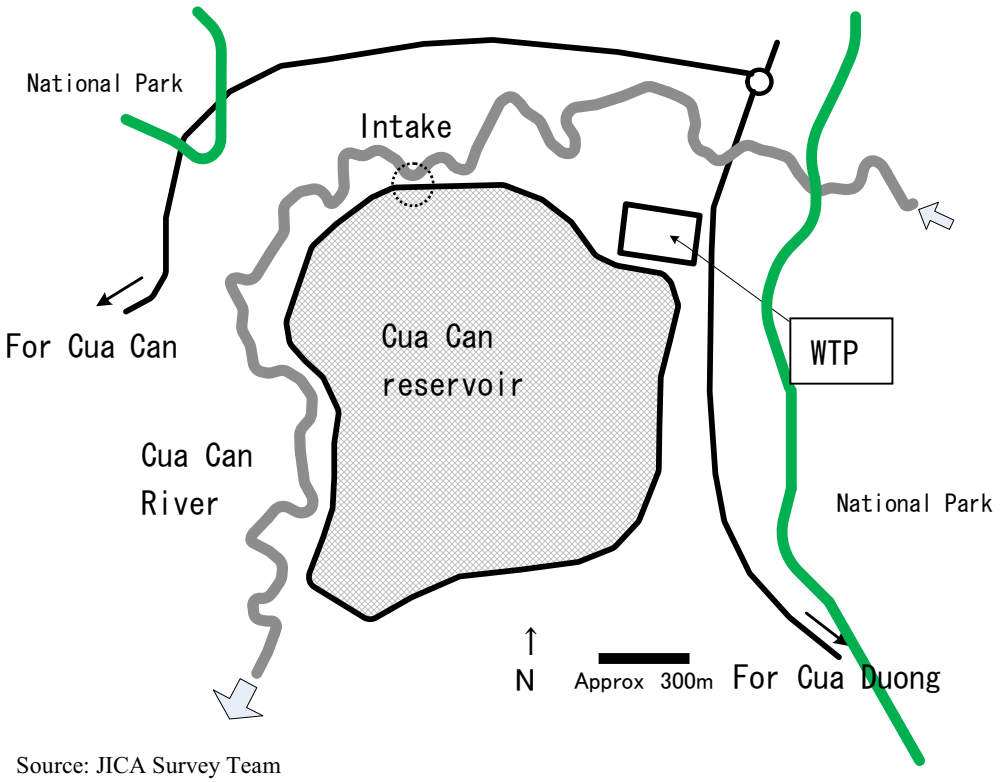
Figure 3-2 shows the outline of Cua Can reservoir design. The present design is that Cua Can River will be left as it is and Cua Can reservoir will be constructed on the side. This design avoids impacts to Cua Can River by the construction of Cua Can reservoir. Besides, the method of intake that will withdraw River water only when extra water exists will remain the current River environment in future as well.

In addition, Cua Can reservoir and the WTP planned site are outside of the national park and the closest distance between the project sites and the park will be approximately 300m.

Reservoir construction will produce extraordinary amount of soil because the planned site will be excavated. The authorities concerned said that soil in Phu Quoc or whole Vietnam is in high demand and salable. However, the amount is extremely large and coordination with other development projects is necessary. Thus, consultation with Kien Giang province or GOV will be necessary.

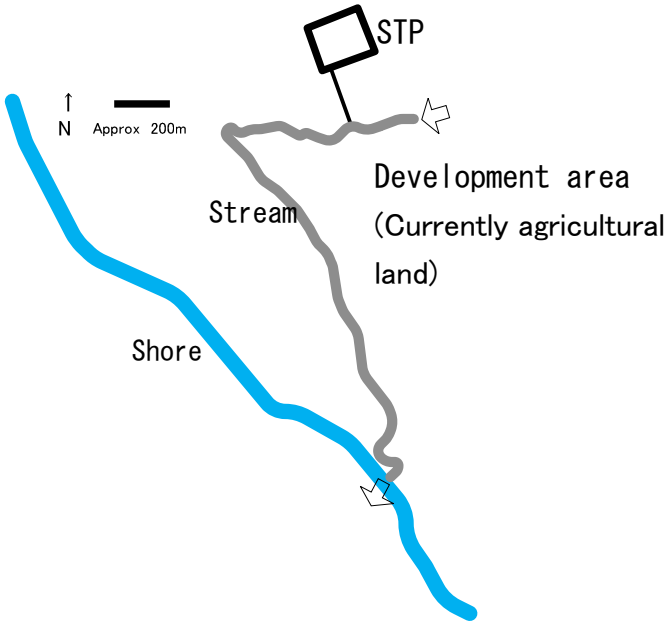
WTP is scheduled to be constructed adjacent to the reservoir, and the site will be approximately 5 to 6ha (**Figure 3-2**).

STP is scheduled to be constructed where is approximately 2km upstream of a stream from the shore and the site will be approximately 4ha. The stream to which the STP will discharge effluent is the depth of about 20cm and the width of 2m in wet season and is dried up in dry season. The environment is not suitable for aquatic organism nor fishery (**Figure 3-2** and **Picture 3-1).**



Source: JICA Survey Team

Figure 3-2 Cua Can reservoir & WTP



Source: JICA Survey Team

Figure 3-3 STP planned site

《Picture 3-1》 The stream to which the STP will discharge effluent (above: wet season, below: dry season)

(by JICA Survey Team)

3.2 Service Area of the Project

Figure 3-1 shows the service area (pipeline routes) of water supply and sewer system.

3.3 Sewerage System Sub-project

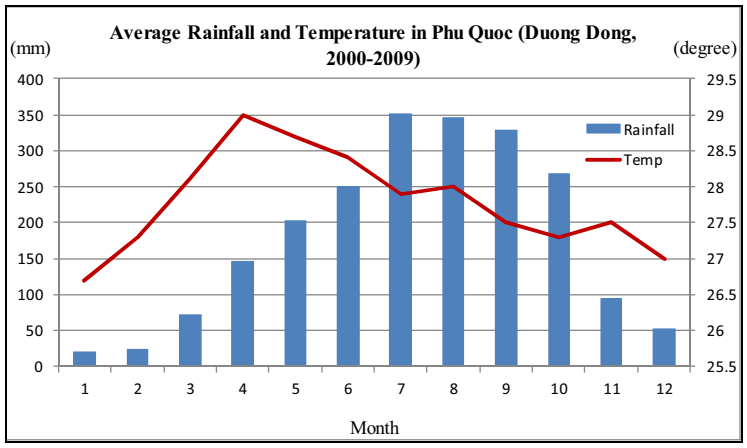
MP 2010 describes that the water environment in Phu Quoc is increasingly polluted and it is to be improved. As water quality of up and downstream of Doung Dong Town in Doung Dong River shows the pollution situation, water environment improve is urgently required (refer to 4.3.2). Thus, The Sewerage System Sub-project is expected to be executed.

4. Current environmental condition

4.1 Nature conditions

4.1.1 Meteorological phenomenon

Phu Quoc Island has tropical climate with monsoon which is divided into two clear seasons: the rain season lasts from May to November, dry season lasts from December to April of the next year with average temperature of 27 deg C; average rainfall of 2,879 mm. Average rainfall and temperature in Duong Dong, Phu Quoc is shown in **Figure 4-1.**



Source: JICA Survey Team

Figure 4-1 Average rainfall and temperature

4.1.2 Geography

Phu Quoc Island (Phú Quốc) is located in the Thailand gulf with the area of 560km² (largest island in Vietnam). It is located 40km away from Vietnam mainland. In the south of the island are small islands of An Thoi. In the North-east of the island, there is a border with islands of Cambodia. Cua Can River and Duong Dong River start from forests in the north-east part of the island and reach to the west shore. Alongside the shore Long Beach and Sao Beach stretch out. The Long Beach is located on the west side with the length of 20km.

4.1.3 Water regime

Phu Quoc has a dense river system with a density of 0.42 km/km^2 with many big rivers and canals. Ground water source is limited, water from the weathered rocks, a supplementary source to ground water is rainy water absorbing and kept in broken and chapped rock. Therefore, it is necessary to provide water storage solutions in the dry season and limit ground water over-exploitation to avoid brackish ground water.

Sources causing surface water and ground water pollution:

- Affected from the salt contamination: its cause is dryness, high tide and northeast wind. The salt contamination impacts significantly on water environment, directly affect the people's living and activities as well as production.
- Affected from the illegal ground water exploitation: the illegal ground water exploitation will not be controlled on area, capacity, yield, groundwater reserve in the region, also risks to contaminate the aquifers and groundwater source is degraded. Ground water reserve is over-exploited, which causes salt contamination, drought reserve, desertification by low drawdown, ground surface subsidence, etc.
- Affected from the domestic wastewater: Domestic wastewater not managed, collected and treated appropriately, will cause risks and adverse impacts on water environment including organic pollution, nutrition pollution and biological pollution. Domestic wastewater is one of the causes of significant pollution to the water environment and easy to spread epidemic diseases to a large extent.

(Source: Environmental Assessment and Environmental Management Plan for Phu Quoc water supply sub-project, 2011, KIWACO)

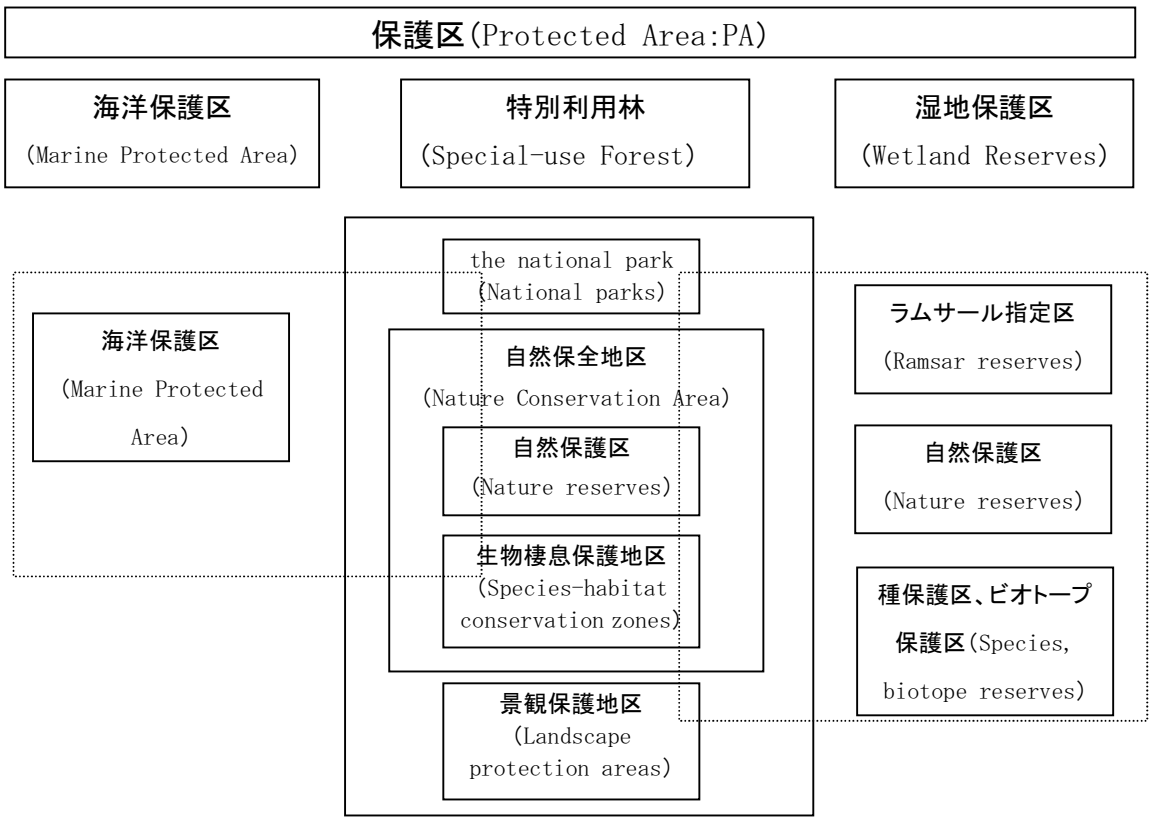
4.1.4 Protected area

The national park occupies 56% of Phu Quoc Island in area. The national park is shown in deep green in **Figure 3-1** and vasts in the northern part of Phu Quoc Island. The project sites are outside of the national park and the closest distance will be approximately 300m.

The national park belongs to Special-use forest. For usage of Special-use forests, followings should be maintained; (i) conservation of biodiversity of forests and habitats of endangered species / rare species, (ii) fauna and flora valuable in terms of science, education, tourism and economy, (iii) Values in terms of scenery, culture, history and environment.

Diagram of Protected area is shown in **Figure 4-2** and related laws and regulations are shown in **Table 4-1.**

Protective forest area shown in **Figure 4-3** is different from the Protected area. It is described in **4.2.3 Land use**.



Related laws and regulations

National MPA System Plan	No.29/2004/QH11 Decree No. 23/2006/ND-CP	No.109/2003/ND-CP No.109/2003/ND-CP No.18/2004/TT-BTNMT

(Source: JICA)

Figure 4-2 Diagram of Protected area

Table 4-1 Main laws and regulations of Special-use forest management

Laws and regulations	Date
Decree 58/LCT/HDNN	1991/08/19
Decision No. 327/CT	1992/09/15
Decree No. 14/CT	1992/12/05
Directive No. 130/TTg	1993/3/27
Decree No. 77/CP	1996/11/29
Directive 286/TTg	1997/5/2
Decision 661/1998/QD-TTg	1998/7/29
Decision 245/QD-TTg	1998/12/21
Decision 34/1999/QD-BNN-TCCB	1999/2/12
Circular 56/1999/TT-BNN-KL	1999/3/30
Decree 163/ND-CP	1999/11/16
Decision No. 08/QD-TTg	2001/01/11
Decree No. 139/2004/ND-CP	2004/01/25
No. 29/2004/Q11	2004/12/14
Decision No. 61/2005/QD-BNN	2005/10/12
Decision No. 62/2005/QD-BNN	2005/10/12
Decree No. 23/2006/ND-CP	2006/03/03

(Source: Review of the Protected Area System of Vietnam (ASEAN Regional Centre for Biodiversity Conservation))

Buffer Zone was designated in the surrounding area of the National Park (Core Zone) in accordance with the idea of Biosphere Reserve. In the Buffer Zone (shown in red in the following map), fire-prevention campaign was held for the inhabitants. However, the division that was in charge of the

management of the zone category was closed in 2005 and the status of the category has been uncertain for the time being.

Development projects in the Buffer Zone area are admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.

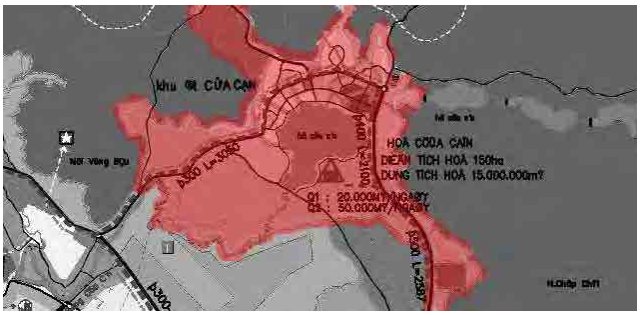


Figure 4-3 Buffer Zone related to the Project sites

4.1.5 Fauna

In the fauna and flora study by the University of Agriculture and Forestry in 2005 targeting the Phu Quoc national park, total number of wildlife species confirmed was 206 in 75 families, 24 orders, 4 classes. 35 species are designated as rare or restricted for hunting. 15 species are from IUCN red book (2004). 24 species are from Vietnam red book (2000). 22 species are from Decree 32/2006/ND-CP. (**Table 4-2**). The study describes followings as commonly seen wildlife.

- Mammals: classes of wild pig, deer, bat, monkey, otter, marten, squirrel, etc.
- Birds: classes of duck, swallow, goosey, hornbill, heronry, pelican, robin, owl, pigeon, wagtail, woodpecker, etc.
- Reptile / Amphibian: classes of snake, crocodile, turtle, lizard, flog, etc.
- Fin: not described

Table 4-2 Rare or restricted species in the Phu Quoc National Park

Classification	No.	Scientific name	IUCN (2004)	SDVN (2000)	ND32 (2006)
Mammal	1	*Nycticebus coucang* *Nycticebus bengalensis*	DD	V	IB
	2	*Nycticebus pygmaeus*	VU	V	IB
	3	*Trachypithecus germaini*	DD		IB
	4	*Aonyx cinerea*	LR/nt	V	IB
	5	*Callosciurus finlaysoni harmandi*		R	
Bird	1	*Buceros bicornis*	T	NT	IIB
	2	*Ichthyophaga ichthyaetus*		NT	
	3	*Halcyon capensis*	T		
	4	*Polihierax insignis*		NT	IIB
	5	*Ketupa flavipes*			IIB
	6	*Copsychus malabaricus*			IIB
	7	*Gracula religiosa*			IIB
	8	*Tyto alba*			IIB
Amphibian / Reptile	1.	*Gekko gecko*		T	
	2.	*Physignathus cocincinus*		V	
	3.	*Varanus bengalensis*		V	IIB

Classification	No.	Scientific name	IUCN (2004)	SDVN (2000)	ND32 (2006)
	4.	*Varanus salvator*		V	IIB
	5.	*Python molurus*	LR/nt	V	IIB
	6.	*Python reticulatus*		V	IIB
	7.	*Elaphe prasina*		T	
	8.	*Elaphe radiata*			IIB
	9.	*Ptyas korros*		T	
	10.	*Ptyas mucosus*		V	IIB
	11.	*Bungarus candidus*			IIB
	12.	*Bungarus fasciatus*		T	IIB
	13.	*Naja atra*		T	IIB
	14.	*Ophiophagus hannah*		E	IB
	15	*Dermochelys coriacea*	CR	E	
	16.	*Chelonia mydas*	EN	E	
	17.	*Eretmochelys imbricata*	CR	E	
	18.	*Lepidochelys olivacea*	EN	V	
	19.	*Hieremys annandalii*	EN	V	IIB
	20.	*Malayemys subtrijuga*	VU		
	21.	*Amyda cartilaginea*	VU		
	22.	*Crocodylus siamensis*	CR	E	IIB

【Legend】
・IUCN (IUCN red book)
- Critically Endangered (CR) - Endangered (EN) - Vulnerable (VU) - Lower Risk / Near Threatened (LR/nt)
- Data Deficiency (DD)
・SDVN (Vietnam red book)
- Endangered: E - Vulnerable: V - Rare: R - Threatened: T
・ND32 (Decree 32/2006/ND-CP)
- IB (Wildlife species that are strictly prohibited to any hunting and use) - IIB (Wildlife species that can be limitedly hunted and used under strict control)

(Source: Ecotourism Development Strategy of The Phu Quoc National Park（University of Agriculture and Forestry,2006）

The study exempt fin as a target but the Department of Kien Giang Natural Resources and Environment (DONRE) which is planning environment study in Cua Can River says it is assumed that only few kinds of fish inhabit. Cua Can Commune's Peoples Committee in whose area Cua Can River exists says that only few kinds of fish inhabit and no fishery is conducted in the river. Phu Quoc National Park Management Board says rare wildlife should inhabit only in the national park.

4.1.6 Flora

The study mentioned in (5) categorize flora such as; i) Mangrove, ii) Melaleuca Forest, iii) Brushland with Oncosperma tigillaria, iv) Dry forest, v) Open Dipterocarp forest, vi) Imperata grassland, vii) Secondary forests and viii) Primary Dipterocarp Forest. The project site is scheduled to be in the Secondary forests.

Table 4-3 shows major flora system in the national park summarized by the study. Rare flora is not mentioned by the study and Phu Quoc Forestry Agent who attended a site visit by JICA Survey Team in October, 2011 says no rare flora species exist in the planned site.

Table 4-3 Geo-botanical Elements in the Flora of Phu Quoc Island

Flora system	Typical elements		Number of Taxa
Malayano-Indonesian	-	Dipterocarpaceae	6 genera / 16 species
Hymalayano-Yunnan	Gymnospermae:	Podocarpaceae	2 genera / 4 species

		Gnetaceae	1 genera / 1 species
	Angiospermae:	Ulmaceae	1 genera / 1 species
		Oleaceae	3 genera / 3 species
		Aceraceae	10 genera / 12 species
		Rosaceae	1 genera / 1 species
		Fagaceae	2 genera / 4 species
		Lauraceae	6 genera / 8 species
Indo-Mianma	-	Combretaceae	5 genera / 7 species
		Lythraceae	1 genera / 3 species
		Bombaceae	2 genera / 2 species

(Source: Ecotourism Development Strategy of The Phu Quoc National Park（University of Agriculture and Forestry,2006）

4.2 Current social condition

4.2.1 Population

Phu Quoc Island consists of 2 towns and 8 villages. The whole population of the island is approximately ninety thousand. **Table 4-4** shows shifts of the population.

Table 4-4 The shifts of the population

Town/Commune		Y2005	Y2006	Y2007	Y2008	Y2009
Town	Duong Dong	28,370	30,074	31,053	31,811	31,940
	An Thoi	17,854	18,927	19,531	20,292	19,880
Commune	Cua Can	3,058	3,241	3,345	3,429	3,394
	Cua Duong	7,213	7,655	7,899	8,096	7,789
	Ham Ninh	6,706	7,108	7,336	7,519	7,573
	Duong To	6,069	6,434	6,640	6,806	7,204
	Bai Thom	4,632	4,909	5,066	5,193	4,404
	Ganh Dau	3,904	4,138	4,271	4,378	4,294
	Hon Thom	2,697	2,859	2,950	3,024	2,438
	Tho Chau	1,480	1,563	1,612	1,652	1,755
Total		81,983	86,908	89,703	92,200	90,671

(Source: Phu Quoc Census Book 2009)

4.2.2 Social economic condition

Major economic activities in Phu Quoc Island are fishery, black pepper and fish sauce (Nuoc Mam). **Table 4-5** shows the population for occupations in the island.

Table 4-6 shows important infrastructure such as educational and medical institutions. They do not exist within 2km from the project site.

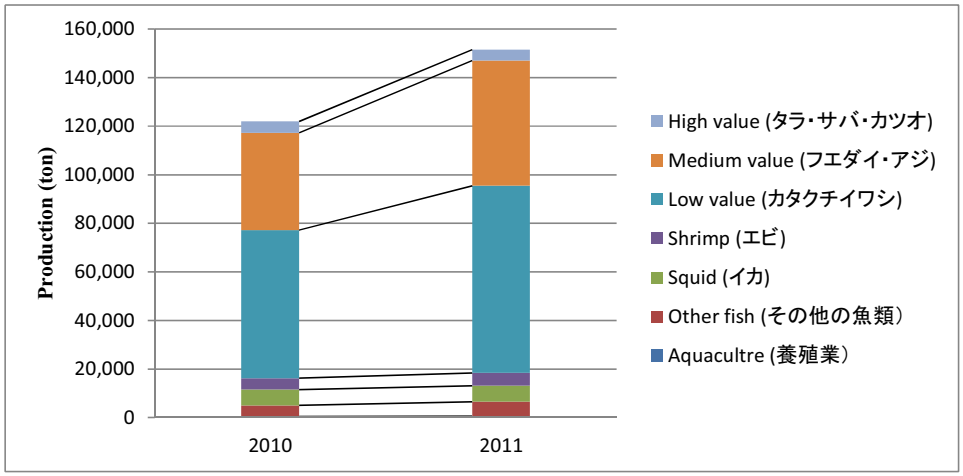
The breakdowns of production of the two major industries (fishery and agriculture) in Phu Quoc are shown in **Figure 4-5** and **4-6**.

Table 4-5 Population for occupations

No.	Occupation	Population (2009)	Rate (%)
1	Aquatic product	13,546	14.94%
2	Agricultural production	7,446	8.21%
3	Commerce, Vehicle's Motor and Engine Repair	3,552	3.92%
4	Food Process Industry	3,146	3.47%
5	State Management , The National Defense Security, etc.	2,616	2.89%
6	Restaurants, Hotel	2,486	2.74%

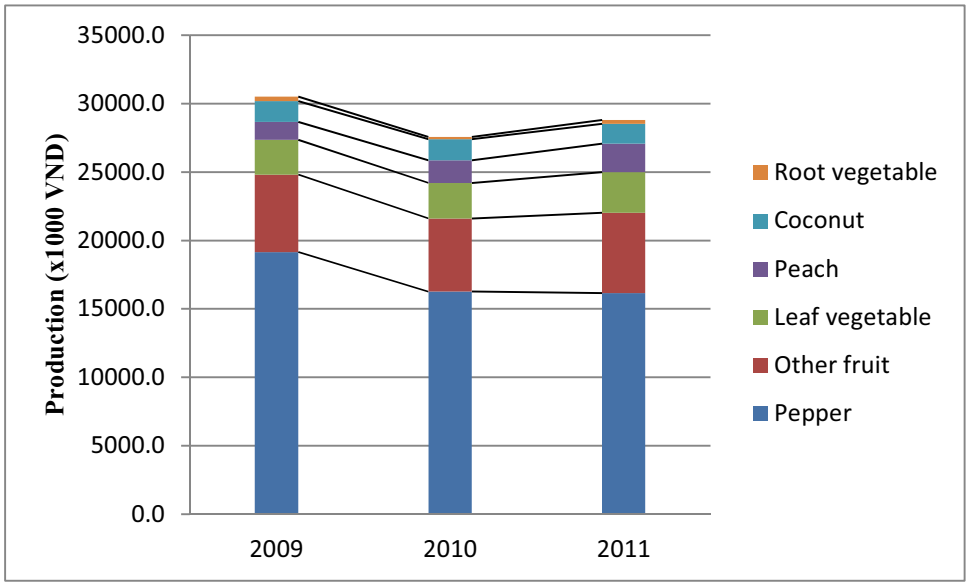
7	Transportation, Warehouse, etc.	2,430	2.68%
8	Education and Training	970	1.07%
9	Construction	857	0.95%
10	Other	2,410	2.66%
-	Total	39,459	43.52%
Not working		51,212	56.48%

(Source: Phu Quoc Census Book 2009)



(Source: Phu Quoc Statistic Bureau)

Figure 4-5 Buffer Zone related to the Project sites



(Source: Phu Quoc Statistic Bureau)

Figure 4-6 Buffer Zone related to the Project sites

Table 4-6 Important infrastructure

No	Important infrastructure	Number
	Educational	
1	Primary School	11
2	Primary+ Secondary School	7
3	Secondary School	6
	Medical	

No	Important infrastructure	Number
1	Hospital	1
2	Regional General Surgery Room	1
3	Town, Commune Medical Care Station	43

(Source: Phu Quoc Census Book 2009)

4.2.3 Tourism

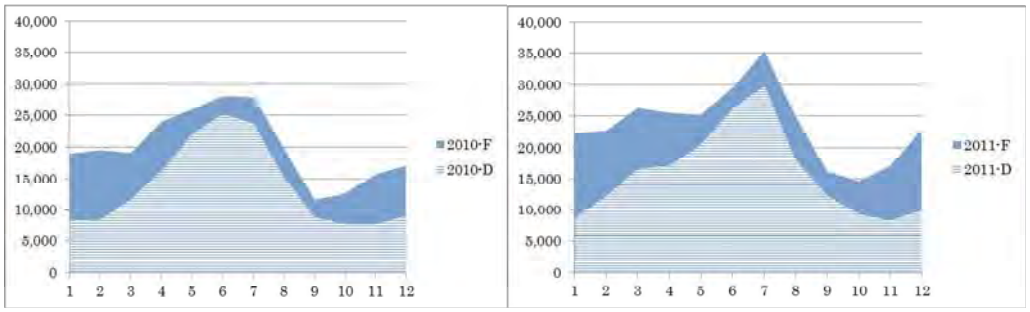
Tourists visiting Phu Quoc Island increase in recent years as shown in **Table 4-7**. The shifts of monthly population of tourists are also shown in **Figure 4-7**. Domestic tourists are as twice as foreigners. Foreign tourists increase in the dry season (Dec.-Apr.) while the whole tourist population increases from May to July which is a major holiday season in Vietnam.

According to the 2009 M/P, two million tourists in 2020 and 5 million in 2030 are estimated but the grounds for estimation are not described and it is assumed that the numbers are nonbinding targets.

Table 4-7 Yearly tourist population in Phu Quoc

Year	2005	2006	2007	2008	2009	2010	2011
Tourist	130,400	148,200	160,200	184,100	220,350	239,794	282,270

(Source: Phu Quoc Census Book 2009 and JICA Survey Team)



Legend : F(foreign)/D(domestic) (Source: Phu Quoc Statistic Bureau)

Figure 4-7 Monthly tourist population in Phu Quoc

4.2.4 Land use

Approximately 70% area of Phu Quoc Island is forest area and 20% is agricultural land. The project site is scheduled in agricultural lands. Reservoir planned site will be in the land with miscellaneous trees where logging and pepper and livestock firming take place. In accordance with the design, it can include protective forest area. WTP planned site will be in the land with miscellaneous trees where no activity is seen and grassland where livestock firming takes place. STP planned site will be in the land with miscellaneous trees where no activity is seen.

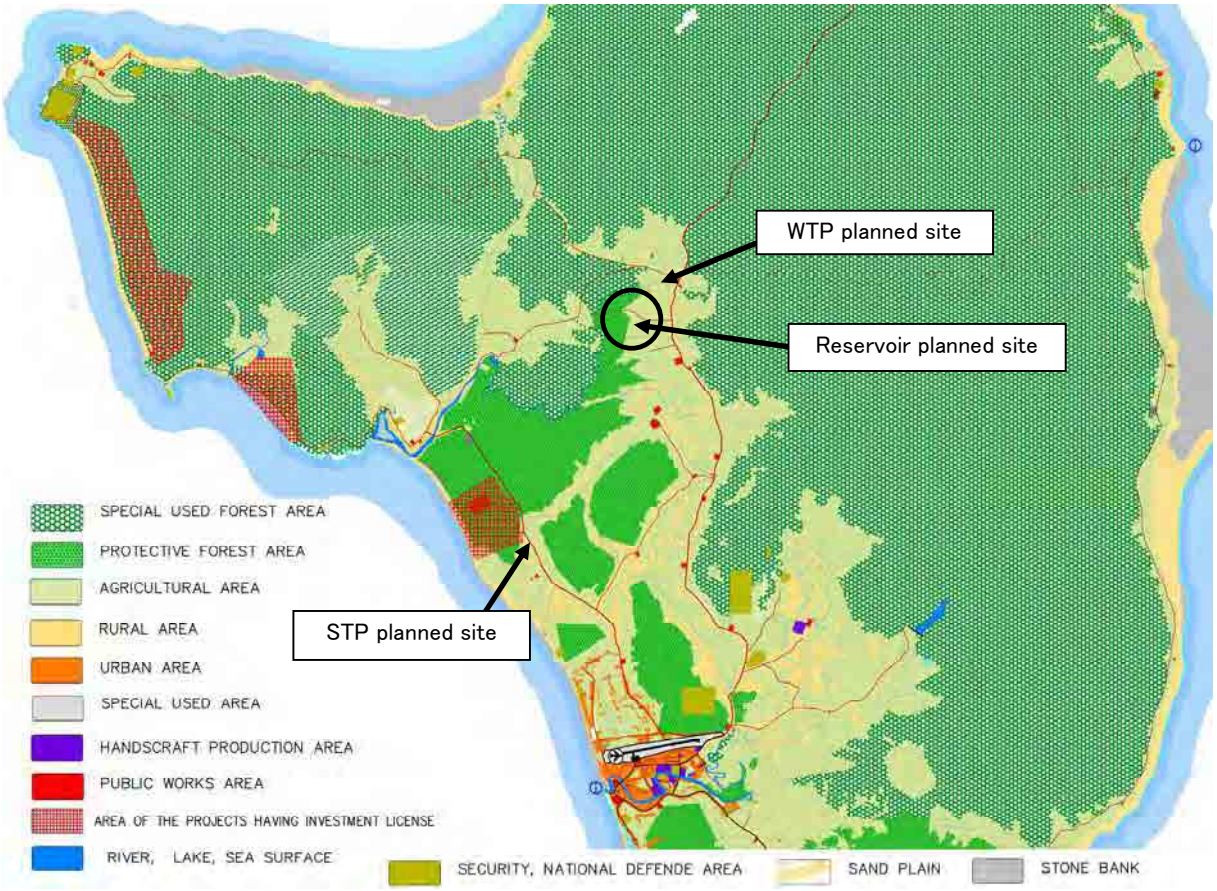
Protective forest area is different from Protected area of Special-use forest mentioned in **(4)**. Protective forest area can be designated to other land category where productive activities are allowed. It is possible due to a certain procedure by the provincial People's Committee and no major problem is found for the project land use.

Land use condition as of 2007 is shown in **Table 4-8** and **Figure 4-8**.

Table 4-8 Land use condition in Phu Quoc Island (2007)

No.	land use	Area(ha)	Rate
1	Urban area	872	1.5%
2	Touristic area	243	0.4%
3	Sporting facility, etc.	179	0.3%
4	Park / Green space	309	0.5%
5	Airport / Port site	969	1.6%
6	Agriculture	11,351	19.3%
7	Military related site	1,880	3.2%
8	Forest	41,757	70.9%
9	Other	1,355	2.3%
Total		58,915	100.0%

(Source: Phu Quoc Census Book 2009)



(Source: Master plan 2009)

Figure 4-8 Land use map of Phu Quoc Island

4.2.5 Water use

In Cua Can River which is located downstream area of the reservoir, no irrigation nor fishery were seen when site visits were conducted by JICA Survey Team in October, 2011. DONRE, in charge of the river, says that no water use is applied in the area. Cua Can Commune People's Committee, located in the area, says that no fishery activities are conducted. Also in the stream near STP planned site, no water use is conducted.

4.3 Current environment situation in the Sub-project area

4.3.1 Land environment

(1) Soil

Soil investigation held from December, 2011 to January, 2012 shows that the soil is not likely to surface corrosion or sliding.

(2) Topological features

Refer to the Final report for the current and planned topological features in the site.

4.3.2 Water environment

Water quality of up and downstream of Doung Dong Town in Doung Dong River measured in the wet season (October, 2011) and the dry season (March, 2012) is shown in **Table 4-9**, which indicates that water quality values of downstream are significantly polluted. The conclusion is obvious when the shifts of COD and BOD are drawn attention.

Table 4-9 Doung Dong River water quality

Wet season (Oct. 2011)					
Upstream of Doung Dong Town			Downstream of Doung Dong Town		
Item	Result	Unit	Item	Result	Unit
Temperature	24.5	Deg C	Temperature	24.5	Deg C
pH	5.2	-	pH	6.6	-
DO	6.0	mg/L	DO	4.1	mg/L
TSS	6.0	mg/L	TSS	4.0	mg/L
COD	36	mg/L	COD	203	mg/L
BOD	12	mg/L	BOD	60	mg/L
Dry season (Mar. 2012)					
Upstream of Doung Dong Town			Downstream of Doung Dong Town		
Item	Result	Unit	Item	Result	Unit
Temperature	31.0	Deg C	Temperature	32.0	Deg C
pH	6.6	-	pH	7.7	-
DO	5.7	mg/L	DO	3.2	mg/L
TSS	8.0	mg/L	TSS	8.0	mg/L
COD	28	mg/L	COD	440	mg/L
BOD	12	mg/L	BOD	148	mg/L

Source：JICA Survey Team

4.3.3 Air environment

(1) Air quality

The air quality in the site before construction is shown in **Table 4-10**.

(Description)

Table 4-10 (1) Baseline Air Quality at Station-A

Item	Value	Standard value TCVN5937	Unit	Method
SO_2				
CO				

NO_x				
O_3				
TSP (Dust)				
PM_{10}				
Pb				

Table 4-10 (2) Baseline Air Quality at Station-B

Item	Value	Standard value TCVN5937	Unit	Method
SO_2				
CO				
NO_x				
O_3				
TSP (Dust)				
PM_{10}				
Pb				

(2) Noise

The noise in the site before construction is shown in Table 4-10.

(Description)

Table 4-11 Baseline Noise

Station	Value	Classification of district area	Standard value TCVN5949
A			
B			
C			

4.3.4 Ecological environment

(1) Fauna

(Description of the fauna investigation)

(2) Vegetation

(Description of the flora investigation)

Table 4- Result of the Flora Investigation

No.	Name of plants	Area (ha)	Area (%)	Possible uses of plant	Protection law / regulation (if any)
Ex.	Eucalyptus		30%	Construction	None
1					
2					
3					
4					
5					

5. Alternatives comparison (including the "without project" situation)

As for sewer system, "without project" situation, collective system and individual systems are compared and the results is shown in **Table 5-1**. One of the advantages of collective system is stable water quality control. On the other hand, the cost is expected to be lower for the individual systems generally, however, when high water quality is required, it ends up with high costing. Even with high specification, such small treatment systems cannot afford the water quality if the regulation on discharge water changes. Furthermore, individual water quality management shall be very difficult. As a result, collective system is selected.

There are two methods to collect sewage such as combined and separate sewer systems. For the project, separate sewer system is selected because of following reasons; i) No major flooding problems are reported in the target area, thus, pipes can be small, ii) No environmental impacts by combined sewer overflow occur in the separate sewer system.

Table 5-1 Alternatives comparison (sewer system)

	Without project	Collective system (broad area)	Individual systems
Water pollution	×	○	▲
Odor	×	○	▲
Public sanitation	×	◎	○
Construction cost	—	×	×
OM cost (tariff)	—	▲	▲
OM	—	○	▲
Increase of employment opportunity	—	○	○
Waste	×	▲ (reviewing composting)	▲
Result of comparison	Rejected	Adopted	Rejected
Conclusive aspect	Pollution	Public sanitation	Difficulty of OM

【Legend】 — : No impact, × : Large adverse impact, ▲ : Adverse impact, ○ : Positive effect, ◎ : Significant positive effect

(Evaluation includes consideration for the future)

6. Scoping

Scoping of the sewerage system is shown in **Table 6-1**. The components are sewage, pumping stations, STP and outlet channel.

Table 6-1 Scoping – evaluation and the reason (Sewerage system)

Item	Evaluation	Reason
1 Air pollution	D	No adverse impacts are expected
2 Water pollution		
3 Soil pollution		
4 Waste	B	Due to soil waste and sludge waste
5 Noise and vibrations	B	Due to Noise and vibration according to construction and transfer
6 Ground subsidence	D	No adverse impacts are expected
7 Offensive odors		
8 Geographical features	B	Due to Small-scale topological change
9 Bottom sediment	D	No adverse impacts are expected
10 Biota and ecosystems	C	Impact is unknown so consideration should be done
11 Water usage	D	No adverse impacts are expected
12 Accidents	B	Due to Accidents during construction and operation
13 Global warming	B	Due to CO_2 from reaction tank, pump, blower, dehydrator usage for distribution
14 Involuntary resettlement	B	Resettlement will not occur but land acquisition is necessary
15 Local economies	C	Impact is unknown so consideration should be done
16 Land use	B	Due to Resettlement
17 Social institutions	D	No adverse impacts are expected
18 Existing social infrastructures and services	C	Impact is unknown so consideration should be done
19 Poor, indigenous, or ethnic people		
20 Misdistribution of benefits and damages		
21 Local conflicts of interest	D	No adverse impacts are expected
22 Gender		
23 Children's rights		
24 Cultural heritage		
25 Infectious diseases such as HIV/AIDS	C	Impact is unknown so consideration should be done

【Evaluation】 A : Large adverse impact is expected, B : Some adverse impact is expected,
C : An adverse impact is indistinct, D : No adverse impact is expected

7. EIA measures

7.1 Purpose of EIA study

The purpose is to predict and assess the contents and scale of possible impacts to natural and social environment by the Sub-project.

7.2 Items to be targeted in the study and evaluation

In principle, items with A, B and C in evaluation in **6. Scoping** should be studied and evaluated. In addition, other items that are assumed to be considered as the survey proceeds should also be targets.

7.3 Target areas

Target areas are construction planned site and the surrounding areas of the project facilities. In addition, in case that access roads are necessary, they and the surrounding areas should also be targeted.

7.4 Target periods

Target periods are the stages of planning and executing of the project.

7.5 Contents and methods of EIA study

7.5.1 Acquisition of information

The contents and methods of the study are shown in **Table 7-1**.

Table 7-1 The study and countermeasure associated with the sewerage system

Eval-uation	No.	Item	Study / Coun-termeasure	Method
B	4	Waste	・Waste countermeasure	・ Estimate of soil produced and used
				・Consideration on disposal methods of logged woods at the construction planned site
				・ Estimate of sludge from STP
				・ Reviewing composting sludge from STP
				・ Confirmation on reception facilities of wastes (materials from settling and screening, dehydrated sludge)
	5	Noise and vibrations	・Noise survey	・ Suggestion on noise measurement before construction, prediction and countermeasure
			・Noise and vibration countermeasure	・ Study on location relationship between the construction planned sites and nearby residences
				・ Suggestion on low-noise and vibration type machineries for pipelines constructions
				・ Suggestion on countermeasure such as reduce noise and vibration of transport of construction materials and so on
	8	Geographical features	・ Geological study	・ Boring study
			・Consideration on topological conversion	・ Minimization of ground leveling for sites of STP
	12	Accidents	・Safety measure	・ Suggestion on safety measures during construction
				・ Suggestion on safety measures during operation in STP
	13	Global warming	・Energy-saving strategy	・Reviewing energy-saving machineries such as pump, blower and dehydrator in associated facilities

Eval-uation	No.	Item	Study / Coun-termeasure	Method
	14	Involuntary resettlement	・ARP preparation	・ Preparation of a draft Abbreviated Resettlement Plan (ARP)
				・ Consideration on smooth procedure of land acquisition for STP
	16	Land use	・Countermeasure for dust and high-turbidity water	・ Sites for STP will occupy limited areas with only 4-6 ha, however, dust prevention by watering, high-turbidity reduction by coagulation treatment and so on should be suggested because the lands will be bare grounds.
C	15	Local economies	・Socioeconomic survey	・ Hearings on the local economies with PCs / Initial baseline survey of RAP preparation
	18	Existing social infrastructures and services	・Socioeconomic survey	・ Consultation with PCs
	19	Poor, indigenous or ethnic people	・Socioeconomic survey	・ Hearings on the existence of poor people with PCs / Initial baseline survey of RAP preparation
	20	Misdistribution of benefits and damages	・Socioeconomic survey	・ Consultation with labor-related authorities
	25	Infectious diseases such as HIV/AIDS	・ Sanitation	・ Consultation with associated authorities (Department of Health)

7.5.2 Prediction and evaluation of the impacts by the project

Prediction and evaluation of the impacts which may be caused by the project should be conducted concerning on items evaluated as A, B or C in **6. Scoping**.

First of all, each item should be re-evaluated as the survey proceeds and update the scoping result. Subsequently, items with A and B after the update shall be evaluated in terms of the scale.

7.5.3 Consideration on the Environment Management Plan (EMP) and the monitoring plan

In case that unavoidable environment impacts by the project are expected to take place, EMP to mitigate the extent of impacts and the monitoring plan to grasp the condition should be prepared in accordance with results of the survey and consultation with the authorities concerned. For both EMP and the monitoring plan, consideration on executing item, frequency, organization, necessary reinforcement of the organization and budget should be included.

7.5.4 Stakeholder consultation

The results of Environmental and Social Consideration mentioned above shall be presented in stakeholder consultation and the stakeholders' opinions shall be collected.

8. Environment Management Plan

8.1 Overall

The environmental management plan (EMP) for the Sub-project has been developed from the results of the environmental impact assessment. The EMP identifies the impact mitigations and environmental monitoring requirements that must be implemented to prevent or minimize any adverse impacts of the Sub-project on the natural environment. The management of social impacts associated

with resettlement and compensation are addressed separately by the Abbreviated RAP prepared for the Sub-project.

The EMP also specifies the responsibilities for the implementation of the EMP, and any capacity development or training required by the responsible parties to ensure successful implementation of the EMP. The purpose of the EMP is to ensure that unnecessary adverse environmental or social impacts of the Sub-project do not occur, and that the natural and social environments are protected. The EMP consists of the following three main components:

1) Mitigation plan;
2) Monitoring plan; and
3) Institutional responsibilities and capacity needs.

Other aspects of the EMP include EMP budget, and reporting requirements. The EMP provided herein focuses on the management of environmental impacts of the subproject.

8.2 Prediction and Evaluation

As a result of EIA study by measures shown in **Table 7-1**, Evaluation of Scoping shown in **Table 6-1** was updated. The results of the prediction and evaluation and the mitigation measures are revealed (**Table 8-1**). Many of them are described in EMP.

Table 8-1 Result of Prediction and Evaluation

Items	Scoping	Evaluation result	Reason / Mitigation measure
4 Waste	B	D'	Excavated soil can be sold. If not, can be dumped in designated dumping sites. Sludge from STP will be concentrated and dumped in designated dumping sites.
	EMP		Monitoring of adequate dumping
5 Noise and vibrations	B	B	Due to Noise and vibration according to earthwork and transfer
	EMP		Noise and vibration measure before construction, prediction and consideration of mitigation / Adoption of low-vibration and low-noise machineries / Slowing down construction vehicles
8 Geographical features	B	D	Significant change of topological feature is not necessary because the site is selected in a flat area.
10 Biota and ecosystems	C	B	The site is mainly agricultural land and no trees for protection are expected. No rare species are also expected but site studies should be conducted.
	Field study		・Flora study (Invention study of existing vegetation with location) ・Fauna study (Refer to following / consider in and around the site) ○Mammal (Field sign study / Trap method) ○Bird (Line-census study) ○Reptile/Amphibian (Random check / collection) ○Insect (Random check & collection / Trap method)
12 Accidents	B	B	Due to accident risks during construction and operation

	EMP		Safety management
13 Global warming	B	D	Consideration on saving energy for power-consuming facilities is conducted.
14 Involuntary Resettlement	B	B	Due to resettlement of a few residents
	ARP		Resettlement and compensation
15 Local economies	C	D	No possible adverse impacts are expected. (result of consultation with PCs)
16 Land use	B	B	Due to bare land under construction
	EMP		Prevention and minimization of dust by watering, etc.
18 Existing social infrastructures and services	C	D	No possible adverse impacts are expected. (result of consultation with PCs)
19 Poor, indigenous, or ethnic people	C	D	No possible adverse impacts are expected. (result of consultation with PCs)
20 Misdistribution of benefits and damages	C	D	No possible adverse impacts are expected. (result of consultation with PCs)
25 Infectious diseases such as HIV/AIDS	C	B	External workers are expected for a long period.
	EMP		Utilization of sanitary program / Consultation with local health authority

【Evaluation】 A：Large adverse impact is expected, B：Some adverse impact is expected,
C：An adverse impact is indistinct, D：No adverse impact is expected

8.3 Mitigation Plan

The mitigation plan for The Sub-project is provided in the following Table. Mitigation measures are defined for the key impacts identified in the impact assessment including the comments received during the stakeholder meetings.

The table links mitigation measures to project activities and impacts for the three phases defined by pre-construction and construction phase.

Table 8-2 Mitigation Plan for Sewerage System Sub-project

No.	Activities	Negative impacts	Mitigation measures	Cost estimate	Implementation Unit	Supervision Unit
I	**Preparation phase**					
1	Land acquisition	Loss of vegetation, building and land	Replace or compensate lost assets according to current regulations of GOV and PQDPC	Resettlement and compensation cost	Center of Land Fund Development	PQDPC
2	Environmental background	Air-pollution / Dust	Recognize potential data to examine the impact by the project.	Monitoring cost	Contractor / PMU / Environmental Consultant	Environmental Consultant
3		Noise / Vibration				
II	**Construction phase**					
1	Construction and transfer of necessity and waste	Exhausted air pollutants	Maintain equipment and vehicles in good working order / Monitoring impact possibilities	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant
2		Noise / Vibration	Drive construction vehicles slowly for transfer of the soil. Maximize use of low-vibration & low-noise machineries. Prevent or minimize operation of heavy equipment at night / Monitoring impact possibilities			
3		Dust	Use watering agents to prevent or reduce dust. Drive construction vehicles slowly with load covers / Monitoring impact possibilities			
4		Land usage	Watering / collection and treatment of high-turbidity water, coagulation and sedimentation			
5		Worker & public injury	Follow workplace health and safety regulations of MoLISA /	Construction cost /	Contractor / PMU / Environmental	PQDPC (Division of health) / PMU /

No.	Activities	Negative impacts	Mitigation measures	Cost estimate	Implementation Unit	Supervision Unit
			DoLISA. Utilize sanitary programs. Consultation with local health authority Use sufficient signage and fencing at construction sites	Monitoring cost	Consultant	Consultant
6	Construction worker presence, and camp operation	Solid waste and domestic waste pollution	Institute regular solids waste collection and disposal program including placement of disposal bins throughout camp and at all construction sites. Ensure adequate number of latrines at camp cleaned regularly. Temporary latrines maintained at construction sites.	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant
7		Worker and public health problems	Ensure proper hygiene in worker camps. Workers should be tested for communicable disease. Locate worker camp away from residential areas	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	PQDPC (Division of health) / PMU / Consultant
8		Worker & public safety	Follow workplace health and safety regulations of MoLISA / DoLISA. Sufficient signage and fencing at construction sites			
9	General construction activities	Production of solid wastes,and waste construction fluids (e.g., oils) causing soil and surface water pollution	Implement solid waste collection and disposal program. Contain waste liquids for regular disposal with solid wastes in designated landfill.	Construction cost / Monitoring cost	Contractor / PMU / Environmental Consultant	DONRE / PQDPC / PMU / Consultant

8.4 Environment Monitoring Plan

The monitoring plan outlines the information from the affected environment in and around the Sub-project target area that must be collected to determine how well the impact mitigations of the EMP are working, and to identify any unexpected environmental impacts of the project.

Monitoring activities focus on the pre-construction, construction and operational phases of the project and includes social impacts associated with construction-related disturbances and issues such as noise, dust, traffic, and public health. Monitoring for the effectiveness of the RAP for resettlement and compensation is evaluated separately as part of the RAP.

The monitoring plan is structured into a table that links monitoring requirements to impacts and mitigation measures for the construction and operational phases of the subproject. Monitoring requirements listed in the table combine measurements for the effectiveness of impact mitigation measures with general environmental information needed to determine whether unexpected impacts of the Sub-project occur. For efficiency and ease of implementation common monitoring requirements are grouped for similar impact/mitigation measures, and distinguished by factors such as location, frequency and reporting requirements as necessary.

Project Management Unit will be responsible for monitoring contractor compliance in implementing the EMP throughout the construction process of the project items

8.5 Estimated Cost for EMP

8.5.1 Estimated cost of Environment Monitoring

The costs of the EMP stem primarily from the costs of environmental monitoring. The costs of mitigation measures are included with the overall construction costs. The costs of monitoring are estimated using the cost norms outlined in the Circular 83/2002/TT-BTC. However, the costs of monitoring must also include the cost for the environmental consultants to assist the PMU to implement the EMP and the independent environmental consultant to audit the implementation of the EMP during the construction phase and during at least the first year of operational phase. The estimated costs of monitoring are summarized in the following Table.

Table 8-3 Estimated Costs of Environmental Monitoring (Example)

Item	Unit price per sample or time (VND)*)	Number of samples or times*)	Amount (VND)
Pre-Construction stage			
M-1: Air quality		(inside 1 + outside 3)*2	
M-2: Noise		(outside 3 + pipeline 5)*2	
Construction stage			
M-3: Air quality		(inside 1 + outside 3)*2year *4	
M-4: Noise		outside 3*2year *4 + pipeline 5 *4year *4	
M-5: Solid wastes		5st. *4year *4	
M-6: Soil		5st. *4year *4	
M-7: Worker & public safety		10st. *4year *4	
M-8: Worker & public health		10st. *4year *4	
Total cost (VND)			

*) Unit price and number of samples should be updated in accordance with the progress of the project

8.5.2 Estimated cost of Environment Audit

The environment consultant will be assigned to support the implementation of PMU to conduct the environment audit with estimated total period of 50 months.

Scope of work includes 16 site inspections at the Sub-project area with one previous inspection trip before construction, 14 trips during the construction phase and one final inspection.

For the assignment mentioned above, the environmental consultant shall dispatch experts specializing in audit and environmental monitoring, with the requirements shown in the following table.

(Numbers indicated here should be updated in accordance with the progress of the project)

Table 8-4 Required Environment Audit Consultants (Example)

Expert	General requirement	Specific requirements	Regional experience/Language
Team Leader	University degree; At least 5-year experience on environmental management.	At least 8-year experience in the environmental field. Experience in audit or environmental monitoring projects financed by international experience is required.	Experience in Vietnam, understanding the project area is preferred, with knowledge of the culture, administrative system and local government organizations. Speaks and writes English well.
Environment Auditor/ Supervison	University degree; At least 05 years experience on environment management.	At least 5 year experience in the environmental field. Experience inaudit or environmental monitoring projects financed by international experience is required.	Experience in Vietnam, understanding the project area is preferred, with knowledge of the culture, administrative system and local government organizations. Speak and write English well.

Environmental consultancy costs are calculated in **Table 8-5**.

Table 8-5 The Environment Audit (Example)

No.	Expert	Qty	Trip	Unit cost (USD)	Cost (USD)
I	**Staff cost**				
1	Team leader	1	16		
2	Environment Auditor / Supervision	2	16		

II	**Other cost (equivalent to 20% of Staff cost)**				
III	**Total**				

Estimated costs vary depending on the scope of work required by the EMP. Estimated costs for environmental audit will be approximately XXX USD.

Table 8-6 Monitoring Plan for Kien Giang Subproject (Example)

Summary of Impact / Mitigation	Monitoring Indicators	Location	Frequency	Environmental Standard	Responsibility Supervision / Implementation	Reporting
Pre-Construction Phase						
Resettlement & physical asset loss / Resettlement Plan	See Abbreviated Resettlement Plan (ARP)	See ARP	See ARP	See ARP	See ARP	See ARP
M-1: Air-pollution / Dust	SO2 / CO / NOx / O3 / TSP (Dust) / PM10 / Pb	Areas in and around the site (4st.)	2 times with an interval for more than 2 months	TCVN 5937: 2005	PMU / Environmental Consultant	Monitoring reports prepared quarterly for PQDPC(Division of natural resources and environment)
M-2: Noise / Vibration	Decibel (dBa) levels	Areas around the site & along pipelines (8st.)	As above	TCVN 6962: 2001	As above	As above
Construction Phase						
M-3: Air-pollution / Dust	SO2 / CO / NOx / O3 / TSP (Dust) / PM10 / Pb	Areas in and around the site(4st.)	Quarterly	TCVN 5937: 2005	PMU / Environmental Consultant	As above
M-4: Noise / Vibration	Decibel (dBa) levels	Areas around the site & along pipelines (8st.)	As above	TCVN 5949: 1998	As above	As above
M-5: Solid waste pollution / Regular waste collection & disposal, placement of disposal bins throughout construction sites.	Amount of solid waste uncontained & littering construction areas and worker camp	All construction areas (5st.)	As above	N/A	As above	As above
M-6: Soil quality pollution / Implement solid waste	As, Cd, Cu, Pb, Zn	Excavated and reused soil	As above	QCVN 03:2008/BTN	As above	As above

collection and disposal program. Contain waste liquids for regular disposal with solid wastes in designated landfill.		(5smpl)		MT		
M-7: Worker & public safety / Follow workplace health and safety regulations of MoLISA / DoLISA. Sufficient signage and fencing at construction sites	Number of worker and public injuries	All construction site locations (10smpl)	As above	Decree 06/1995, Decree 10/2002/ ND-CP	As above	Monitoring reports prepared quarterly for MoLISA / DoLISA
M-8: Worker and public health problems / Ensure proper hygiene in worker camps. Workers should be tested for communicable disease. Locate worker camp away from residential areas	Incidence of sexually transmitted & other communicable diseases	Worker camp and nearby community (10smpl)	As above	N/A	As above	Monitoring reports prepared quarterly for PQDPC(Division of health)

8.6 Management Responsibilities and Training Needs

8.6.1 Management Responsibilities

Environmental Consultant; is to supervise activities for Mitigation Plan such as Environmental background, Construction and transfer of necessity and waste, Construction worker presence and camp operation, and General construction activities. It also is in charge of the most activities for Monitoring Plan.

DONRE and the subsidiary organizations; are to supervise activities for Mitigation Plan such as Construction and transfer of necessity and waste, Construction worker presence and camp operation, and General construction activities. They are also most likely in charge of receiving reports for the activities for Monitoring Plan.

PQDPC and CPCs concerned; are to supervise activities for Mitigation Plan such as Land acquisition, Construction and transfer of necessity and waste, Construction worker presence and camp operation and General construction activities. They are also most likely in charge of receiving reports for the activities for Monitoring Plan.

8.6.2 Training Needs

Center of Land Fund Development; is to implement Land acquisition. It is organized for dedicated purposes including land acquisition and no trainings should be necessary.

PMU; will be organized with specialists of the area from GOV, KGPPC, Professional Engineers and Consultants. It can be both of an Implementation Unit and Supervision Unit. It is a team composed of experts, so they should be available for the assignments. However, it is a temporary unit and can be supervised or trained by other management authorities when necessary.

Contractor (Constructor); is to implement activities for Mitigation Plan such as Environmental background, Construction and transfer of necessity and waste, Construction worker presence and camp operation, and General construction activities. For each activity, special lecture is necessary. PMU should be in charge of lectures or trainings generally but the authorities should supervise technical trainings for areas such as infectious disease prevention.

9. Stakeholder consultation and Information Disclosure

9.1 Stakeholder consultation

The survey is categorized as Category A for JICA's environmental and social consideration. Thus, a stakeholder consultation for scoping draft was conducted. In addition, the second consultation will be held at the stage of the draft final report of the survey. In accordance with the progress of the

Sub-project, subsequent consultation should be conducted if necessary. The outline is shown in **Table 9-1**.

Table 9-1 The outline of stakeholder consultations

	The first	The second (scheduled)
Purpose	Consultation on the scoping draft	Consultation on the survey result / EIA contents and methods
Date	16/12/2011	July, 2012
Venue	Phu Quoc District PC, Kien Giang province	Phu Quoc Island, Kien Giang province
Theme	- Project outline - Scoping draft	- Survey results - EIA contents / methods
Stakeholder	**Table 9-2**	**Table 9-2**, etc.

Table 9-2 The 1st Stakeholder consultation attendants

Affiliation	No.
District PC	3
Inhabitants	3
Central Government South-western Steering Board	1
Construction Department	1
KIWACO	3
KGPPC	4
DONRE	5
DARD	1
Phu Quoc National Park	1
Phu Quoc Military Service	1
Associated organization	2
NGO (PQ women's Association)	1
Mass media (television / radio station)	2
Construction consultant	3
Kobelco Eco-Solutions Vietnam	3
JICA Survey Team	10
Total	44

In the first stakeholder consultation, explanation of the outline of the project and the scoping draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussions were focused on impacts by the reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, it was explained that; i) the reservoir would be located outside the national park, ii) the reservoir would give no impacts on downstream area, iii) the location of the STP was decided after detailed consideration and consultation. See details in **Table 9-3**.

Table 9-3 Record of Stakeholder Consultations

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
1	The location of STP is very important.	South-West Department of the Central government	【Answer】(Survey Team) Location of STP is decided on the Decision No. 633. The study team decided the location in a tourist area which has Ong long resort in the south and golf courses in the north after careful considerations. Based on the Decision No.633 and the detail plan of Ong resort, the STP is located in the northern part of
2	Please consider the buffer zone for the residential areas which might have odor problems of sewage treatment.		

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
3	The location of STP seems to be close to Duong Dong district.		Ong resort because hotels and houses are planned in the southern part. The land size of STP is only 4 ha in the park which is located in the 247 ha resort area. Also, the STP is located far away from the residential area and there are golf courses in the north. Moreover, another reason of location is that treated water of STP is available to trees and golf courses.
4	Does the sewerage catchment area cover necessary areas?		【Answer】(was conducted at a later date) Since urban areas of year 2030 land use in the master plan are covered through phase I and II, it is appropriate at present stage. of the master plan
5	Is there any relation among Cua Can reservoir, other facilities, and the national park?	Phu Quoc National Park	【Answer】(Survey Team) Since the reservoir is adjacent to the national park, mitigation measures to reduce the negative impacts on national park have been studied. This is the land use map of adjusted master plan based on Decision No.633. Based on this map, the reservoir of this project is located outside the national park.
6	Are Cua Can reservoir and other reservoirs which will be constructed in the national park investigated at the same time?		【Answer】(Survey Team) Although three small reservoirs in the national park are described in the land use map of the master plan, these are not in the scope of our study.
7	It is necessary to consider the impacts on water cycle including groundwater and water stored in the forest since Cua Can river in the national park dries up in 6 months of dry season. Also, impacts on the water flow, and the ecosystem in the river and the river bank should be studied.		【Answer】(Survey Team) There is no negative impact on water flow because the rain water accumulated in the river is taken in rainy season and water is not taken in dry season. Therefore, water flow in dry season does not change. 【Additional explanations】(was conducted at a later date) The intake of water in rainy season is considered to have a positive impact on the flood prevention because the water flow is normalized by the intake of excess water in rainy season. Also, since reservoir is constructed far away from the river, the negative impact on ecosystem is not expected. 【Actions to be taken in the future】 Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation in the permeable layer is planned, additional measures will be studied in this survey.
8	We would like to ask the survey team to identify how much area is necessary for the reservoir in the forest area.	Kien Giang Agriculture and Rural Development Department	【Answer】(Survey Team) 180 ha land is necessary in our plan. To reduce area, the depth should be deeper to keep necessary water volume. 【Actions to be taken in the future】 The dimension of reservoir will be determined later in this survey.
9	An irrigation engineering consultant mentioned us that a small reservoir is necessary before a big reservoir.		【Actions to be taken in the future】 Problems at the construction stage will be examined later in this survey.

In addition, anonymous opinions from attendants were collected in order to hear as many people as possible. The contents and countermeasures were distributed to authorities concerned and attendants. See details in **Table 9-4**.

Table 9-4 Anonymous Comments submitted after Stakeholder Consultations

Component	Comments	Actions to respond to Comments in the survey
Reservoir	It is necessary to make proper scenarios for the evaluation of impacts to the national park during the construction and the operation of the reservoir.	All project sites are outside the national park.
Reservoir	The area of the national park to be used in the project should be determined. The impacts and countermeasures should be evaluated. In my opinion, the huge impacts on organic resources are expected.	
Reservoir	The impacts on the national park should be studied.	
Reservoir	Reservoir construction will have negative impacts on the forest. It is necessary to conduct a detail study and the evaluation of impact for construction. Also, the labor management for workers impacting the forest is required. Therefore, construction is a very important issue.	This issue will be studied in section 10-5 Forest (Flora) survey. Although there is the forest of the national park around the reservoir, the impact on the forest is not expected because the reservoir is far away from the national park.
Reservoir	It is necessary to study ecosystems and resources around the project sites as well as the project sites.	Impacts on the areas around the project sites will be considered in ecosystem survey.
Reservoir	Since a large volume of water runs from the upstream during rainy season, a dam to keep water should be considered for mitigating the damages of water on embankment of reservoir and residential areas around the reservoir.	The purpose of the reservoir is the storage of water during rainy season for use in dry season. Therefore, the reservoir mitigates the flood. Also, because only structures for intake and transmission of water are built, the dimension of river will be almost same as before the construction and impacts on surrounding area will be minimized. On discharge of water during the construction, supernatant water is discharged by using sedimentation ponds in which muddy water is separated into water and sludge. After being in service, the discharge from the reservoir is not conducted. The reservoir will be built away from the river. The plan maintains the river and does not reduce flow ability. Also, the 25 to 200m buffer zone between the river and the reservoir is secured to minimize impacts on surrounding areas.
Reservoir	Planned site of the reservoir performs the function as a sluice gate for Cua Can river, and a large volume of water with high velocity flows to the planned site (about 2m water level occurs three or four times a year). Therefore, the appropriate discharge during the construction and operation, and the impacts of flood (on residents around the planned site, embankments, and ecosystem) should be investigated in detail.	
Reservoir	Impacts on the way of water use should be evaluated if the reservoir is constructed by damming up the present Cua Can river.	The construction of the reservoir is not related to Cua Can river, and does not need to dam up.

Component	Comments	Actions to respond to Comments in the survey
Reservoir	A proper drainage to Cua Can river should be considered. Currently, the bottom of Cua Can river near the mouth consists of (settled) soils and mud. During January to April (the second half of rainy season), sediments are flushed out by rain water in the upstream. (Because there are above phenomenon,) negative impacts on Cua Can river might occur when the balance of water flow is changed by the discharge from the reservoir.	There is no discharge to Cua Can river, and current natural conditions of the river are not changed.
Reservoir	As for the construction of the reservoir, problems (such as drought of well water) might occur when the water balance between the used (of water taken from ground water) and the available volume (of water in ground) is changed. Discharge measures to control water volume of the reservoir should be modified if the impacts on people living around the reservoir are expected. Water level of the reservoir should be carefully considered.	There is no discharge to Cua Can river. Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	The accidents due to the deformation of ground by the increase of high water level should be considered.	Since the storage of water is conducted by pump, high water level is managed by pump. Therefore, high water level does not exceed the design high water level.
Reservoir	A geographical evaluation and an earthquake study should be conducted because of large water storage.	Geographical evaluation is conducted on the results of soil investigation. As for the relation between the water depth of the reservoir and earthquake, now there is no scientific evidence. Therefore, no impact is expected. As for measures of earthquake, structures are designed on the Vietnamese seismic standards for withstanding earthquakes.
Reservoir	The increase of groundwater level should be considered.	Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	Collapses of the reservoir and the surrounding areas, and the erosion of embankment should be considered.	Construction methods to prevent collapses and erosions are selected based on the results of soil investigation.
Reservoir	Accidents on slope failures and erosions under construction should be considered.	
Reservoir	To avoid any social adverse effect during the construction, proper labor management should be conducted.	Socio-economic survey and hygiene measures are studied sufficiently in section 10-5.
Water Distribution	Please consider to construct a distribution tank in Cua Can commune because water supply system has been built in Duoung Dong town. This tank is useful to distribute water to Cua Can, Ganh Dau communes and its environs.	Water supply to Cua Can and Ganh Dau must be conducted. A distribution tank is not directly related to whether water is distributed or not.
Sewerage	Please reconsider the location (of sewage treatment plant). The planned location is still close to residential areas and resorts of Duong Dong town and Cua Can.	As for nuisances on STP, odor might be a main problem. In this plan the location is decided by taking consideration of odor. The STP is planned to be built between golf courses and (50ha) forest of resort. This location also is good for the reuse of reclaimed water in terms of water conservation.
Sewerage	Please consider the location of STP because of many resorts and houses.	

Component	Comments	Actions to respond to Comments in the survey
Others	Since construction has impacts on environment, appropriate environmental considerations should be taken when the project components are constructed.	Evaluations on environmental impacts are carried out properly based on the scoping.
Others	The execution of projects has impacts on flora and fauna. Therefore, the investigation should be conducted to protect them at project sites.	Considerations of flora and fauna protection are carried out properly based on the scoping.
Others	Evaluation of the impact of workers on the National Park. One of mitigation measures is to obtain the permission before the worker starts the investigation in the national park and to present ID card when he enters the project sites.	All project sites are located outside the national park.
Others	Total project area is 190ha (including reservoir, WTP and STP). Does this project use the national park? If use the national park, how much area of the national park is necessary for the project? Impacts of the project on Phu Quoc and especially impacts on ecosystem of the national park should be considered.	All project sites are located outside the national park. Evaluation of impacts on ecology is carried out based on the scoping.

9.2 Information Disclosure

The project information should be widely publicized to people in and around the project area, so that the community can access these information and having better understanding of the possible impacts directly to daily lives caused by the project.

Final EMP documents (in Vietnamese) will be released to local communities in the process of project preparation. Simultaneously environment report will be sent to the Vietnam Information Center for Development (VDIC) for information and storage. The announcement of the environmental assessment report must be conducted before implementing the project construction. Environmental Impact Assessment Documents for the project will be conducted as follows:

· They will be exhibited publicly at the office of Phu Quoc District PC at Duong Dong and Cua Doung Commune PC: (1) Draft documents (presented XX/XX/ 20XX); (2) The official documents (presented XX/XX/ 20XX).

· They will be stored at PMU office (address: XXX) and presented to the public space so that the community can access.

· They will be published (uploaded) on the website: http:// www.XXX .

ABBREVIATED RESETTLEMENT PLAN

Cua Can Reservoir Sub-Project (provisional title)

For

Water Supply and Sewerage System Project

In

Phu Quoc Island, Vietnam

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Notification for Revision

"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewer system. As for the construction of the reservoir, "Cua Can Reservoir Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project") will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Abbreviated Resettlement Plan (ARP) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This ARP report is prepared to summarize the result of resettlement survey complied with JICA GL.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the resettlement survey is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

ABBREVIATIONS

ARP Abbreviated Resettlement Plan

DMS Detailed Measurement Survey

DP Displaced Person

DPC District People's Committee

DRC District Resettlement Committee

EA Executing Agency

EMA External Monitoring Agency

GOV Government of Vietnam

KGPPC Kien Giang Provincial People's Committee

KIWACO Kien Giang Water Supply and Drainage One Member Limited Company

LURC Land User Rights Certificate

MOF Ministry of Finance

ODA Official Development Assistance

PAH Project Affected Household

PAP Project Affected Person

PC People's Committee

PIB Public Information Booklet

PMU Project Management Unit

PPC Provincial People's Committee

PWSC Provincial Water Supply Company

RAP Resettlement Action Plan

VND Vietnam Dong

WB World Bank

WTP Water Treatment Plant

Definition of Terms

Cut-off-date	The date of commencement of census and asset inventory surveys during preparation of the RP. Affected people and local communities will be informed of the cut-off date for each subproject. Persons not covered in the census, because they were not residing, having assets, or deriving an income from the project area, are not eligible for compensation and other entitlements.
Eligibility	Any person who at the cut-of-date was located within the area affected by the project, its sub-components, or other sub-project parts thereof, and would: (a) have formal legal rights to land (including customary and traditional rights recognized under the Vietnamese laws); or (b) not have formal legal rights to land at the time the census begins but have a claim to such land or assets - provided that such claims are recognized under the laws of Vietnam or become recognized through processes identified in the resettlement plan; or (c) not have legal nor recognizable by law rights to the land they are occupying or land have properties/assets within the project areas before the cut-off date. Persons covered under (a) and (b) are provided compensation for the land they lose and other assistance at full replacement cost. Persons covered under (c) are provided resettlement assistance in lieu of compensation for the land they occupy, and other assistance, as necessary, to achieve the objectives set in this RPF, if they occupy the project area prior to the cut-off date. Persons who encroach on the area after the cut-off date are not entitled to compensation or other form of resettlement assistance. All persons in (a), (b) or (c) are provided compensation for loss of assets other than land.
Replacement Cost	Is the term used to determine the amount sufficient to replace lost assets and cover transaction costs. For losses that cannot easily be valued or compensated for in monetary terms (e.g. access to public services, customers, and supplies; or to fishing, grazing, or forest areas), attempts are made to establish access to equivalent and culturally acceptable resources and earning opportunities. When domestic laws do not meet the standard of compensation at full replacement cost, compensation under domestic law is supplemented by additional measures necessary to meet the replacement cost standards. In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account.
Resettlement	Is the general term related to land acquisition and compensation for loss of assets whether it involves actual relocation, loss of land, shelter, assets or other means of livelihood.
Displaced Persons (DPs)	Persons who are affected by the involuntary taking of land resulting in the relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood.

1. INTRODUCTION

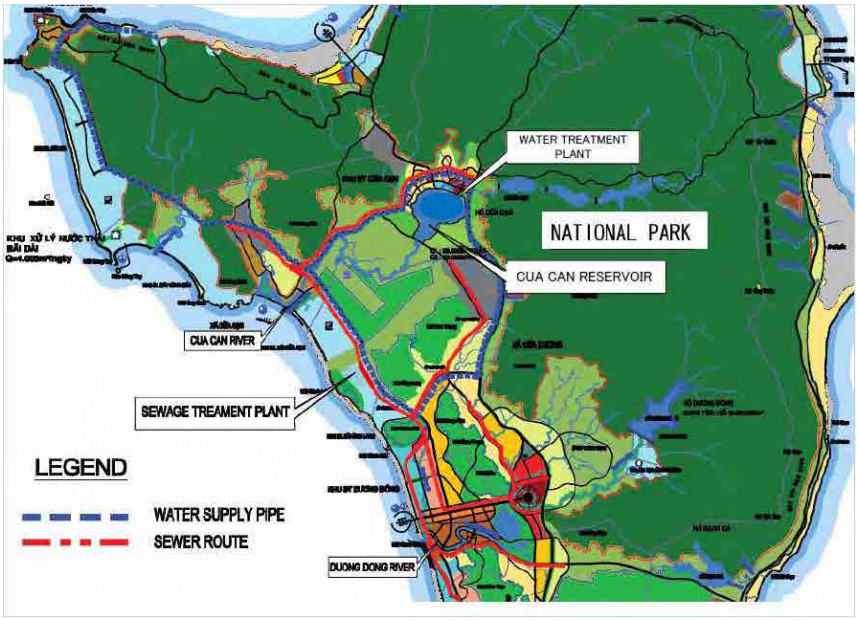
"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewer system. As for the construction of the reservoir, "Cua Can Reservoir Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project")will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Abbreviated Resettlement Plan (ARP) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This report as "Abbreviated Resettlement Plan" is prepared to summarize the result of RAP complied with JICA GL. Since JICA GL refers to World Bank Policy, its references are also described in this report.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the EA is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

2. OUTLINE OF THE PROJECT

2.1 Outline of project components

Main components of the project are; i) reservoir, ii) water supply system and iii) sewer system. The map shown below indicates the project site with the components.



Source: Master plan 2009

Figure 2-1 The project site

Figure 2-2 shows the outline of Cua Can reservoir design. The present design is that Cua Can River

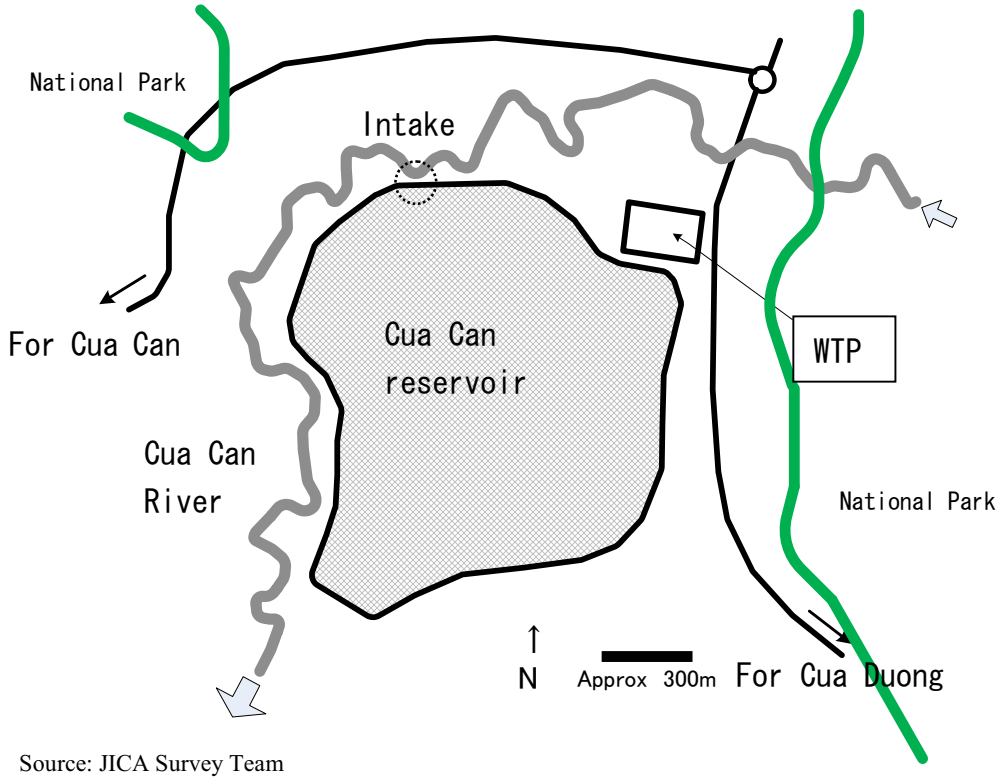
will be left as it is and Cua Can reservoir will be constructed on the side. This design avoids impacts to Cua Can River by the construction of Cua Can reservoir. Besides, the method of intake that will withdraw River water only when extra water exists will remain the current River environment in future as well.

In addition, Cua Can reservoir and the WTP planned site are outside of the national park and the closest distance between the project sites and the park will be approximately 300m.

Reservoir construction will produce extraordinary amount of soil because the planned site will be excavated. The authorities concerned said that soil in Phu Quoc or whole Vietnam is in high demand and salable. However, the amount is extremely large and coordination with other development projects is necessary. Thus, consultation with Kien Giang province or GOV will be necessary.

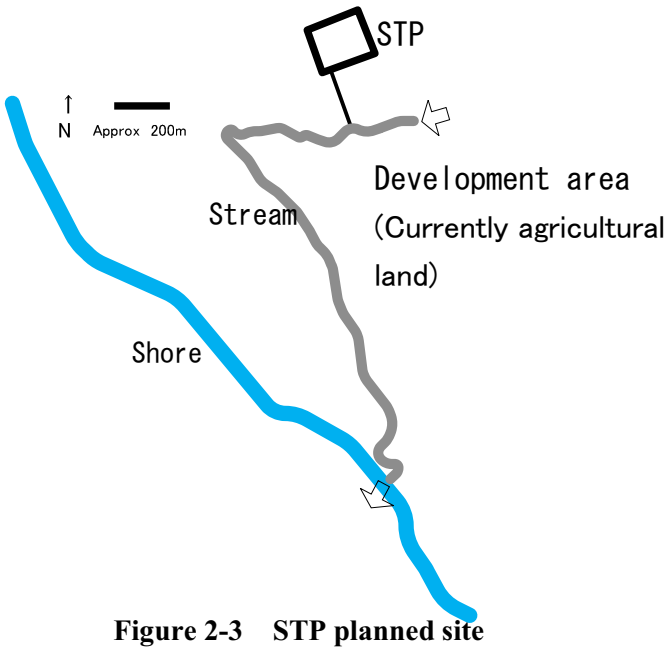
WTP is scheduled to be constructed adjacent to the reservoir, and the site will be approximately 5 to 6ha (**Figure2-2**).

STP is scheduled to be constructed where is approximately 2km upstream of a stream from the shore and the site will be approximately 4ha. (**Figure 2-3).**



Source: JICA Survey Team

Figure 2-2 Cua Can reservoir & WTP



Source: JICA Survey Team

Figure 2-3 STP planned site

2.2 Current social condition

(1) Population

Phu Quoc Island consists of 2 towns and 8 villages. The whole population of the island is approximately ninety thousand. **Table2-1** shows shifts of the population.

Table2-1 The shifts of the population

Town/Commune		Y2005	Y2006	Y2007	Y2008	Y2009
Town	Duong Dong	28,370	30,074	31,053	31,811	31,940
	An Thoi	17,854	18,927	19,531	20,292	19,880
Commune	Cua Can	3,058	3,241	3,345	3,429	3,394
	Cua Duong	7,213	7,655	7,899	8,096	7,789
	Ham Ninh	6,706	7,108	7,336	7,519	7,573
	Duong To	6,069	6,434	6,640	6,806	7,204
	Bai Thom	4,632	4,909	5,066	5,193	4,404
	Ganh Dau	3,904	4,138	4,271	4,378	4,294
	Hon Thom	2,697	2,859	2,950	3,024	2,438
	Tho Chau	1,480	1,563	1,612	1,652	1,755
Total		81,983	86,908	89,703	92,200	90,671

(Source: Phu Quoc Census Book 2009)

(2) Social economic condition

Major economic activities in Phu Quoc Island are fishery, black pepper and fish sauce (Nuoc Mam). **Table2-2** shows the population for occupations in the island.

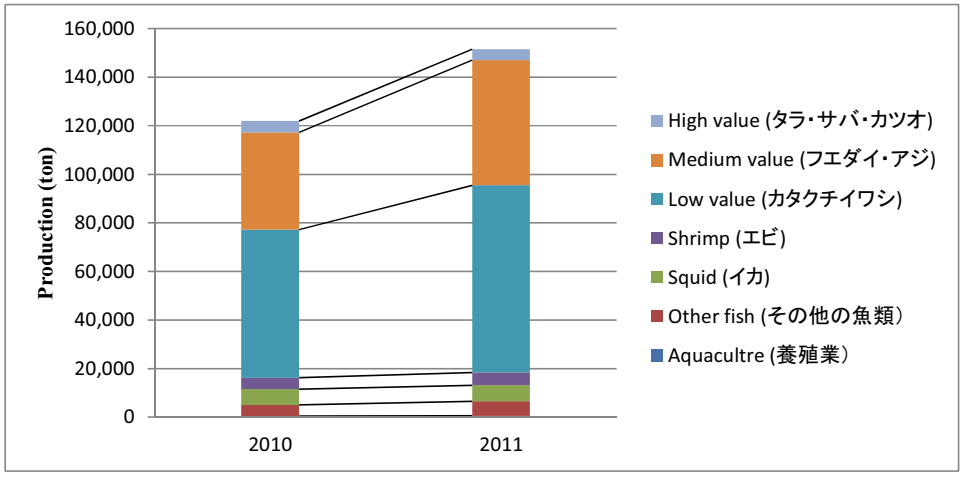
Table2-3 shows important infrastructure such as educational and medical institutions. They do not exist within 2km from the project site.

The breakdowns of production of the two major industries (fishery and agriculture) in Phu Quoc are shown in **Figure 2-4** and **2-5**.

Table2-2 Population for occupations

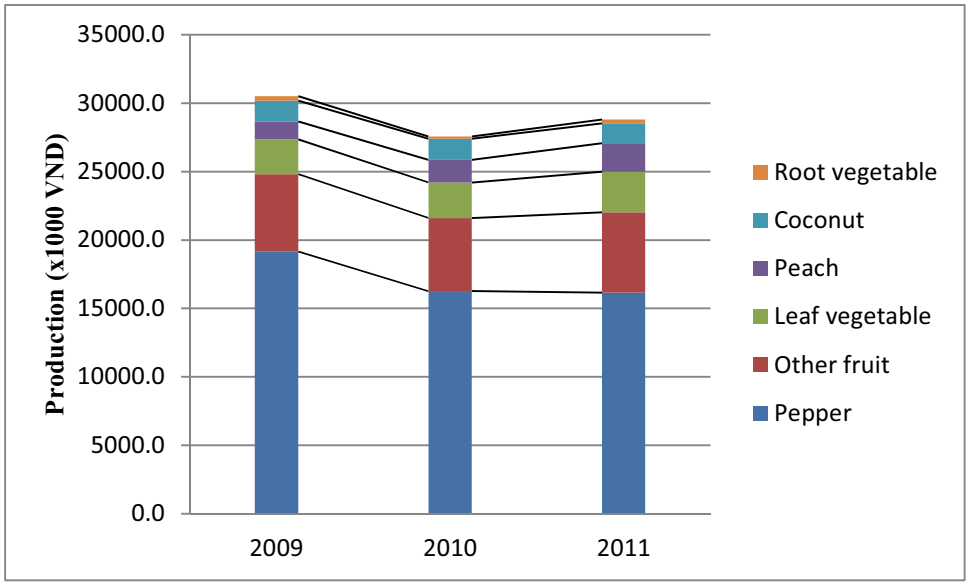
No.	Occupation	Population (2009)	Rate (%)
1	Aquatic product	13,546	14.94%
2	Agricultural production	7,446	8.21%
3	Commerce, Vehicle's Motor and Engine Repair	3,552	3.92%
4	Food Process Industry	3,146	3.47%
5	State Management , The National Defense Security, etc.	2,616	2.89%
6	Restaurants, Hotel	2,486	2.74%
7	Transportation, Warehouse, etc.	2,430	2.68%
8	Education and Training	970	1.07%
9	Construction	857	0.95%
10	Other	2,410	2.66%
-	Total	39,459	43.52%
Not working		51,212	56.48%

(Source: Phu Quoc Census Book 2009)



(Source: Phu Quoc Statistic Bureau)

Figure 2-4 Buffer Zone related to the Project sites



(Source: Phu Quoc Statistic Bureau)

Figure 2-5 Buffer Zone related to the Project sites

Table2-3 Important infrastructure

No	Important infrastructure	Number
	Educational	
1	Primary School	11
2	Primary+ Secondary School	7
3	Secondary School	6
	Medical	
1	Hospital	1
2	Regional General Surgery Room	1
3	Town, Commune Medical Care Station	43

(Source: Phu Quoc Census Book 2009)

(3) Tourism

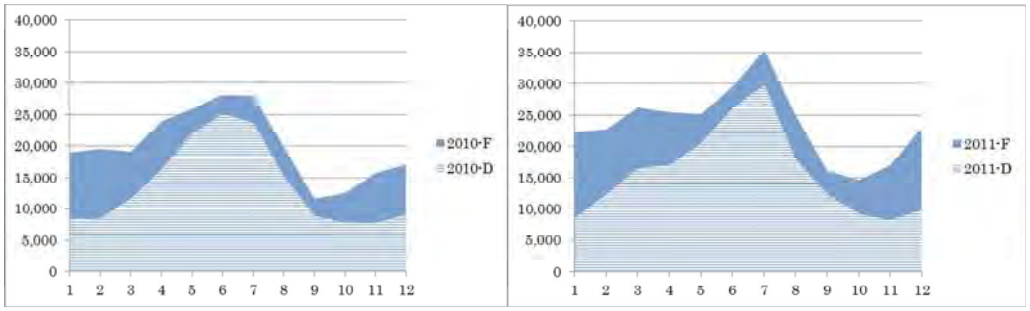
Tourists visiting Phu Quoc Island increase in recent years as shown in **Table 2-4**. The shifts of monthly population of tourists are also shown in **Figure 2-6**. Domestic tourists are as twice as foreigners. Foreign tourists increase in the dry season (Dec.-Apr.) while the whole tourist population increases from May to July which is a major holiday season in Vietnam.

According to the 2009 M/P, two million tourists in 2020 and 5 million in 2030 are estimated but the grounds for estimation are not described and it is assumed that the numbers are nonbinding targets.

Table 2-4 Yearly tourist population in Phu Quoc

Year	2005	2006	2007	2008	2009	2010	2011
Tourist	130,400	148,200	160,200	184,100	220,350	239,794	282,270

(Source: Phu Quoc Census Book 2009 and JICA Survey Team)



Legend : F(foreign)/D(domestic) (Source: Phu Quoc Statistic Bureau)

Figure 2-6 Monthly tourist population in Phu Quoc

(4) Land use

Approximately 70% area of Phu Quoc Island is forest area and 20% is agricultural land. The project site is scheduled in agricultural lands. Reservoir planned site will be in the land with miscellaneous trees where logging and pepper and livestock firming take place. In accordance with the design, it can include protective forest area. WTP planned site will be in the land with miscellaneous trees where no activity is seen and grassland where livestock firming takes place. STP planned site will be in the land with miscellaneous trees where no activity is seen.

Protective forest area is different from Protected area of Special-use forest mentioned in **(4)**. Protective forest area can be designated to other land category where productive activities are allowed. It is

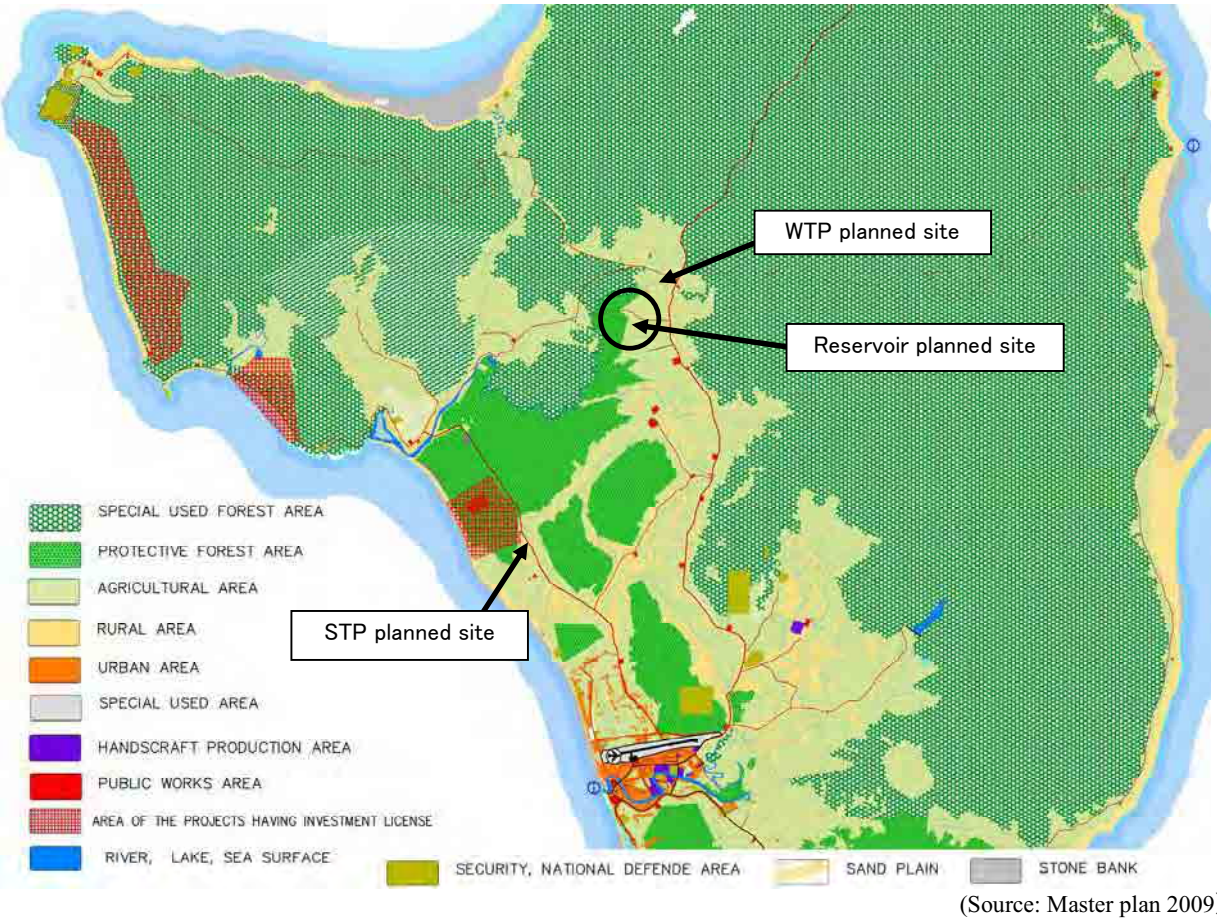
possible due to a certain procedure by the provincial People's Committee and no major problem is found for the project land use.

Land use condition as of 2007 is shown in **Table2-5** and **Figure2-7**.

Table2-5 Land use condition in Phu Quoc Island (2007)

No.	land use	Area(ha)	Rate
1	Urban area	872	1.5%
2	Touristic area	243	0.4%
3	Sporting facility, etc.	179	0.3%
4	Park / Green space	309	0.5%
5	Airport / Port site	969	1.6%
6	Agriculture	11,351	19.3%
7	Military related site	1,880	3.2%
8	Forest	41,757	70.9%
9	Other	1,355	2.3%
Total		58,915	100.0%

(Source: Phu Quoc Census Book 2009)



(Source: Master plan 2009)

Figure2-7 Land use map of Phu Quoc Island

(5) Water use

In Cua Can River which is located downstream area of the reservoir, no irrigation nor fishery were seen when site visits were conducted by JICA Survey Team in October, 2011. DONRE, in charge of the river, says that no water use is applied in the area. Cua Can Commune People's Committee,

located in the area, says that no fishery activities are conducted. Also in the stream near STP planned site, no water use is conducted.

2.3 Socio-economic condition of PAH

(1) Population by Age

(Description)

Table2-6 Population by Age for PAH

Age	Y20xx	%
80-		
70-80		
60-70		
50-60		
40-50		
30-40		
20-30		
10-20		
0-10		

(2) Population by Occupation

(Description)

Table2-7 Population by occupations for PAH

No.	Occupation	Population	Rate (%)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
-	Total		
Not working			

(3) Household Income

(Description)

Table2-8 Household Income for PAH

Income (VND per month)	% Interviewed Households
5 million or more	
4-4.5 million	
3.5-4 million	
3-3.5 million	
2.5-3 million	
2-2.5 million	
1.5-2 million	
1-1.5 million	
1 million or less	

3. SCOPE OF LAND ACQUISITION AND RESETTLEMENT

Land acquisition will be necessary only for the reservoir, intake facility and raw water transmission pipes. The sub-project will require the permanent acquisition of XXX m2 of land. Temporary land acquisition, if any, will be given during project construction. The sub-project will also affect around XXX trees (breakdown: XXX A trees, XXX B tree and XXX C trees).

There is demolition of XXX houses. PAH will be affected due to the sub-project. Table 3.1 and Table 3.2 present the project impacts regarding land acquisition and resettlement.

Table 3-1: Project Impacts

Location	Affected area (m2)	Type of land	Tenure	Trees

Table 3-2: List of PAH

Name of PAH	Components	Occupation of PAH	Affected area (m2)	Total land holding	% affected

4. LEGAL FRAMEWORK AND ENTITLEMENT POLICY

This Resettlement Plan is consistent with the various laws, decrees and circulars regulating land acquisition, compensation and resettlement in Vietnam, and World Bank policy on Involuntary Resettlement.

4.1 Vietnamese Laws, Decrees, and Circulars

• The Constitution of the Socialist Republic of Vietnam, 15 April 1992; the right of citizens to own and protect the ownership of a house

• Land Law, 26 November 2003, effective 1 July 2004. Article 39 Requires disclosure of information to affected people prior to recovery of agricultural and non-agricultural land a minimum of 90 and 180 days respectively

• Decree No. 181/2004/ND-CP, 29 October 2004, relating to implementing the Land Law

• Law of Construction effective 01 Jan 2004 by Presidential Order of 26/2003/L-CTN dated 10 December 2003; Compensation and relocation of people affected by ground clearance for investment projects

• Decree 16/2005/ND-CP; implementation of the Construction Law.

• Decree No. 188/2004/ND-CP, 16 November 2004, and Decree No. 123/2007/ND-CP specifying methods for land pricing and issuance of land price framework for land categories;

• Circular No. 145/2007/TT-BTC by MOF; providing guidelines for implementation of the Decree 188/2004/CP.

• Decree No. 123/2007/ND-CP; amending and supplementing Decree No. 188/2004/ND-CP that gives Provincial People's Committees the authority to set local land prices by establishing ranges for all categories of land.

• Decree No 182/2004/ND-CP, 29 October 2004; penalty for administrative violation in land issues.

• Decree No. 198/2004/ND-CP, 03 December 2004; on collection of land tax. Issued guidelines in Circulation No. 117/2004/KT-BTC by MOF.

• Decree No. 95/2005/ND-CP, 15 July 2005, regulation on property ownership and the right to use urban residential land;

• Decree No. 08/2005/ND-CP, 24 January 2005 regulation on Urban Planning Management

• Decree No. 197/2004/ND-CP, 03 December 2004, on compensation, assistance and resettlement when land is recovered by the State (replacing Decree No. 22/CP).

• Circular No.116/2004/TT-BTC by MOF guiding the implementation of Decree 197.

• Decree No. 17/2006/ND-CP, 27 January 2006 (amending Decree No. 181/2004/ND-CP and Decree No. 197/2004/ND-CP and other decrees); compensation, assistance and resettlement when land is recovered by the State.

• Decree No. 69/2009/ND-CP, an amendment to Decree No. 197/2004/ND-CP; supplementary regulations on land use planning, land prices, land acquisition, compensation, support and resettlement.

• Decree No. 84/2007/ND-CP; supplementary stipulations on the issue of land use rights certificates (LURC), land acquisition, land use right implementation, procedure of compensation, and assistance in the event of land recovery by the state; grievance redress.
• Degree No. 64/1993/ND-CP, 27 September 1993, regulation on allocating agricultural land to households for long-term use;
• Ordinance No 34/2007/PL-UBTVQH11 on Exercise of Democracy in Communes, Wards and Townships.
• Decree No. 172/1999/ND-CP, Article 25, and its 2009 amendment decree. Sites that are currently recognized for cultural and historical preservation and that are situated within the boundaries of waterway safety corridors, should be kept intact according to current legal regulations.
• Decree No. 131/2006/ND-CP 9 November 2006, regulation on Management and Utilization of ODA (of which international commitments of Government are prevailing and enforceable)
• Decision No. 48/2008/QD-TTg issued on 3 April 2008 by the Prime Minister, and Common General Guidelines on Feasibility Study Preparation For Official Development Assistance (ODA) Projects Funded by the Five Banks.

Under the 2003 Land Law, ownership of land in Viet Nam resides with the State. The State exercises the right to decide the purpose of land use specified in land use planning and land use plans; to regulate the duration of land use; to decide on land allocation; to rent land; to acquire land, and to evaluate land prices. The State can assign and lease land to land users, including individuals, households and organizations. In the case of assigned land, the State delegates to the Provincial People's Committees the authority to grant LURC to land users. With respect to land acquisition, resettlement and compensation, the Land Law makes the following provisions:

a. The State reserves the right to "recover" land for purposes of defense, national security, national interests, public interests, and economic development. Individuals, households and organizations that have or are eligible to be granted land use right certificates for recovered land will receive compensation for the loss of these assets (Article 42[1]).
b. Individuals, households and organizations that have or are eligible to be granted land use right certificates for recovered land will receive compensation for the loss of these assets (Article 42[1]).
c. Before land is recovered, the user must be informed of the reasons for recovery; the schedule and plans for resettlement, if necessary; and, options for compensation. This must occur at least 3 months prior to the recovery of agricultural land and 6 months prior to the recovery of nonagricultural land (Article 39).
d. Compensation for recovered agricultural and rural residential land will be in the form of new land of the same purpose of use or, if no new land is available, cash equivalent to the land use right value of the recovered land (Article 42[2] and [3]). In the latter case, the land use right value is established as the value of similar land under normal market conditions, as determined on an annual basis by PPCs (Article 56).

e. Recovery of land from people directly involved in agricultural production but having no land available for continued production will receive cash compensation and, in addition, support from the State to rehabilitate their living conditions, either through training to enable them to shift into new occupations, or through new employment being arranged (Article 42[4]).
f. Where the use right value of recovered residential land is greater than that of the land given as compensation, affected people will receive cash equal to the difference in the values (Article 42[3]).
g. Resettlement zones will be developed for people having residential land recovered and having to move their places of residence. Resettlement zones will be developed for many projects in the same area and will provide living conditions that are equal to or better than the conditions in the former places of residence. In areas where there is no established resettlement zone, people will receive cash for recovered residential land and priority to purchase or lease State-owned dwellings (Article 42[3]).
h. Recovery of land will occur without compensation in the following cases, among others: (i) land is recovered from organizations that use State funds to pay land use levies for assigned land or land rents for leased land, or are assigned land without having to pay land use levies; (ii) recovered land has been illegally encroached or occupied, or the occupants are not eligible to be granted land use right certificates; (iii) recovered land is rented from the State; and, (iv) recovered land is road or canal, or used for cemeteries or graveyards (Article 43[1]).
i. Structures and other fixed assets on recovered land will not be compensated in cases where they have been constructed without permission; in contravention of permitted uses in land use plans; or, when structures are located on illegally encroached land (Article 43[2]).
j. In the event of temporary recovery of land, for example during construction, upon the expiry of temporary land acquisition the State will return the land and pay compensation for any damages (Article 45).

Land Law 2003 defines the principles for the State's evaluation of land prices:

a. These should reflect the market price of land use right transfer, in normal market conditions. In the event that in the price offered there is a significant difference between the identified land prices and the local market ones, the price should be adjusted accordingly
b. Plots bordering each other that have: i) similar natural, socio-economic, and infrastructure conditions, and ii) similar existing and/or planned type of land use, will have similar land prices;
c. Land located in areas on the borders between provinces, cities under direct Central Government's management, that have i) similar natural, socio-economic, and infrastructure conditions, and ii) similar existing and/or planned type of land use, will have similar land prices.

Land Law 2003 provides that land prices regulated by the PPC or PC of Cities under the direct Central Government, will be publicly announced on the First of January annually. Land Law 2003 makes a clear statement about the application of the Law. Clause 2 of Article 3 regulates: In the event that International treaties, which the Socialist Republic of Vietnam has signed or acceded, contain

provisions different from the provisions of this Law, the provisions of such international treaties shall be applied.

Decree No. 197/2004/ND-CP regulates the eligibility and procedures for compensation, assistance and resettlement in the event of State recovery of land. The principles underlying compensation are: (i) recovery of land from eligible persons shall be compensated; (ii) in the event the affected person is not eligible for compensation, consideration will be given to forms of assistance; (iii) compensation for affected land will be in the form new land allocation with the same purpose of use or, if no such land is available, cash compensation equal to the value of land use rights at the time of recovery; and, (iv) outstanding financial liabilities associated with land to be recovered will be deducted from the amount of compensation or assistance money. The Decree and Circular No. 116/2004 TT-BTC set out in detail the types of compensation for different types of users and losses; assistance policies; provisions for individual and group resettlement; and, the roles and responsibilities for implementation of resettlement projects.

Decree No. 17/2006/ND-CP amends Decree 197 to strengthen several aspects of the provisions for compensation, assistance and resettlement, including: (i) a requirement to update official PPC prices, as necessary, to reflect market values for affected assets; (ii) life stabilization assistance for poor households that must be provided for not less than three years and not more than ten years; and, (iii) assistance for occupational change and job creation for affected households losing significant portions of their productive assets, as well as for affected households that relocate to resettlement sites.

Decree No. 188/2004/ND-CP regulates the methodology for determining land prices and price frames for State recovery of land, as well as for taxation on land use and the transfer of land use rights and for land rents for government lands. It establishes the minimum and maximum prices for different types and categories of land. The principle underlying the determination of land prices is the actual transfer price on the market under normal conditions between a willing seller and buyer without regard to factors such as speculation, changes in planning, forceful transfer or blood relationship. Circular No. 114/2004/TT-BTC elaborates in detail the methods (direct comparison and income methods) for determining land prices.

Decree 123/2007/ND-CP amends Decree 188/2007/ND-CP giving the Provincial People's Committees the authority to set local land prices by establishing ranges for all categories of land.

Decree 69/2009-ND-CP regulates compensation Payments. Where compensation is made in the form of offering a new piece of land or resettlement land or resettlement house, and there is a difference in value, then the resettled person is entitled to the difference if compensation is greater than the value of the resettlement land or house; the resettled person pays the difference if the support money is less than the value of the resettlement land or house (except in special circumstances). State support

includes: (i) removal support, resettlement support when residential land is acquired; (ii) support for life and production restabilization, training support for change of jobs and job creation where agricultural land is acquired; (iii) support for acquisition of "agricultural use" land in residential areas eg. gardens, ponds; and (iv) other support. The Provincial People's Committee shall specify in detail the rate of support, the area of land of support and the average price of residential land for calculations which are appropriate to local reality.

Decree No. 131/2006/ND-CP provides that in case of "discrepancy between any provision in an international treaty on Official Development Assistance, to which the Socialist Republic of Viet Nam is a signatory, and the Vietnamese Law, the provision in the international treaty on ODA shall take precedence" (Article 2, Item 5).

Provincial Government decisions on resettlement and compensation and on land price will be incorporated into the Resettlement Plans.

4.2 Kien Giang Province Regulations on Resettlement

• Decision No. 31/2009/QĐ-UBND dated 21 December 2009 on compensation, assistance and resettlement in Kien Giang Province. This decision applied the Decree No. 69/2009/ND-CP of the Central Government.
• Decision No. 03/2010/QĐ-UBND dated 11 February 2010 on compensation, assistance and resettlement in Phu Quoc district.

4.3 World Bank Policy on Involuntary Resettlement

The World Bank recognizes that involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. The Bank's Resettlement Policy OP 4.12, includes safeguards to address and mitigate the economic, social, and environmental risks arising from involuntary resettlement.

The basic guiding principles of the World Bank's resettlement policy are that:

(i) Involuntary resettlement should be avoided where feasible, or minimized after exploring all viable alternatives in project design;
(ii) Where resettlement cannot be avoided, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the people displaced by the Project to share in benefits. Displaced Persons should be meaningful consulted and should have opportunities to participate in planning and implementing resettlement programs.
(iii) Displaced Persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The OP 4.10 on lndigenous Peoples, requiring all projects that are affecting indigenous peoples to engage these people in a process of free, prior, and informed consultation; conduct social assessment and to prepare an lndigenous Peoples Plan that will ensure these people to receive social and economic benefits that are culturally appropriate and gender and "inter-generationally" inclusive.

4.4 JICA Guideline on Involuntary Resettlement

The contents of JICA Guideline on involuntary resettlement are compared with the Government's Laws and Decrees. The differences between the Government's Laws and Decrees and JICA Guideline with regard to resettlement and compensation for this sub-project, and how to address these gaps are shown in Table 4.1.

Table 4-1: Comparison table between JICA Guideline and Laws of Vietnam

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	"Location options should be in line with construction planning and provide solutions to minimize the social and environmental impacts" and "assessment of conditions and reasoning for selected location". Decision 48/2008/QD-TT on development of F/S	Alternatives	Alternatives were considered in the EIA report.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	Land hand over: "Within twenty (20) days after being fully paid the compensation and support money, the person having land recovered shall hand over land to the compensation and ground clearance organization." Article 29; Circular 14/2009/TT-BTNMT	Equivalent	Not necessary

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
		Dated 01 October 2009		
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	The scale-criterion is not yet specified for involuntary resettlement.	Specific countermeasures for large-scale resettlement	Abbreviated resettlement plan will be adopted because DP are estimated approx. 50
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	RAP should include information of public consultation. Decision 48. Issuing general guidelines on feasibility study reports of projects using ODA funds of the 5 bank group	Equivalent	Not necessary
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	Not properly specified. RAP should include information of public consultation. Decision 48. Issuing general guidelines on feasibility study reports of projects using ODA funds of the 5 bank group	Language designation	Explanations were given in local language
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	Not specified	Participation promotion	Participation of affected people is promoted (Described in 7.1 in this report)
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	Properly specified at Article 138 of Land Law (2003); Article 63 & 64, Decree 84/2007/ND-CP and Decree 136/2006/ND-CP	Equivalent	(Described in 7.3 in this report)
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	An initial baseline survey is not specified. Decree 136/2006/ND-CP	Cut-off-date specification	Cut-off-date shall be defined (Described in 5.2 & 5.3 in this report)
12.	Eligibility of benefits includes, the PAPs who have - formal legal rights to land (including customary and traditional land rights recognized under law), - the PAPs who don't have	Compensation will be paid to current users of land recovered by the State who fully satisfy the conditions specified in Clauses 1, 2, 3, 4, 5, 7, 9, 10 and 11, Article 8 of Decree No. 197/2004/ND-CP and Articles 44, 45 and 46 of Decree No.	Similar	The site is basically private-owned land and External land-users should not

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
	formal legal rights to land at the time of census but have a claim to such land or assets and - the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	84/2007/ND-CP. For land users who are ineligible for compensation, provincial level PC shall consider these cases in order to provide support.		exist.
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	"Land used for a certain purpose which is recovered by the State shall be compensated with new land with the same use purpose,…" Decree 69; Article 14[2] Compensation and support principles	Preference specification	Livelihoods of displaced persons are basically land-based and no misdistributions are expected.
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Supports include: (i) support for relocation and resettlement in case of recovery of residential land; (ii) support for life and production and stabilization; (iii) support for job-change training and job creation in case of recovery of agricultural land; (iv) support upon recovery of agricultural land in residential areas or garden or pond land not recognised as residential land and other supports. Article 17; Decree 69.	Covered	Not necessary
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	Not specified.	Vulnerable groups specification	PPCs are in charge of attention in the process of important decisions
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	Not specified.	Preparation of ARP	By this report

4.5 The Sub-project's Land Acquisition and Resettlement Policy

With consideration of 4.4, The Sub-project's principle is shown as following.

I. The Government of Vietnam will use the Project Resettlement Policy (the Project Policy) for the Project specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations

cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the Vietnam legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.

II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.

III. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

・ Standard of living adversely affected;

・ Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;

・ Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or

・ Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets(IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. Where a host community is affected by the development of a resettlement site in that

community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

IX. The resettlement plans will be designed in accordance with Vietnam's National Involuntary Resettlement Policy and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of replacement cost.

XII. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing

activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, cut-off dates for titleholders will be the date of notification under the land acquisition and for non-titled holders will be the beginning date of the population census; XX / XX / XXXX. This date has been disclosed to each affected village by the relevant local governments and the villages have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

(Example of the Project's replacement cost calculation)

a. Productive Land based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes, fees and taxes or in the absence of such sales, based on productive value;

b. Residential land based on actual current market prices that reflect recent land sales, and in the absence of such recent land sales, based on prices of recent sales in comparable locations with comparable attributes; fees and taxes.

c. Existing local government regulations for compensation calculations for building, crops and trees will be used where ever available.

d. Houses and other related structures based on actual current market prices of affected materials;

e. Annual crops equivalent to current market value of crops at the time of compensation;

f. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.

g. For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree.

5. COMPENSATION POLICY

5.1 Objectives for Resettlement

The objectives of the Vietnamese legislation governing resettlement and rehabilitation of displaced persons, and that of the World Bank concerning involuntary resettlement, have been adapted for the preparation of this Abbreviated Resettlement Plan (ARP). The objectives are set out below. The policies and principles adopted for the sub-project supersede the provisions of relevant decrees currently in force in Vietnam, wherever a gap exists between the World Bank's OP 4.12 and Vietnamese law.

The main objective of the ARP is to ensure that all Displaced Persons (DP's) will be compensated for their losses at replacement cost.

5.2 Principles of Resettlement

The principle for resettlement policy in the sub-project will be as follows:

(i) Acquisition of land and other assets, and resettlement of people will be minimized as much as possible.

(ii) All DPs residing, working, doing business or cultivating land within the recovered area under the Project as of the cut-off-date are entitled to be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-Project living standards, income earning capacity and production levels. Lack of legal rights to the assets lost will not bar the DP from entitlement to such rehabilitation measures.

(iii) Compensation for loss of land and trees at replacement cost

(iv) Adequate budgetary support will be fully committed and be made available to cover the costs of land acquisition and resettlement and rehabilitation within the agreed implementation period. Physical resources for resettlement and rehabilitation will be made available as and when required.

(v) Civil works contractors will not be issued a notice of possession or a notice to proceed for any sub-project unless the Government has

a. Completed, satisfactorily and in accordance with the approved ARP for that sub-project, compensation payments, and

b. Entitlements will be provided to DPs no later than one month prior to expected start-up of civil works at the respective project site.

(vi) Institutional arrangements will ensure effective and timely design, planning, consultation and implementation of the ARP.

5.3 Cut-off Date and Eligibility

For the Project, the cut-off-date for eligibility for entitlement is defined as the completion of the measurement survey on affected land. The survey was completed on XX/XX/20XX based on the preliminary scheme design. Should the design be developed further to require more, or different land, the inventory of loss will be updated and the cut-off date revised in accordance. Those whose

livelihood activities may be affected by temporary land acquisition as the result of civil works will also receive compensation and assistance.

5.4 Project Entitlements

The Entitlement Matrix, presented in Table 5.1, covers the impacts currently identified during project preparation. It covers also the impacts which could arise during the construction period.

Table 5-1: Entitlement Matrix (Example)

Item	Type of loss	Application	Definition of entitled person	Compensation policy	Implementation issues
1	Permanent loss of land	Total landholding of XX ha is lost	Legal user with permanent or legalizable rights to use the affected land. - Mr. XX	DPs will be entitled to cash compensation for acquird land at 100% of replacement cost.	DPs will be given notice several months in advance regarding evacuation.
2					
3					

5.5 Site Preparation and Relocation

(Description)

Table 5-2: Site Candidates for Resettlement

No.	Region	Area	No. of HH to be accepted	Remark
1				
2				
3				
4				
5				

6. INSTITUTIONAL ARRANGEMENTS

The implementation of resettlement activities requires the involvement of agencies at the national, provincial, district and commune level. The provisions and policies of the ARP will form the legal basis for the implementation of resettlement activities during the Sub-project. The Provincial Project Management Unit (PPMU) can agree with the DPs on their compensation payment options for losses, following the provisions in the ARP.

The following is a general overview of key responsibilities with respect to land acquisition and resettlement at/for each level/unit involved in Project implementation.

6.1 The Kien Giang People's Committee (Example)

The Kien Giang Provincial People's Committee (KGPPC) is responsible as the Executing Agency (EA) for overall coordination and direction of the Sub-project, including the implementation of the

ARP. The KGPPC is responsible for approving the ARP for the Sub-project, and for making decisions related to sub-project resettlement issues. The latter includes decisions relating to compensation rates and rehabilitation assistance measures for DPs. The KGPPC is also responsible for providing the budget for resettlement compensation. KIWACO is responsible for implementation of the sub-project as the Implementing Agency (IA).

After detailed engineering designs have been completed, the number of DPs will be revised, and compensation unit rates and allowances will be updated for all categories of lost assets, based on replacement cost surveys carried out during project implementation. Following approval by JICA of the updated ARP, the KGPPC will be responsible for directing and supervising ARP implementation. This will include ensuring speedy resolution of any grievances voiced by DPs or town/district authorities. Based on local requirements for implementing resettlement, in each project implementation stages, the KGPPC will delegate responsibilities for resettlement implementation to agencies at the appropriate level, in accordance with Decree No. 197/2004/ND-CP and Decree 69/2009/ND-CP.

Due to the limited impacts, no resettlement committee at the provincial level will be established for this sub-project.

6.2 The Project Management Unit (PMU) (Example)

The KIWACO will set up a PMU within the PWSC for daily project implementation. The PMU will include technical, institutional, social and resettlement, administrative management, and representatives of accounting divisions. Key responsibilities of the PMU will include, but not be limited to, the following:

(i) updating the ARP at the time of project implementation, when the detailed design is available, and then submitting the updated ARP to PPC for approval.

(ii) coordinating civil works with land acquisition and resettlement activities;

(iii) instigating information campaigns, in accordance with established Project guidelines. This includes preparation and distribution of the public information booklet, and stakeholder consultation with the DPs. it includes having primary responsibility for letters, forms and other relevant documents, although the preparation of these may be delegated as required;

(iv) developing the mechanisms through which resettlement disbursements and compensation payments for DPs will be made, and preparing any associated documents that may be required;

(v) co-ordinating with other departments for the effective implementation of the ARP, as approved for the sub-project, and in compliance with the WB resettlement principles and objectives. This will include ensuring that rehabilitation measures and supporting activities are properly implemented;

(vi) ensuring a timely resettlement budget flow for the delivery of compensation payments and the rehabilitation of DPs, and providing the compensation payments to the DPs, and

(vii) implementing sub-project accounting and auditing with respect to resettlement implementation,

and preparing and submitting regular progress reports to the KIWACO and PPC on the civil works and status of ARP activities.

6.3 Phu Quoc District People's Committee

The Phu Quoc District People's Committees will be responsible for identification of land and trees and assigning functional tasks for the various agencies. The District People's Committee (DPC) will be responsible for the Detailed Measurement Survey (DMS) in collaboration with town/commune People's Committees. Due to the limited impacts, no resettlement committee at the district level will be established for this sub-project.

6.4 Commune People's Committee

Cua Duong People's Committees will be responsible for the following:
(i) assigning concerned ward/commune officials/professionals to carry out all resettlement activities in its ward/commune;
(ii) assisting other bodies/agencies, including the PMU, in the dissemination of sub-project information and facilitating public meetings and consultation with DPs;
(iii) assisting other agencies, including the PMU, in census surveys, a replacement cost survey, DMS and other resettlement related activities;
(iv) checking and confirming the legal status of affected land, houses, structures and other assets/losses of organizations; and
(v) ensuring the DP's grievances redress mechanisms are appropriate and properly put in place,. documenting DP grievances and maintaining records of all grievances, and assisting and advising DPs with respect to the speedy redress of grievances.

6.5 Agency Responsible for External Monitoring

If necessary, an external monitoring agency should be engaged. By the agency, socioeconomic surveys on DP will be conducted.

6.6 Institutional Capacity

If needed, specific training courses on resettlement will be required for an agency involved.

7. PUBLIC PARTICIPATION, CONSULTATION, AND GRIEVANCE MECHANISMS

7.1 Objectives of Public Information and Consultation

Information dissemination to DPs and involved agencies is an important part of sub-project preparation and implementation. Consultation with DPs and ensuring their active participation will reduce the potential for conflicts and minimize the risk of project delays. The objectives of the public information and consultation program are as follows:
(i) to ensure that both local authorities and representatives of DPs, are included in the planning

and decision-making processes. The PMU will work closely with the PPC, the DPC and the Commune PC during project implementation.
(ii) to fully share information about the proposed project components and activities with the DPs;
(iii) to obtain information about the needs and priorities of the DPs, as well as information about their reactions to proposed policies and activities;
(iv) to ensure that DPs are able to make fully informed decisions that will directly affect their incomes and living standards, and that they will have the opportunity to participate in activities and decision-making about issues that will directly affect them;
(v) to obtain the co-operation and participation of the DPs and communities in activities necessary for resettlement planning and implementation, and
(vi) to ensure transparency in all activities related to land acquisition, resettlement, and rehabilitation.
(vii) to ensure that basically all DPs should be informed in advance of public consultation and all or parts of DPs should be accepted to the consultation meetings.

7.2 Consultation during Project Preparation

A consultation with local authorities and affected persons was organized on XX/XX/XXXX. Annex 2 presents the minutes of the meeting. The following information was provided:
(Example)
- Characteristics of the project;
- Scope of land acquisition;
- Policy on resettlement (essentially concept of replacement costs);
- Schedule of work;
- Grievances mechanism;

(Description of the result) All the companies and individuals fully support the project and …

7.2.1 Information Dissemination and Consultation

During project implementation, the PMUs will undertake the following:
(i) Disseminate information to and consult with DPs throughout the life of the Project.
(ii) Update the provincial unit prices, and confirm the land acquisition requirements and impact on properties through a DMS, carried out in consultation with DPs.

The DPC will then apply prices, calculate compensation entitlements, and complete the Compensation Forms for each affected household. Information on entitlements will then be presented on an individual basis to DPs in a DMS follow-up visit to each household.

The Compensation Form, showing a household's affected assets and compensation entitlements, will then need to be signed by the DPs to indicate their agreement with the assessment. Any complaints the DPs have about the contents of the form will be recorded at the time.

7.2.2 Public Meetings

(Description of public meetings)

7.2.3 Rehabilitation

(Description of rehabilitation measures if needed)

7.2.4 Public Information Booklet (PIB)

(Description of PIB if needed)

7.2.5 Disclosure

In addition to disclosure to affected people and communities, the ARP will be available at the PMU office (address: XXX), XXX office and XXX office.

7.3 Grievance Redress Procedure

DPs will be able lodge their complaints regarding any aspect of compensation policy, rates, land acquisition, resettlement and entitlements relating to rehabilitation assistance programs. Complaints by DPs can be lodged verbally or in written form, but if they are lodged verbally, the committee to which it is lodged will write it down during the first meeting with the DP. DPs will be exempted from administrative and legal fees.

A four-stage procedure for redressing grievances is proposed as follows:

Stage 1- Complaints from DPs regarding any aspect of the resettlement program or losses not previously addressed shall first be lodged verbally or in written form at the PC at the commune level. The complaint can be discussed in an informal meeting with the plaintiff and the chairperson of the PC at commune level. The PC at the commune level will be responsible for resolving the issue within XX (e.g. 15) days from the day it is lodged.

Stage 2 - If no understanding or amicable solution can be reached, or if the DP receives no response from the Commune PC within XX (e.g. 15) days of registering the complaint, he/she can appeal to the DPC. The DPC will provide a decision within XX (e.g. 1 month) of the registering of the appeal.

Stage 3 - If the DP is not satisfied with the decision of the DPC or its representative, or, in the absence of any response by the DPC, the DPs can appeal to the PPC. The PPC will provide a decision on the appeal within XX (e.g. 30) days from the day it is lodged with the PPC.

Stage 4 - If the DP is still not satisfied with the decision of the PPC on appeal, or in absence of any response from the PPC within the stipulated time, the DPs may submit his/her case to the district court.

8. MONITORING AND EVALUATION

8.1 Monitoring

Monitoring is the continuous process of assessing project implementation in relation to agreed schedules, the use of inputs, and the provision of infrastructure and services by the Sub-project. Monitoring provides all stakeholders with continuous feedback on implementation. It identifies actual or potential successes. It also identifies problems as early as possible to facilitate timely correction during project operation. Monitoring has two purposes:

(i) to verify that project activities have been effectively completed including quantity, quality, and timeliness, and
(ii) to assess whether and how well these activities are achieving the stated goal and purpose of the Project.

Regular monitoring of the ARP implementation will be conducted by the PMU.

8.2 Monitoring Report

Monitoring of the implementation of the ARP will be the responsibility of the PMU. The implementing agencies will oversee the progress in resettlement preparation and implementation through regular progress reports.

The main indicators that will be monitored regularly are:
(i) payment of compensation to DPs in various categories, according to the compensation policy described in the ARP;
(ii) public information dissemination and consultation procedures;
(iii) adherence to grievance procedures and outstanding issues requiring management's attention; and
(iv) coordination and completion of resettlement activities in context of the awarding of civil works contracts.

The implementing agencies will submit a quarterly monitoring report to the KGPPC on the progress of the implementation of the ARP. The internal monitoring reports shall include the following topics:
(i) the number of DPs, by category of impact per component, and the status of compensation payment and relocation and income restoration for each category;
(ii) the amount of funds allocated for operations or for compensation, and the amount of funds disbursed for each;
(iii) the eventual outcome of complaints and grievances and any outstanding issues requiring action by management;
(iv) implementation problems, and

(v) revised actual resettlement implementation schedules.

9. COST ESTIMATE AND BUDGET

9.1 Flow of Funds

Funds for compensation and implementation of the plan will be from PMU and KGPPC. PMU will be responsible for channeling funds for the compensation for land acquisition and resettlement to the Phu Quoc DPC (or Phu Quoc Centre for Land Fund Development) who will be responsible for making payments directly to displaced persons.

9.2 Adjustment for Inflation

The rates for compensation and cash entitlements for rehabilitation as well as allowances payable to displaced persons will be adjusted annually, based on the current annual inflation rate. KGPPC will determine the annual inflation rates and all cash entitlements.

9.3 Compensation Prices

9.3.1 Prices for land

KGPPC issued Decision 29/2009/QD-UBND dated 21/12/ 2009 (Update if necessary) on compensation, for land. In Cua Duong commune, where private land acquisition is necessary, the following rates have been established:

- Compensation rate for agricultural land for growing annual crops: XXX VND/m2;
- Compensation rate for agricultural land for growing perennial crops: XXX VND/m2.

These rates have been found acceptable by the owners.

9.3.2 Prices for trees and crops

Decision No. 18/2007/QĐ-UBND, dated 6 July 2007 (Update if necessary), of KGPPC stipulates compensation rates for trees and crops. These prices apply in all of Kien Giang province.

- Compensation rate for AAA tree is XXX VND per tree.
- Compensation rate for BBB crop is XXX VND per tree.

9.3.3 Allowances

Based on Decision No. 31/2009/QĐ-UBND, a cash allowance of 3 times the compensation rate for agriculture land is required. This allowance applies only to cultivated land. This allowance intends to cover the eventual cost of training in case the land owner has to change of career.

9.4 Cost estimates

Table 9.1 presents the cost estimates for the Sub-project. The total budget for land acquisition under this ARP is estimated at VND XXX M (XXX USD). This amount covers administration and implementation activities. A contingency of 10% has been added.

Table 9-1: Cost Estimates for the Sub-project (Example)

No	Description	Unit	Qty	Unit Price VND	Amount VND	USD
I	**Land**					
1	Agriculture land					
2	Residential land					
3						
II	**Trees**					
1						
2						
III	**Allowance**					
1	Career change					
2	Vocational training					
3						
IV	**Administration**					
V	**Contingencies**					
	Total					

10. IMPLEMENTATION SCHEDULE

The implementation schedule is as follows:

(i) Updating Compensation Rates. During the preliminary detailed design process, the KGPPC will update unit rates at replacement cost for all categories of loss. This will be done in consultation with DPs and local government agencies.
(ii) Detailed Measurement and Census Survey. Once the detailed design has been completed, a new DMS will be conducted. These surveys will serve as a basis for compensation and updating ARP. Data will be computerized by the PMU.
(iii) Pricing Application and Compensation to DP. DPC will be responsible for price application (calculating payments on the basis of the market survey) and preparing compensation charts for each affected commune/district. Unit prices, quantity of affected assets, DPs' entitlements, etc. will be subject to verification by the PMU and PPC before being posted in each commune for people to review and comment on. All compensation forms must be checked and signed by the DPs to indicate their agreement.
(iv) Compensation will be handled under the supervision of representatives of Commune/Town People's Committee, DPC and representatives of DPs.

PMU shall ensure that civil works contractors are not issued a notice of possession of site for construction works until PMU has (i) satisfactorily completed, in accordance with the approved ARP,

compensation payments and relocation to new sites; and (ii) ensured that required rehabilitation assistance is in place and the area required for civil works is free of all encumbrances.

Table 10.1 summarizes the steps remaining for the implementation of land acquisition, compensation and resettlement activities for the Sub-project.

Table 10-1: Implementation Schedule

Activities	Schedule

ABBREVIATED RESETTLEMENT PLAN

Sewerage System Sub-Project (provisional title)

For

Water Supply and Sewerage System Project

In

Phu Quoc Island, Vietnam

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Notification for Revision

"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewerage system. As for the construction of the sewerage system, "Sewerage System Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project") will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Abbreviated Resettlement Plan (ARP) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This ARP report is prepared to summarize the result of resettlement survey complied with JICA GL.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the resettlement survey is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

ABBREVIATIONS

ARP Abbreviated Resettlement Plan

DMS Detailed Measurement Survey

DP Displaced Person

DPC District People's Committee

DRC District Resettlement Committee

EA Executing Agency

EMA External Monitoring Agency

GOV Government of Vietnam

KGPPC Kien Giang Provincial People's Committee

KIWACO Kien Giang Water Supply and Drainage One Member Limited Company

LURC Land User Rights Certificate

MOF Ministry of Finance

ODA Official Development Assistance

PAH Project Affected Household

PAP Project Affected Person

PC People's Committee

PIB Public Information Booklet

PMU Project Management Unit

PPC Provincial People's Committee

PWSC Provincial Water Supply Company

RAP Resettlement Action Plan

VND Vietnam Dong

WB World Bank

WTP Water Treatment Plant

Definition of Terms

Cut-off-date	The date of commencement of census and asset inventory surveys during preparation of the RP. Affected people and local communities will be informed of the cut-off date for each subproject. Persons not covered in the census, because they were not residing, having assets, or deriving an income from the project area, are not eligible for compensation and other entitlements.
Eligibility	Any person who at the cut-of-date was located within the area affected by the project, its sub-components, or other sub-project parts thereof, and would: (a) have formal legal rights to land (including customary and traditional rights recognized under the Vietnamese laws); or (b) not have formal legal rights to land at the time the census begins but have a claim to such land or assets - provided that such claims are recognized under the laws of Vietnam or become recognized through processes identified in the resettlement plan; or (c) not have legal nor recognizable by law rights to the land they are occupying or land have properties/assets within the project areas before the cut-off date. Persons covered under (a) and (b) are provided compensation for the land they lose and other assistance at full replacement cost. Persons covered under (c) are provided resettlement assistance in lieu of compensation for the land they occupy, and other assistance, as necessary, to achieve the objectives set in this RPF, if they occupy the project area prior to the cut-off date. Persons who encroach on the area after the cut-off date are not entitled to compensation or other form of resettlement assistance. All persons in (a), (b) or (c) are provided compensation for loss of assets other than land.
Replacement Cost	Is the term used to determine the amount sufficient to replace lost assets and cover transaction costs. For losses that cannot easily be valued or compensated for in monetary terms (e.g. access to public services, customers, and supplies; or to fishing, grazing, or forest areas), attempts are made to establish access to equivalent and culturally acceptable resources and earning opportunities. When domestic laws do not meet the standard of compensation at full replacement cost, compensation under domestic law is supplemented by additional measures necessary to meet the replacement cost standards. In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account.
Resettlement	Is the general term related to land acquisition and compensation for loss of assets whether it involves actual relocation, loss of land, shelter, assets or other means of livelihood.
Displaced Persons (DPs)	Persons who are affected by the involuntary taking of land resulting in the relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood.

1. INTRODUCTION

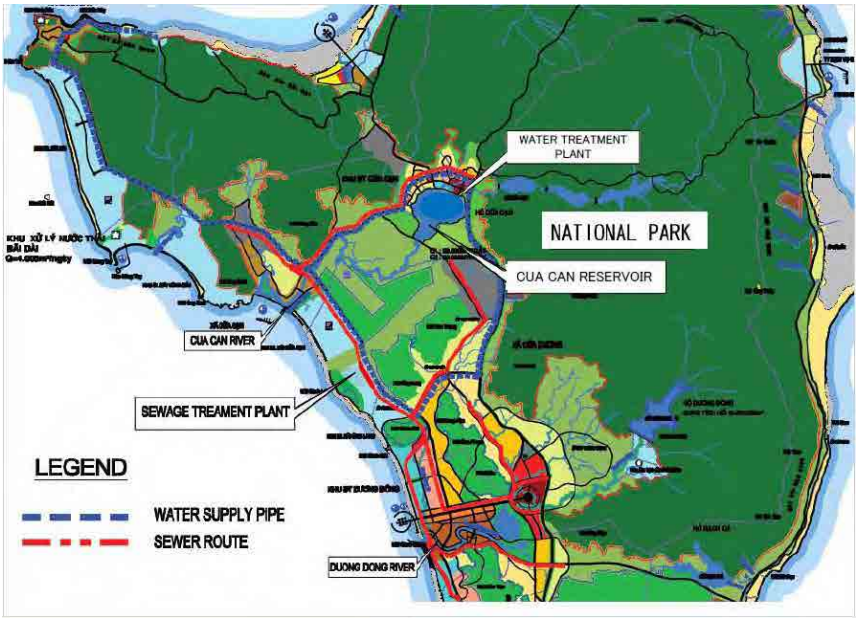
"Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam" (hereinafter referred to as "the Project") consists of three major components such as; i) reservoir, ii) water supply system and iii) sewer system. As for the construction of the sewerage system, "Sewerage System Sub-Project (provisional title)" (hereinafter referred to as "the Sub-project")will be conducted. In order to be funded by the Japan International Cooperation Agency (JICA), Abbreviated Resettlement Plan (ARP) should be conducted in compliance with the JICA Guidelines for Environmental and Social Considerations (JICA GL). This report as "Abbreviated Resettlement Plan" is prepared to summarize the result of RAP complied with JICA GL. Since JICA GL refers to World Bank Policy, its references are also described in this report.

This draft report is prepared by the JICA Survey Team in the preparatory survey for the Project before the EA is fixed, so it is described based on general ideas and should be modified in accordance with the future situation.

2. OUTLINE OF THE PROJECT

2.1 Outline of project components

Main components of the project are; i) reservoir, ii) water supply system and iii) sewer system. The map shown below indicates the project site with the components.



Source: Master plan 2009

Figure 2-1 The project site

Figure 2-2 shows the outline of Cua Can reservoir design. The present design is that Cua Can River

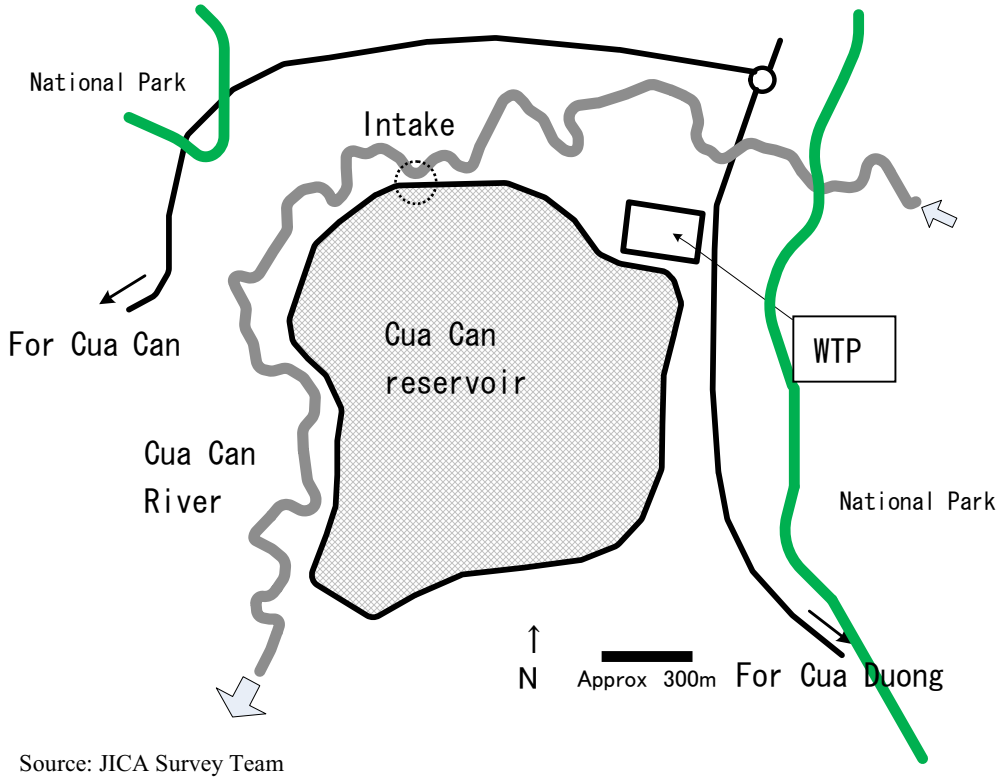
will be left as it is and Cua Can reservoir will be constructed on the side. This design avoids impacts to Cua Can River by the construction of Cua Can reservoir. Besides, the method of intake that will withdraw River water only when extra water exists will remain the current River environment in future as well.

In addition, Cua Can reservoir and the WTP planned site are outside of the national park and the closest distance between the project sites and the park will be approximately 300m.

Reservoir construction will produce extraordinary amount of soil because the planned site will be excavated. The authorities concerned said that soil in Phu Quoc or whole Vietnam is in high demand and salable. However, the amount is extremely large and coordination with other development projects is necessary. Thus, consultation with Kien Giang province or GOV will be necessary.

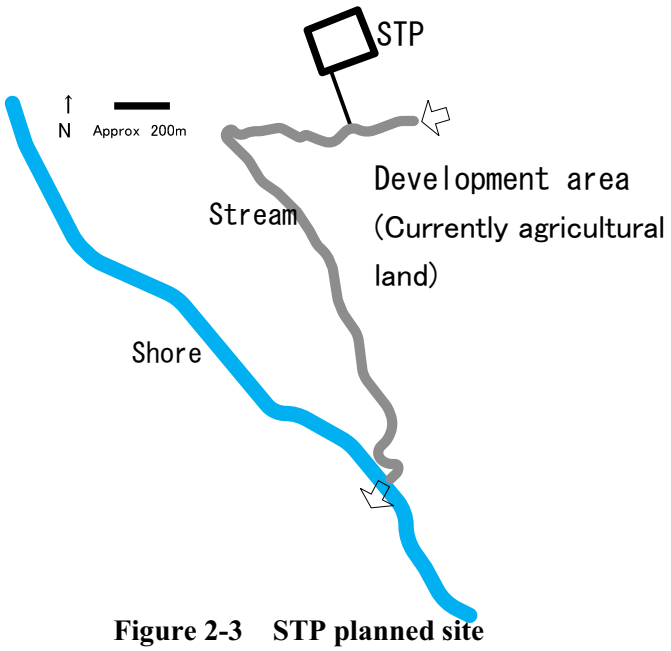
WTP is scheduled to be constructed adjacent to the reservoir, and the site will be approximately 5 to 6ha (**Figure2-2**).

STP is scheduled to be constructed where is approximately 2km upstream of a stream from the shore and the site will be approximately 4ha. (**Figure 2-3).**



Source: JICA Survey Team

Figure 2-2 Cua Can reservoir & WTP



Source: JICA Survey Team

Figure 2-3 STP planned site

2.2 Current social condition

(1) Population

Phu Quoc Island consists of 2 towns and 8 villages. The whole population of the island is approximately ninety thousand. **Table2-1** shows shifts of the population.

Table2-1 The shifts of the population

Town/Commune		Y2005	Y2006	Y2007	Y2008	Y2009
Town	Duong Dong	28,370	30,074	31,053	31,811	31,940
	An Thoi	17,854	18,927	19,531	20,292	19,880
Commune	Cua Can	3,058	3,241	3,345	3,429	3,394
	Cua Duong	7,213	7,655	7,899	8,096	7,789
	Ham Ninh	6,706	7,108	7,336	7,519	7,573
	Duong To	6,069	6,434	6,640	6,806	7,204
	Bai Thom	4,632	4,909	5,066	5,193	4,404
	Ganh Dau	3,904	4,138	4,271	4,378	4,294
	Hon Thom	2,697	2,859	2,950	3,024	2,438
	Tho Chau	1,480	1,563	1,612	1,652	1,755
Total		81,983	86,908	89,703	92,200	90,671

(Source: Phu Quoc Census Book 2009)

(2) Social economic condition

Major economic activities in Phu Quoc Island are fishery, black pepper and fish sauce (Nuoc Mam). **Table2-2** shows the population for occupations in the island.

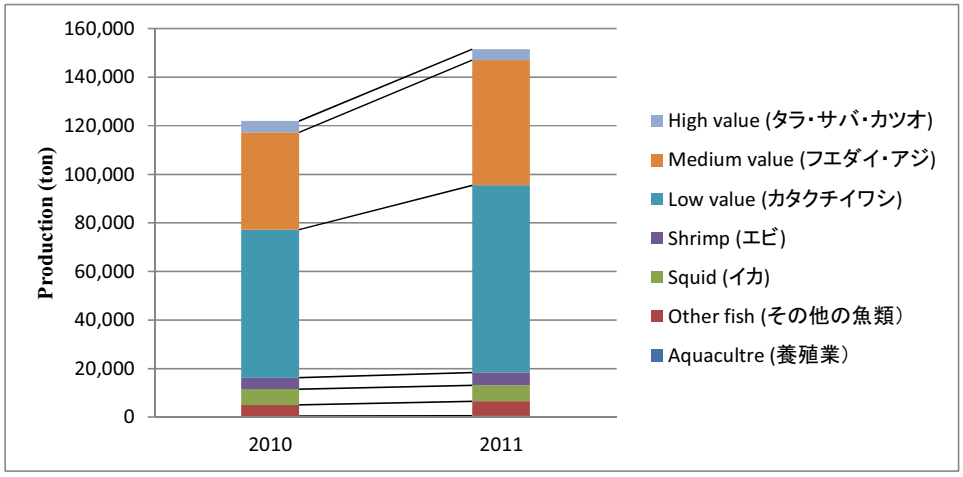
Table2-3 shows important infrastructure such as educational and medical institutions. They do not exist within 2km from the project site.

The breakdowns of production of the two major industries (fishery and agriculture) in Phu Quoc are shown in **Figure 2-4** and **2-5**.

Table2-2 Population for occupations

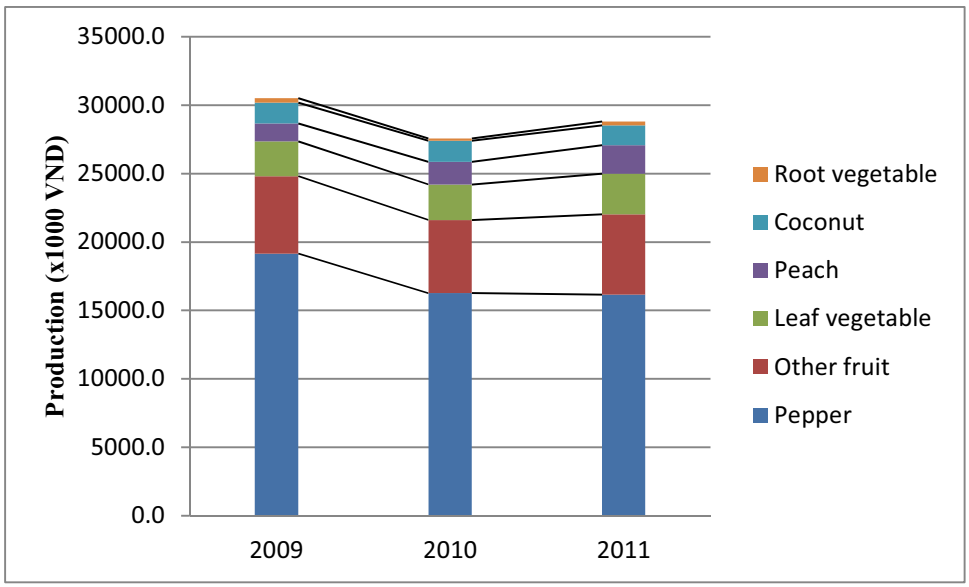
No.	Occupation	Population (2009)	Rate (%)
1	Aquatic product	13,546	14.94%
2	Agricultural production	7,446	8.21%
3	Commerce, Vehicle's Motor and Engine Repair	3,552	3.92%
4	Food Process Industry	3,146	3.47%
5	State Management , The National Defense Security, etc.	2,616	2.89%
6	Restaurants, Hotel	2,486	2.74%
7	Transportation, Warehouse, etc.	2,430	2.68%
8	Education and Training	970	1.07%
9	Construction	857	0.95%
10	Other	2,410	2.66%
-	Total	39,459	43.52%
Not working		51,212	56.48%

(Source: Phu Quoc Census Book 2009)



(Source: Phu Quoc Statistic Bureau)

Figure 2-4 Buffer Zone related to the Project sites



(Source: Phu Quoc Statistic Bureau)

Figure 2-5 Buffer Zone related to the Project sites

Table2-3 Important infrastructure

No	Important infrastructure	Number
	Educational	
1	Primary School	11
2	Primary+ Secondary School	7
3	Secondary School	6
	Medical	
1	Hospital	1
2	Regional General Surgery Room	1
3	Town, Commune Medical Care Station	43

(Source: Phu Quoc Census Book 2009)

(3) Tourism

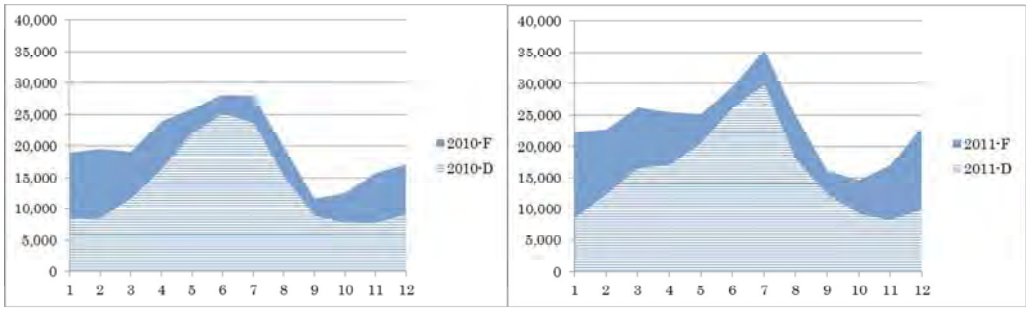
Tourists visiting Phu Quoc Island increase in recent years as shown in **Table 2-4**. The shifts of monthly population of tourists are also shown in **Figure 2-6**. Domestic tourists are as twice as foreigners. Foreign tourists increase in the dry season (Dec.-Apr.) while the whole tourist population increases from May to July which is a major holiday season in Vietnam.

According to the 2009 M/P, two million tourists in 2020 and 5 million in 2030 are estimated but the grounds for estimation are not described and it is assumed that the numbers are nonbinding targets.

Table 2-4 Yearly tourist population in Phu Quoc

Year	2005	2006	2007	2008	2009	2010	2011
Tourist	130,400	148,200	160,200	184,100	220,350	239,794	282,270

(Source: Phu Quoc Census Book 2009 and JICA Survey Team)



Legend : F(foreign)/D(domestic) (Source: Phu Quoc Statistic Bureau)

Figure 2-6 Monthly tourist population in Phu Quoc

(4) Land use

Approximately 70% area of Phu Quoc Island is forest area and 20% is agricultural land. The project site is scheduled in agricultural lands. Reservoir planned site will be in the land with miscellaneous trees where logging and pepper and livestock firming take place. In accordance with the design, it can include protective forest area. WTP planned site will be in the land with miscellaneous trees where no activity is seen and grassland where livestock firming takes place. STP planned site will be in the land with miscellaneous trees where no activity is seen.

Protective forest area is different from Protected area of Special-use forest mentioned in **(4)**. Protective forest area can be designated to other land category where productive activities are allowed. It is

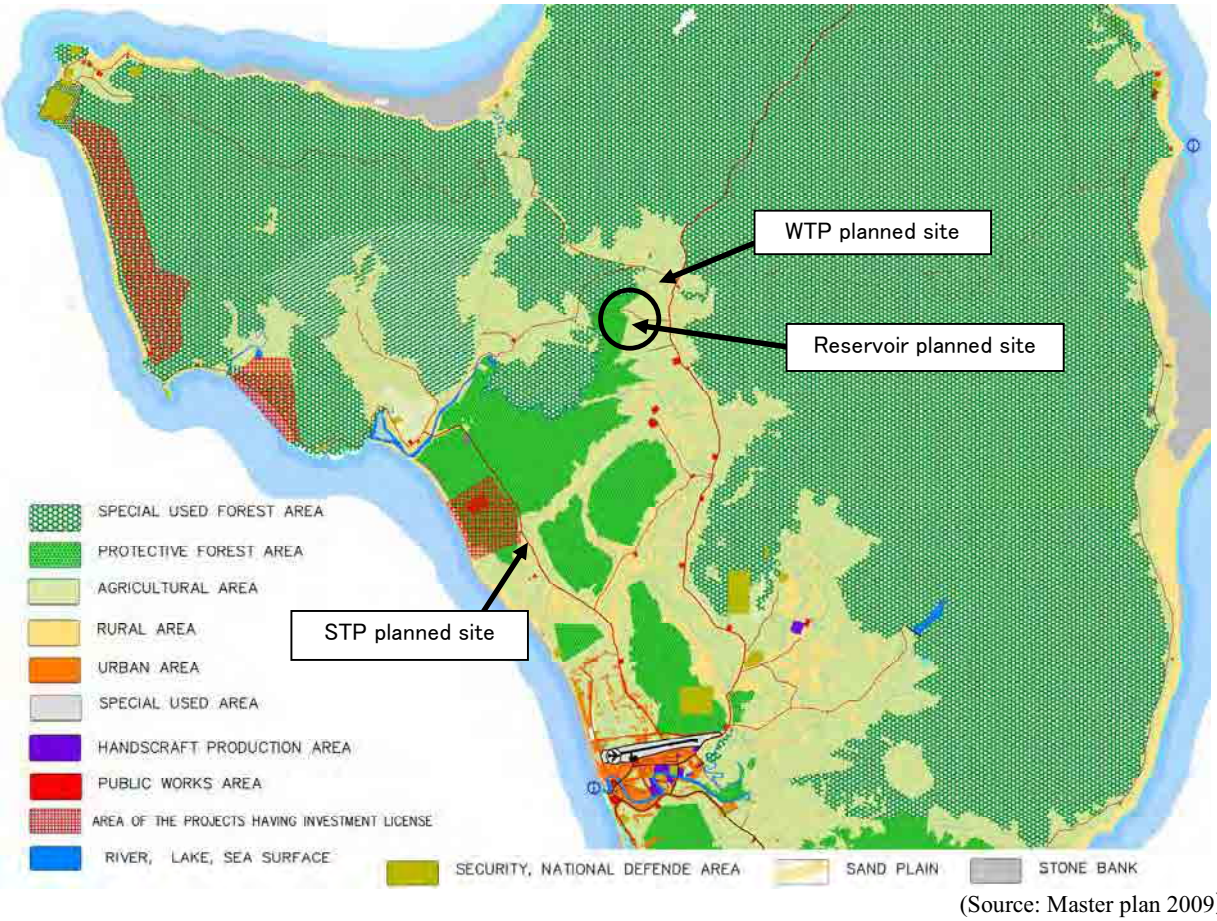
possible due to a certain procedure by the provincial People's Committee and no major problem is found for the project land use.

Land use condition as of 2007 is shown in **Table2-5** and **Figure2-7**.

Table2-5 Land use condition in Phu Quoc Island (2007)

No.	land use	Area(ha)	Rate
1	Urban area	872	1.5%
2	Touristic area	243	0.4%
3	Sporting facility, etc.	179	0.3%
4	Park / Green space	309	0.5%
5	Airport / Port site	969	1.6%
6	Agriculture	11,351	19.3%
7	Military related site	1,880	3.2%
8	Forest	41,757	70.9%
9	Other	1,355	2.3%
Total		58,915	100.0%

(Source: Phu Quoc Census Book 2009)



(Source: Master plan 2009)

Figure2-7 Land use map of Phu Quoc Island

(5) Water use

In Cua Can River which is located downstream area of the reservoir, no irrigation nor fishery were seen when site visits were conducted by JICA Survey Team in October, 2011. DONRE, in charge of the river, says that no water use is applied in the area. Cua Can Commune People's Committee,

located in the area, says that no fishery activities are conducted. Also in the stream near STP planned site, no water use is conducted.

2.3 Socio-economic condition of PAH

(1) Population by Age

(Description)

Table2-6 Population by Age for PAH

Age	Y20xx	%
80-		
70-80		
60-70		
50-60		
40-50		
30-40		
20-30		
10-20		
0-10		

(2) Population by Occupation

(Description)

Table2-7 Population by occupations for PAH

No.	Occupation	Population	Rate (%)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
-	Total		
Not working			

(3) Household Income

(Description)

Table2-8 Household Income for PAH

Income (VND per month)	% Interviewed Households
5 million or more	
4-4.5 million	
3.5-4 million	
3-3.5 million	
2.5-3 million	
2-2.5 million	
1.5-2 million	
1-1.5 million	
1 million or less	

3. SCOPE OF LAND ACQUISITION AND RESETTLEMENT

Land acquisition will be necessary only for the STP. The sub-project will require the permanent acquisition of XXX m2 of land. Temporary land acquisition, if any, will be given during project construction. The sub-project will also affect around XXX trees (breakdown: XXX A trees, XXX B tree and XXX C trees).

There is demolition of XXX houses. PAH will be affected due to the sub-project. Table 3.1 and Table 3.2 present the project impacts regarding land acquisition and resettlement.

Table 3-1: Project Impacts

Location	Affected area (m2)	Type of land	Tenure	Trees

Table 3-2: List of PAH

Name of PAH	Components	Occupation of PAH	Affected area (m2)	Total land holding	% affected

4. LEGAL FRAMEWORK AND ENTITLEMENT POLICY

This Resettlement Plan is consistent with the various laws, decrees and circulars regulating land acquisition, compensation and resettlement in Vietnam, and World Bank policy on Involuntary Resettlement.

4.1 Vietnamese Laws, Decrees, and Circulars

• The Constitution of the Socialist Republic of Vietnam, 15 April 1992; the right of citizens to own and protect the ownership of a house

• Land Law, 26 November 2003, effective 1 July 2004. Article 39 Requires disclosure of information to affected people prior to recovery of agricultural and non-agricultural land a minimum of 90 and 180 days respectively

• Decree No. 181/2004/ND-CP, 29 October 2004, relating to implementing the Land Law

• Law of Construction effective 01 Jan 2004 by Presidential Order of 26/2003/L-CTN dated 10 December 2003; Compensation and relocation of people affected by ground clearance for investment projects

• Decree 16/2005/ND-CP; implementation of the Construction Law.

• Decree No. 188/2004/ND-CP, 16 November 2004, and Decree No. 123/2007/ND-CP specifying methods for land pricing and issuance of land price framework for land categories;

• Circular No. 145/2007/TT-BTC by MOF; providing guidelines for implementation of the Decree 188/2004/CP.

• Decree No. 123/2007/ND-CP; amending and supplementing Decree No. 188/2004/ND-CP that gives Provincial People's Committees the authority to set local land prices by establishing ranges for all categories of land.

• Decree No 182/2004/ND-CP, 29 October 2004; penalty for administrative violation in land issues.

• Decree No. 198/2004/ND-CP, 03 December 2004; on collection of land tax. Issued guidelines in Circulation No. 117/2004/KT-BTC by MOF.

• Decree No. 95/2005/ND-CP, 15 July 2005, regulation on property ownership and the right to use urban residential land;

• Decree No. 08/2005/ND-CP, 24 January 2005 regulation on Urban Planning Management

• Decree No. 197/2004/ND-CP, 03 December 2004, on compensation, assistance and resettlement when land is recovered by the State (replacing Decree No. 22/CP).

• Circular No.116/2004/TT-BTC by MOF guiding the implementation of Decree 197.

• Decree No. 17/2006/ND-CP, 27 January 2006 (amending Decree No. 181/2004/ND-CP and Decree No. 197/2004/ND-CP and other decrees); compensation, assistance and resettlement when land is recovered by the State.

• Decree No. 69/2009/ND-CP, an amendment to Decree No. 197/2004/ND-CP; supplementary regulations on land use planning, land prices, land acquisition, compensation, support and resettlement.

• Decree No. 84/2007/ND-CP; supplementary stipulations on the issue of land use rights certificates (LURC), land acquisition, land use right implementation, procedure of compensation, and assistance in the event of land recovery by the state; grievance redress.
• Degree No. 64/1993/ND-CP, 27 September 1993, regulation on allocating agricultural land to households for long-term use;
• Ordinance No 34/2007/PL-UBTVQH11 on Exercise of Democracy in Communes, Wards and Townships.
• Decree No. 172/1999/ND-CP, Article 25, and its 2009 amendment decree. Sites that are currently recognized for cultural and historical preservation and that are situated within the boundaries of waterway safety corridors, should be kept intact according to current legal regulations.
• Decree No. 131/2006/ND-CP 9 November 2006, regulation on Management and Utilization of ODA (of which international commitments of Government are prevailing and enforceable)
• Decision No. 48/2008/QD-TTg issued on 3 April 2008 by the Prime Minister, and Common General Guidelines on Feasibility Study Preparation For Official Development Assistance (ODA) Projects Funded by the Five Banks.

Under the 2003 Land Law, ownership of land in Viet Nam resides with the State. The State exercises the right to decide the purpose of land use specified in land use planning and land use plans; to regulate the duration of land use; to decide on land allocation; to rent land; to acquire land, and to evaluate land prices. The State can assign and lease land to land users, including individuals, households and organizations. In the case of assigned land, the State delegates to the Provincial People's Committees the authority to grant LURC to land users. With respect to land acquisition, resettlement and compensation, the Land Law makes the following provisions:

a. The State reserves the right to "recover" land for purposes of defense, national security, national interests, public interests, and economic development. Individuals, households and organizations that have or are eligible to be granted land use right certificates for recovered land will receive compensation for the loss of these assets (Article 42[1]).
b. Individuals, households and organizations that have or are eligible to be granted land use right certificates for recovered land will receive compensation for the loss of these assets (Article 42[1]).
c. Before land is recovered, the user must be informed of the reasons for recovery; the schedule and plans for resettlement, if necessary; and, options for compensation. This must occur at least 3 months prior to the recovery of agricultural land and 6 months prior to the recovery of nonagricultural land (Article 39).
d. Compensation for recovered agricultural and rural residential land will be in the form of new land of the same purpose of use or, if no new land is available, cash equivalent to the land use right value of the recovered land (Article 42[2] and [3]). In the latter case, the land use right value is established as the value of similar land under normal market conditions, as determined on an annual basis by PPCs (Article 56).

e. Recovery of land from people directly involved in agricultural production but having no land available for continued production will receive cash compensation and, in addition, support from the State to rehabilitate their living conditions, either through training to enable them to shift into new occupations, or through new employment being arranged (Article 42[4]).
f. Where the use right value of recovered residential land is greater than that of the land given as compensation, affected people will receive cash equal to the difference in the values (Article 42[3]).
g. Resettlement zones will be developed for people having residential land recovered and having to move their places of residence. Resettlement zones will be developed for many projects in the same area and will provide living conditions that are equal to or better than the conditions in the former places of residence. In areas where there is no established resettlement zone, people will receive cash for recovered residential land and priority to purchase or lease State-owned dwellings (Article 42[3]).
h. Recovery of land will occur without compensation in the following cases, among others: (i) land is recovered from organizations that use State funds to pay land use levies for assigned land or land rents for leased land, or are assigned land without having to pay land use levies; (ii) recovered land has been illegally encroached or occupied, or the occupants are not eligible to be granted land use right certificates; (iii) recovered land is rented from the State; and, (iv) recovered land is road or canal, or used for cemeteries or graveyards (Article 43[1]).
i. Structures and other fixed assets on recovered land will not be compensated in cases where they have been constructed without permission; in contravention of permitted uses in land use plans; or, when structures are located on illegally encroached land (Article 43[2]).
j. In the event of temporary recovery of land, for example during construction, upon the expiry of temporary land acquisition the State will return the land and pay compensation for any damages (Article 45).

Land Law 2003 defines the principles for the State's evaluation of land prices:

a. These should reflect the market price of land use right transfer, in normal market conditions. In the event that in the price offered there is a significant difference between the identified land prices and the local market ones, the price should be adjusted accordingly
b. Plots bordering each other that have: i) similar natural, socio-economic, and infrastructure conditions, and ii) similar existing and/or planned type of land use, will have similar land prices;
c. Land located in areas on the borders between provinces, cities under direct Central Government's management, that have i) similar natural, socio-economic, and infrastructure conditions, and ii) similar existing and/or planned type of land use, will have similar land prices.

Land Law 2003 provides that land prices regulated by the PPC or PC of Cities under the direct Central Government, will be publicly announced on the First of January annually. Land Law 2003 makes a clear statement about the application of the Law. Clause 2 of Article 3 regulates: In the event that International treaties, which the Socialist Republic of Vietnam has signed or acceded, contain

provisions different from the provisions of this Law, the provisions of such international treaties shall be applied.

Decree No. 197/2004/ND-CP regulates the eligibility and procedures for compensation, assistance and resettlement in the event of State recovery of land. The principles underlying compensation are: (i) recovery of land from eligible persons shall be compensated; (ii) in the event the affected person is not eligible for compensation, consideration will be given to forms of assistance; (iii) compensation for affected land will be in the form new land allocation with the same purpose of use or, if no such land is available, cash compensation equal to the value of land use rights at the time of recovery; and, (iv) outstanding financial liabilities associated with land to be recovered will be deducted from the amount of compensation or assistance money. The Decree and Circular No. 116/2004 TT-BTC set out in detail the types of compensation for different types of users and losses; assistance policies; provisions for individual and group resettlement; and, the roles and responsibilities for implementation of resettlement projects.

Decree No. 17/2006/ND-CP amends Decree 197 to strengthen several aspects of the provisions for compensation, assistance and resettlement, including: (i) a requirement to update official PPC prices, as necessary, to reflect market values for affected assets; (ii) life stabilization assistance for poor households that must be provided for not less than three years and not more than ten years; and, (iii) assistance for occupational change and job creation for affected households losing significant portions of their productive assets, as well as for affected households that relocate to resettlement sites.

Decree No. 188/2004/ND-CP regulates the methodology for determining land prices and price frames for State recovery of land, as well as for taxation on land use and the transfer of land use rights and for land rents for government lands. It establishes the minimum and maximum prices for different types and categories of land. The principle underlying the determination of land prices is the actual transfer price on the market under normal conditions between a willing seller and buyer without regard to factors such as speculation, changes in planning, forceful transfer or blood relationship. Circular No. 114/2004/TT-BTC elaborates in detail the methods (direct comparison and income methods) for determining land prices.

Decree 123/2007/ND-CP amends Decree 188/2007/ND-CP giving the Provincial People's Committees the authority to set local land prices by establishing ranges for all categories of land.

Decree 69/2009-ND-CP regulates compensation Payments. Where compensation is made in the form of offering a new piece of land or resettlement land or resettlement house, and there is a difference in value, then the resettled person is entitled to the difference if compensation is greater than the value of the resettlement land or house; the resettled person pays the difference if the support money is less than the value of the resettlement land or house (except in special circumstances). State support

includes: (i) removal support, resettlement support when residential land is acquired; (ii) support for life and production restabilization, training support for change of jobs and job creation where agricultural land is acquired; (iii) support for acquisition of "agricultural use" land in residential areas eg. gardens, ponds; and (iv) other support. The Provincial People's Committee shall specify in detail the rate of support, the area of land of support and the average price of residential land for calculations which are appropriate to local reality.

Decree No. 131/2006/ND-CP provides that in case of "discrepancy between any provision in an international treaty on Official Development Assistance, to which the Socialist Republic of Viet Nam is a signatory, and the Vietnamese Law, the provision in the international treaty on ODA shall take precedence" (Article 2, Item 5).

Provincial Government decisions on resettlement and compensation and on land price will be incorporated into the Resettlement Plans.

4.2 Kien Giang Province Regulations on Resettlement

• Decision No. 31/2009/QĐ-UBND dated 21 December 2009 on compensation, assistance and resettlement in Kien Giang Province. This decision applied the Decree No. 69/2009/ND-CP of the Central Government.
• Decision No. 03/2010/QĐ-UBND dated 11 February 2010 on compensation, assistance and resettlement in Phu Quoc district.

4.3 World Bank Policy on Involuntary Resettlement

The World Bank recognizes that involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. The Bank's Resettlement Policy OP 4.12, includes safeguards to address and mitigate the economic, social, and environmental risks arising from involuntary resettlement.

The basic guiding principles of the World Bank's resettlement policy are that:

(i) Involuntary resettlement should be avoided where feasible, or minimized after exploring all viable alternatives in project design;
(ii) Where resettlement cannot be avoided, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the people displaced by the Project to share in benefits. Displaced Persons should be meaningful consulted and should have opportunities to participate in planning and implementing resettlement programs.
(iii) Displaced Persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The OP 4.10 on lndigenous Peoples, requiring all projects that are affecting indigenous peoples to engage these people in a process of free, prior, and informed consultation; conduct social assessment and to prepare an lndigenous Peoples Plan that will ensure these people to receive social and economic benefits that are culturally appropriate and gender and "inter-generationally" inclusive.

4.4 JICA Guideline on Involuntary Resettlement

The contents of JICA Guideline on involuntary resettlement are compared with the Government's Laws and Decrees. The differences between the Government's Laws and Decrees and JICA Guideline with regard to resettlement and compensation for this sub-project, and how to address these gaps are shown in Table 4.1.

Table 4-1: Comparison table between JICA Guideline and Laws of Vietnam

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	"Location options should be in line with construction planning and provide solutions to minimize the social and environmental impacts" and "assessment of conditions and reasoning for selected location". Decision 48/2008/QD-TT on development of F/S	Alternatives	Alternatives were considered in the EIA report.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Decision 48/2008/QD-TT on development of F/S and Decision 29/2009/QD-UBND	Equivalent	(Described in 5.2 & 9.3 in this report)
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	Land hand over: "Within twenty (20) days after being fully paid the compensation and support money, the person having land recovered shall hand over land to the compensation and ground clearance organization." Article 29; Circular 14/2009/TT-BTNMT	Equivalent	Not necessary

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
		Dated 01 October 2009		
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	The scale-criterion is not yet specified for involuntary resettlement.	Specific countermeasures for large-scale resettlement	Abbreviated resettlement plan will be adopted because DP are estimated approx. XX(this number should be less than 200)
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	RAP should include information of public consultation. Decision 48. Issuing general guidelines on feasibility study reports of projects using ODA funds of the 5 bank group	Equivalent	Not necessary
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	Not properly specified. RAP should include information of public consultation. Decision 48. Issuing general guidelines on feasibility study reports of projects using ODA funds of the 5 bank group	Language designation	Explanations were given in local language
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	Not specified	Participation promotion	Participation of affected people is promoted (Described in 7.1 in this report)
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	Properly specified at Article 138 of Land Law (2003); Article 63 & 64, Decree 84/2007/ND-CP and Decree 136/2006/ND-CP	Equivalent	(Described in 7.3 in this report)
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	An initial baseline survey is not specified. Decree 136/2006/ND-CP	Cut-off-date specification	Cut-off-date shall be defined (Described in 5.2 & 5.3 in this report)
12.	Eligibility of benefits includes, the PAPs who have - formal legal rights to land	Compensation will be paid to current users of land recovered by the State who fully satisfy the conditions	Similar	The site is basically private-owned

No.	JICA Guidelines (GL)	Laws of Vietnam	JICA GL not covered by Laws of Vietnam	Counter-measures
	(including customary and traditional land rights recognized under law), - the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and - the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	specified in Clauses 1, 2, 3, 4, 5, 7, 9, 10 and 11, Article 8 of Decree No. 197/2004/ND-CP and Articles 44, 45 and 46 of Decree No. 84/2007/ND-CP. For land users who are ineligible for compensation, provincial level PC shall consider these cases in order to provide support.		land and External land-users should not exist.
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	"Land used for a certain purpose which is recovered by the State shall be compensated with new land with the same use purpose,…" Decree 69; Article 14[2] Compensation and support principles	Preference specification	Livelihoods of displaced persons are basically land-based and no misdistributions are expected.
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Supports include: (i) support for relocation and resettlement in case of recovery of residential land; (ii) support for life and production and stabilization; (iii) support for job-change training and job creation in case of recovery of agricultural land; (iv) support upon recovery of agricultural land in residential areas or garden or pond land not recognised as residential land and other supports. Article 17; Decree 69.	Covered	Not necessary
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	Not specified.	Vulnerable groups specification	PPCs are in charge of attention in the process of important decisions
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	Not specified.	Preparation of ARP	By this report

4.5 The Sub-project's Land Acquisition and Resettlement Policy

With consideration of 4.4, The Sub-project's principle is shown as following.

I. The Government of Vietnam will use the Project Resettlement Policy (the Project Policy) for

the Project specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the Vietnam legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.

II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.

III. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

- Standard of living adversely affected;
- Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;
- Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
- Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets(IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

IX. The resettlement plans will be designed in accordance with Vietnam's National Involuntary Resettlement Policy and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of replacement cost.

XII. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the

livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, cut-off dates for titleholders will be the date of notification under the land acquisition and for non-titled holders will be the beginning date of the population census; XX / XX / XXXX. This date has been disclosed to each affected village by the relevant local governments and the villages have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

(Example of the Project's replacement cost calculation)

a. Productive Land based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes, fees and taxes or in the absence of such sales, based on productive value;

b. Residential land based on actual current market prices that reflect recent land sales, and in the absence of such recent land sales, based on prices of recent sales in comparable locations with comparable attributes; fees and taxes.

c. Existing local government regulations for compensation calculations for building, crops and trees will be used where ever available.

d. Houses and other related structures based on actual current market prices of affected materials;

e. Annual crops equivalent to current market value of crops at the time of compensation;

f. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.

g. For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of

compensation based on the diameter at breast height of each tree.

5. COMPENSATION POLICY

5.1 Objectives for Resettlement

The objectives of the Vietnamese legislation governing resettlement and rehabilitation of displaced persons, and that of the World Bank concerning involuntary resettlement, have been adapted for the preparation of this Abbreviated Resettlement Plan (ARP). The objectives are set out below. The policies and principles adopted for the sub-project supersede the provisions of relevant decrees currently in force in Vietnam, wherever a gap exists between the World Bank's OP 4.12 and Vietnamese law.

The main objective of the ARP is to ensure that all Displaced Persons (DP's) will be compensated for their losses at replacement cost.

5.2 Principles of Resettlement

The principle for resettlement policy in the sub-project will be as follows:

(i) Acquisition of land and other assets, and resettlement of people will be minimized as much as possible.

(ii) All DPs residing, working, doing business or cultivating land within the recovered area under the Project as of the cut-off-date are entitled to be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-Project living standards, income earning capacity and production levels. Lack of legal rights to the assets lost will not bar the DP from entitlement to such rehabilitation measures.

(iii) Compensation for loss of land and trees at replacement cost

(iv) Adequate budgetary support will be fully committed and be made available to cover the costs of land acquisition and resettlement and rehabilitation within the agreed implementation period. Physical resources for resettlement and rehabilitation will be made available as and when required.

(v) Civil works contractors will not be issued a notice of possession or a notice to proceed for any sub-project unless the Government has

a. Completed, satisfactorily and in accordance with the approved ARP for that sub-project, compensation payments, and

b. Entitlements will be provided to DPs no later than one month prior to expected start-up of civil works at the respective project site.

(vi) Institutional arrangements will ensure effective and timely design, planning, consultation and implementation of the ARP.

5.3 Cut-off Date and Eligibility

For the Project, the cut-off-date for eligibility for entitlement is defined as the completion of the

measurement survey on affected land. The survey was completed on XX/XX/20XX based on the preliminary scheme design. Should the design be developed further to require more, or different land, the inventory of loss will be updated and the cut-off date revised in accordance. Those whose livelihood activities may be affected by temporary land acquisition as the result of civil works will also receive compensation and assistance.

5.4 Project Entitlements

The Entitlement Matrix, presented in Table 5.1, covers the impacts currently identified during project preparation. It covers also the impacts which could arise during the construction period.

Table 5-1: Entitlement Matrix (Example)

Item	Type of loss	Application	Definition of entitled person	Compensation policy	Implementation issues
1	Permanent loss of land	Total landholding of XX ha is lost	Legal user with permanent or legalizable rights to use the affected land. - Mr. XX	DPs will be entitled to cash compensation for acquired land at 100% of replacement cost.	DPs will be given notice several months in advance regarding evacuation.
2					
3					

5.5 Site Preparation and Relocation

(Description)

Table 5-2: Site Candidates for Resettlement

No.	Region	Area	No. of HH to be accepted	Remark
1				
2				
3				
4				
5				

6. INSTITUTIONAL ARRANGEMENTS

The implementation of resettlement activities requires the involvement of agencies at the national, provincial, district and commune level. The provisions and policies of the ARP will form the legal basis for the implementation of resettlement activities during the Sub-project. The Provincial Project Management Unit (PPMU) can agree with the DPs on their compensation payment options for losses, following the provisions in the ARP.

The following is a general overview of key responsibilities with respect to land acquisition and resettlement at/for each level/unit involved in Project implementation.

6.1 The Kien Giang People's Committee (Example)

The Kien Giang Provincial People's Committee (KGPPC) is responsible as the Executing Agency (EA) for overall coordination and direction of the Sub-project, including the implementation of the ARP. The KGPPC is responsible for approving the ARP for the Sub-project, and for making decisions related to sub-project resettlement issues. The latter includes decisions relating to compensation rates and rehabilitation assistance measures for DPs. The KGPPC is also responsible for providing the budget for resettlement compensation. KIWACO is responsible for implementation of the sub-project as the Implementing Agency (IA).

After detailed engineering designs have been completed, the number of DPs will be revised, and compensation unit rates and allowances will be updated for all categories of lost assets, based on replacement cost surveys carried out during project implementation. Following approval by JICA of the updated ARP, the KGPPC will be responsible for directing and supervising ARP implementation. This will include ensuring speedy resolution of any grievances voiced by DPs or town/district authorities. Based on local requirements for implementing resettlement, in each project implementation stages, the KGPPC will delegate responsibilities for resettlement implementation to agencies at the appropriate level, in accordance with Decree No. 197/2004/ND-CP and Decree 69/2009/ND-CP.

Due to the limited impacts, no resettlement committee at the provincial level will be established for this sub-project.

6.2 The Project Management Unit (PMU) (Example)

The KIWACO will set up a PMU within the PWSC for daily project implementation. The PMU will include technical, institutional, social and resettlement, administrative management, and representatives of accounting divisions. Key responsibilities of the PMU will include, but not be limited to, the following:

(i) updating the ARP at the time of project implementation, when the detailed design is available, and then submitting the updated ARP to PPC for approval.

(ii) coordinating civil works with land acquisition and resettlement activities;

(iii) instigating information campaigns, in accordance with established Project guidelines. This includes preparation and distribution of the public information booklet, and stakeholder consultation with the DPs. it includes having primary responsibility for letters, forms and other relevant documents, although the preparation of these may be delegated as required;

(iv) developing the mechanisms through which resettlement disbursements and compensation payments for DPs will be made, and preparing any associated documents that may be required;

(v) co-ordinating with other departments for the effective implementation of the ARP, as approved for the sub-project, and in compliance with the WB resettlement principles and objectives. This will include ensuring that rehabilitation measures and supporting activities are properly implemented;

(vi) ensuring a timely resettlement budget flow for the delivery of compensation payments and the rehabilitation of DPs, and providing the compensation payments to the DPs, and
(vii) implementing sub-project accounting and auditing with respect to resettlement implementation, and preparing and submitting regular progress reports to the KIWACO and PPC on the civil works and status of ARP activities.

6.3 Phu Quoc District People's Committee

The Phu Quoc District People's Committees will be responsible for identification of land and trees and assigning functional tasks for the various agencies. The District People's Committee (DPC) will be responsible for the Detailed Measurement Survey (DMS) in collaboration with town/commune People's Committees. Due to the limited impacts, no resettlement committee at the district level will be established for this sub-project.

6.4 Commune People's Committee

Cua Duong People's Committees will be responsible for the following:
(i) assigning concerned ward/commune officials/professionals to carry out all resettlement activities in its ward/commune;
(ii) assisting other bodies/agencies, including the PMU, in the dissemination of sub-project information and facilitating public meetings and consultation with DPs;
(iii) assisting other agencies, including the PMU, in census surveys, a replacement cost survey, DMS and other resettlement related activities;
(iv) checking and confirming the legal status of affected land, houses, structures and other assets/losses of organizations; and
(v) ensuring the DP's grievances redress mechanisms are appropriate and properly put in place,. documenting DP grievances and maintaining records of all grievances, and assisting and advising DPs with respect to the speedy redress of grievances.

6.5 Agency Responsible for External Monitoring

If necessary, an external monitoring agency should be engaged. By the agency, socioeconomic surveys on DP will be conducted.

6.6 Institutional Capacity

If needed, specific training courses on resettlement will be required for an agency involved.

7. PUBLIC PARTICIPATION, CONSULTATION, AND GRIEVANCE MECHANISMS

7.1 Objectives of Public Information and Consultation

Information dissemination to DPs and involved agencies is an important part of sub-project preparation and implementation. Consultation with DPs and ensuring their active participation will

reduce the potential for conflicts and minimize the risk of project delays. The objectives of the public information and consultation program are as follows:
(i) to ensure that both local authorities and representatives of DPs, are included in the planning and decision-making processes. The PMU will work closely with the PPC, the DPC and the Commune PC during project implementation.
(ii) to fully share information about the proposed project components and activities with the DPs;
(iii) to obtain information about the needs and priorities of the DPs, as well as information about their reactions to proposed policies and activities;
(iv) to ensure that DPs are able to make fully informed decisions that will directly affect their incomes and living standards, and that they will have the opportunity to participate in activities and decision-making about issues that will directly affect them;
(v) to obtain the co-operation and participation of the DPs and communities in activities necessary for resettlement planning and implementation, and
(vi) to ensure transparency in all activities related to land acquisition, resettlement, and rehabilitation.
(vii) to ensure that basically all DPs should be informed in advance of public consultation and all or parts of DPs should be accepted to the consultation meetings.

7.2 Consultation during Project Preparation

A consultation with local authorities and affected persons was organized on XX/XX/XXXX. Annex 2 presents the minutes of the meeting. The following information was provided:
(Example)
- Characteristics of the project;
- Scope of land acquisition;
- Policy on resettlement (essentially concept of replacement costs);
- Schedule of work;
- Grievances mechanism;

(Description of the result) All the companies and individuals fully support the project and …

7.2.1 Information Dissemination and Consultation

During project implementation, the PMUs will undertake the following:
(i) Disseminate information to and consult with DPs throughout the life of the Project.
(ii) Update the provincial unit prices, and confirm the land acquisition requirements and impact on properties through a DMS, carried out in consultation with DPs.

The DPC will then apply prices, calculate compensation entitlements, and complete the Compensation Forms for each affected household. Information on entitlements will then be presented on an individual basis to DPs in a DMS follow-up visit to each household.

The Compensation Form, showing a household's affected assets and compensation entitlements, will

then need to be signed by the DPs to indicate their agreement with the assessment. Any complaints the DPs have about the contents of the form will be recorded at the time.

7.2.2 Public Meetings

(Description of public meetings)

7.2.3 Rehabilitation

(Description of rehabilitation measures if needed)

7.2.4 Public Information Booklet (PIB)

(Description of PIB if needed)

7.2.5 Disclosure

In addition to disclosure to affected people and communities, the ARP will be available at the PMU office (address: XXX), XXX office and XXX office.

7.3 Grievance Redress Procedure

DPs will be able lodge their complaints regarding any aspect of compensation policy, rates, land acquisition, resettlement and entitlements relating to rehabilitation assistance programs. Complaints by DPs can be lodged verbally or in written form, but if they are lodged verbally, the committee to which it is lodged will write it down during the first meeting with the DP. DPs will be exempted from administrative and legal fees.

A four-stage procedure for redressing grievances is proposed as follows:

Stage 1- Complaints from DPs regarding any aspect of the resettlement program or losses not previously addressed shall first be lodged verbally or in written form at the PC at the commune level. The complaint can be discussed in an informal meeting with the plaintiff and the chairperson of the PC at commune level. The PC at the commune level will be responsible for resolving the issue within XX (e.g. 15) days from the day it is lodged.

Stage 2 - If no understanding or amicable solution can be reached, or if the DP receives no response from the Commune PC within XX (e.g. 15) days of registering the complaint, he/she can appeal to the DPC. The DPC will provide a decision within XX (e.g. 1 month) of the registering of the appeal.

Stage 3 - If the DP is not satisfied with the decision of the DPC or its representative, or, in the absence of any response by the DPC, the DPs can appeal to the PPC. The PPC will provide a decision on the appeal within XX (e.g. 30) days from the day it is lodged with the PPC.

Stage 4 - If the DP is still not satisfied with the decision of the PPC on appeal, or in absence of any response from the PPC within the stipulated time, the DPs may submit his/her case to the district court.

8. MONITORING AND EVALUATION

8.1 Monitoring

Monitoring is the continuous process of assessing project implementation in relation to agreed schedules, the use of inputs, and the provision of infrastructure and services by the Sub-project. Monitoring provides all stakeholders with continuous feedback on implementation. It identifies actual or potential successes. It also identifies problems as early as possible to facilitate timely correction during project operation. Monitoring has two purposes:

(i) to verify that project activities have been effectively completed including quantity, quality, and timeliness, and
(ii) to assess whether and how well these activities are achieving the stated goal and purpose of the Project.

Regular monitoring of the ARP implementation will be conducted by the PMU.

8.2 Monitoring Report

Monitoring of the implementation of the ARP will be the responsibility of the PMU. The implementing agencies will oversee the progress in resettlement preparation and implementation through regular progress reports.

The main indicators that will be monitored regularly are:
(i) payment of compensation to DPs in various categories, according to the compensation policy described in the ARP;
(ii) public information dissemination and consultation procedures;
(iii) adherence to grievance procedures and outstanding issues requiring management's attention; and
(iv) coordination and completion of resettlement activities in context of the awarding of civil works contracts.

The implementing agencies will submit a quarterly monitoring report to the KGPPC on the progress of the implementation of the ARP. The internal monitoring reports shall include the following topics:
(i) the number of DPs, by category of impact per component, and the status of compensation payment and relocation and income restoration for each category;
(ii) the amount of funds allocated for operations or for compensation, and the amount of funds disbursed for each;

(iii) the eventual outcome of complaints and grievances and any outstanding issues requiring action by management;
(iv) implementation problems, and
(v) revised actual resettlement implementation schedules.

9. COST ESTIMATE AND BUDGET

9.1 Flow of Funds

Funds for compensation and implementation of the plan will be from PMU and KGPPC. PMU will be responsible for channeling funds for the compensation for land acquisition and resettlement to the Phu Quoc DPC (or Phu Quoc Centre for Land Fund Development) who will be responsible for making payments directly to displaced persons.

9.2 Adjustment for Inflation

The rates for compensation and cash entitlements for rehabilitation as well as allowances payable to displaced persons will be adjusted annually, based on the current annual inflation rate. KGPPC will determine the annual inflation rates and all cash entitlements.

9.3 Compensation Prices

9.3.1 Prices for land

KGPPC issued Decision 29/2009/QD-UBND dated 21/12/ 2009 (Update if necessary) on compensation, for land. In Cua Duong commune, where private land acquisition is necessary, the following rates have been established:

- Compensation rate for agricultural land for growing annual crops: XXX VND/m2;
- Compensation rate for agricultural land for growing perennial crops: XXX VND/m2.

These rates have been found acceptable by the owners.

9.3.2 Prices for trees and crops

Decision No. 18/2007/QĐ-UBND, dated 6 July 2007 (Update if necessary), of KGPPC stipulates compensation rates for trees and crops. These prices apply in all of Kien Giang province.

- Compensation rate for AAA tree is XXX VND per tree.
- Compensation rate for BBB crop is XXX VND per tree.

9.3.3 Allowances

Based on Decision No. 31/2009/QĐ-UBND, a cash allowance of 3 times the compensation rate for

agriculture land is required. This allowance applies only to cultivated land. This allowance intends to cover the eventual cost of training in case the land owner has to change of career.

9.4 Cost estimates

Table 9.1 presents the cost estimates for the Sub-project. The total budget for land acquisition under this ARP is estimated at VND XXX M (XXX USD). This amount covers administration and implementation activities. A contingency of 10% has been added.

Table 9-1: Cost Estimates for the Sub-project (Example)

No	Description	Unit	Qty	Unit Price VND	Amount VND	USD
I	**Land**					
1	Agriculture land					
2	Residential land					
3						
II	**Trees**					
1						
2						
III	**Allowance**					
1	Career change					
2	Vocational training					
3						
IV	**Administration**					
V	**Contingencies**					
	Total					

10. IMPLEMENTATION SCHEDULE

The implementation schedule is as follows:

(i) Updating Compensation Rates. During the preliminary detailed design process, the KGPPC will update unit rates at replacement cost for all categories of loss. This will be done in consultation with DPs and local government agencies.
(ii) Detailed Measurement and Census Survey. Once the detailed design has been completed, a new DMS will be conducted. These surveys will serve as a basis for compensation and updating ARP. Data will be computerized by the PMU.
(iii) Pricing Application and Compensation to DP. DPC will be responsible for price application (calculating payments on the basis of the market survey) and preparing compensation charts for each affected commune/district. Unit prices, quantity of affected assets, DPs' entitlements, etc. will be subject to verification by the PMU and PPC before being posted in each commune for people to review and comment on. All compensation forms must be checked and signed by the DPs to indicate their agreement.
(iv) Compensation will be handled under the supervision of representatives of Commune/Town People's Committee, DPC and representatives of DPs.

PMU shall ensure that civil works contractors are not issued a notice of possession of site for construction works until PMU has (i) satisfactorily completed, in accordance with the approved ARP, compensation payments and relocation to new sites; and (ii) ensured that required rehabilitation assistance is in place and the area required for civil works is free of all encumbrances.

Table 10.1 summarizes the steps remaining for the implementation of land acquisition, compensation and resettlement activities for the Sub-project.

Table 10-1: Implementation Schedule

Activities	Schedule

The Result
of
The Stakeholder Consultation
for
Water Supply and Sewerage System Project
in Phu Quoc Island, Vietnam

December 2011

by KGPPC

in collaboration with

JICA Preparatory Survey Team

The stakeholder consultation for scoping draft was conducted. In addition, the second consultation will be held at the stage of the draft final report. The outline is shown in **Table 1**.

Table 1 The outline of stakeholder consultations

Purpose	Consultation on the scoping draft
Date	16/12/2011
Venue	Phu Quoc District PC, Kien Giang province
Theme	- Project outline - Scoping draft
Stakeholder	**Table 2**

Table 2 The 1st Stakeholder consultation attendants

Affiliation	No.
District PC	3
Inhabitants	3
Central Government South-western Steering Board	1
Construction Department	1
KIWACO	3
KGPPC	4
DONRE	5
DARD	1
Phu Quoc National Park	1
Phu Quoc Military Service	1
Associated organization	2
NGO (PQ women's Association)	1
Mass media (television / radio station)	2
Construction consultant	3
Kobelco Eco-Solutions Vietnam	3
JICA Survey Team	10
Total	44

In the first stakeholder consultation, explanation of the outline of the project and the scoping

draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussions were focused on impacts by the reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, it was explained that; i) the reservoir would be located outside the national park, ii) the reservoir would give no impacts on downstream area, iii) the location of the STP was decided after detailed consideration and consultation. See details in Table 3.

Table 3 Record of Stakeholder Consultations

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
1	The location of STP is very important.	South-West Department of the Central government	【Answer】(Survey Team) Location of STP is decided on the Decision No. 633. The study team decided the location in a tourist area which has Ong long resort in the south and golf courses in the north after careful considerations. Based on the Decision No.633 and the detail plan of Ong resort, the STP is located in the northern part of Ong resort because hotels and houses are planned in the southern part. The land size of STP is only 4 ha in the park which is located in the 247 ha resort area. Also, the STP is located far away from the residential area and there are golf courses in the north. Moreover, another reason of location is that treated water of STP is available to trees and golf courses.
2	Please consider the buffer zone for the residential areas which might have odor problems of sewage treatment.		
3	The location of STP seems to be close to Duong Dong district.		
4	Does the sewerage catchment area cover necessary areas?		【Answer】(was conducted at a later date) Since urban areas of year 2030 land use in the master plan are covered through phase I and II, it is appropriate at present stage. of the master plan
5	Is there any relation among Cua Can reservoir, other facilities, and the national park?	Phu Quoc National Park	【Answer】(Survey Team) Since the reservoir is adjacent to the national park, mitigation measures to reduce the negative impacts on national park have been studied. This is the land use map of adjusted master plan based on Decision No.633. Based on this map, the reservoir of this project is located outside the national park.
6	Are Cua Can reservoir and other reservoirs which will be constructed in the national park investigated at the same time?		【Answer】(Survey Team) Although three small reservoirs in the national park are described in the land use map of the master plan, these are not in the scope of our study.

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
7	It is necessary to consider the impacts on water cycle including groundwater and water stored in the forest since Cua Can river in the national park dries up in 6 months of dry season. Also, impacts on the water flow, and the ecosystem in the river and the river bank should be studied.		【Answer】(Survey Team) There is no negative impact on water flow because the rain water accumulated in the river is taken in rainy season and water is not taken in dry season. Therefore, water flow in dry season does not change. 【Additional explanations】(was conducted at a later date) The intake of water in rainy season is considered to have a positive impact on the flood prevention because the water flow is normalized by the intake of excess water in rainy season. Also, since reservoir is constructed far away from the river, the negative impact on ecosystem is not expected. 【Actions to be taken in the future】 Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation in the permeable layer is planned, additional measures will be studied in this survey.
8	We would like to ask the survey team to identify how much area is necessary for the reservoir in the forest area.	Kien Giang Agriculture and Rural Development Department	【Answer】(Survey Team) 180 ha land is necessary in our plan. To reduce area, the depth should be deeper to keep necessary water volume. 【Actions to be taken in the future】 The dimension of reservoir will be determined later in this survey.
9	An irrigation engineering consultant mentioned us that a small reservoir is necessary before a big reservoir.		【Actions to be taken in the future】 Problems at the construction stage will be examined later in this survey.

In addition, anonymous opinions from attendants were collected in order to hear as many people as possible. See details in Table 4.

Table 4 Anonymous Comments submitted after Stakeholder Consultations

Component	Comments	Actions to respond to Comments in the survey
Reservoir	It is necessary to make proper scenarios for the evaluation of impacts to the national park during the construction and the operation of the reservoir.	All project sites are outside the national park.
Reservoir	The area of the national park to be used in the project should be determined. The impacts and countermeasures should be evaluated. In my opinion, the huge impacts on organic resources are expected.	
Reservoir	The impacts on the national park should be studied.	

Component	Comments	Actions to respond to Comments in the survey
Reservoir	Reservoir construction will have negative impacts on the forest. It is necessary to conduct a detail study and the evaluation of impact for construction. Also, the labor management for workers impacting the forest is required. Therefore, construction is a very important issue.	This issue will be studied in section 10-5 Forest (Flora) survey. Although there is the forest of the national park around the reservoir, the impact on the forest is not expected because the reservoir is far away from the national park.
Reservoir	It is necessary to study ecosystems and resources around the project sites as well as the project sites.	Impacts on the areas around the project sites will be considered in ecosystem survey.
Reservoir	Since a large volume of water runs from the upstream during rainy season, a dam to keep water should be considered for mitigating the damages of water on embankment of reservoir and residential areas around the reservoir.	The purpose of the reservoir is the storage of water during rainy season for use in dry season. Therefore, the reservoir mitigates the flood. Also, because only structures for intake and transmission of water are built, the dimension of river will be almost same as before the construction and impacts on surrounding area will be minimized. On discharge of water during the construction, supernatant water is discharged by using sedimentation ponds in which muddy water is separated into water and sludge. After being in service, the discharge from the reservoir is not conducted. The reservoir will be built away from the river. The plan maintains the river and does not reduce flow ability. Also, the 25 to 200m buffer zone between the river and the reservoir is secured to minimize impacts on surrounding areas.
Reservoir	Planned site of the reservoir performs the function as a sluice gate for Cua Can river, and a large volume of water with high velocity flows to the planned site (about 2m water level occurs three or four times a year). Therefore, the appropriate discharge during the construction and operation, and the impacts of flood (on residents around the planned site, embankments, and ecosystem) should be investigated in detail.	
Reservoir	Impacts on the way of water use should be evaluated if the reservoir is constructed by damming up the present Cua Can river.	The construction of the reservoir is not related to Cua Can river, and does not need to dam up.
Reservoir	A proper drainage to Cua Can river should be considered. Currently, the bottom of Cua Can river near the mouth consists of (settled) soils and mud. During January to April (the second half of rainy season), sediments are flushed out by rain water in the upstream. (Because there are above phenomenon,) negative impacts on Cua Can river might occur when the balance of water flow is changed by the discharge from the reservoir.	There is no discharge to Cua Can river, and current natural conditions of the river are not changed.
Reservoir	As for the construction of the reservoir, problems (such as drought of well water) might occur when the water balance between the used (of water taken from ground water) and the available volume (of water in ground) is changed. Discharge measures to control water volume of the reservoir should be modified if the impacts on people living around the reservoir are expected. Water level of the reservoir should be carefully considered.	There is no discharge to Cua Can river. Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	The accidents due to the deformation of ground by the increase of high water level should be considered.	Since the storage of water is conducted by pump, high water level is managed by pump. Therefore, high water level does not exceed the design high water level.

Component	Comments	Actions to respond to Comments in the survey
Reservoir	A geographical evaluation and an earthquake study should be conducted because of large water storage.	Geographical evaluation is conducted on the results of soil investigation. As for the relation between the water depth of the reservoir and earthquake, now there is no scientific evidence. Therefore, no impact is expected. As for measures of earthquake, structures are designed on the Vietnamese seismic standards for withstanding earthquakes.
Reservoir	The increase of groundwater level should be considered.	Impacts on groundwater around the reservoir are expected in the case of that the excavation for the reservoir is conducted in the permeable layer. Now, soil investigation is being conducted to identify the relation between construction and permeable layer. When the excavation is conducted in the permeable layer, additional measures will be studied in this survey.
Reservoir	Collapses of the reservoir and the surrounding areas, and the erosion of embankment should be considered.	Construction methods to prevent collapses and erosions are selected based on the results of soil investigation.
Reservoir	Accidents on slope failures and erosions under construction should be considered.	
Reservoir	To avoid any social adverse effect during the construction, proper labor management should be conducted.	Socio-economic survey and hygiene measures are studied sufficiently in section 10-5.
Water Distribution	Please consider to construct a distribution tank in Cua Can commune because water supply system has been built in Duoung Dong town. This tank is useful to distribute water to Cua Can, Ganh Dau communes and its environs.	Water supply to Cua Can and Ganh Dau must be conducted. A distribution tank is not directly related to whether water is distributed or not.
Sewerage	Please reconsider the location (of sewage treatment plant). The planned location is still close to residential areas and resorts of Duong Dong town and Cua Can.	As for nuisances on STP, odor might be a main problem. In this plan the location is decided by taking consideration of odor. The STP is planned to be built between golf courses and (50ha) forest of resort. This location also is good for the reuse of reclaimed water in terms of water conservation.
Sewerage	Please consider the location of STP because of many resorts and houses.	
Others	Since construction has impacts on environment, appropriate environmental considerations should be taken when the project components are constructed.	Evaluations on environmental impacts are carried out properly based on the scoping.
Others	The execution of projects has impacts on flora and fauna. Therefore, the investigation should be conducted to protect them at project sites.	Considerations of flora and fauna protection are carried out properly based on the scoping.
Others	Evaluation of the impact of workers on the National Park. One of mitigation measures is to obtain the permission before the worker starts the investigation in the national park and to present ID card when he enters the project sites.	All project sites are located outside the national park.
Others	Total project area is 190ha (including reservoir, WTP and STP). Does this project use the national park? If use the national park, how much area of the national park is necessary for the project? Impacts of the project on Phu Quoc and especially impacts on ecosystem of the national park should be considered.	All project sites are located outside the national park. Evaluation of impacts on ecology is carried out based on the scoping.

Minutes of Second Stakeholder Meeting for Water Supply and Sewerage System Project in Phu Quoc Island, Vietnam in June 2013 by Phu Quoc DPC in collaboration with JICA Preparatory Survey Team

The second stakeholder consultation was conducted at Phu Quoc island on 21 June 2013 before the final report was held at Kiên Giang PPC. The outline is shown in **Table 1**.

Table 1 The outline of stakeholder consultations

	The second (finished)
Purpose	Consultation on the survey result / EIA contents and methods
Date	21/06/2013
Venue	Phu Quoc District PC, Kien Giang province
Theme	- Survey results - Contents of the draft final report
Stakeholder	**Table 2**, etc.

Table 2 The 2nd Stakeholder consultation attendants

Affiliation	No.
District PC	3
Inhabitants	1
KIWACO	3
Phu Quoc National Park	1
Women Union	1
Mass media (television / radio station)	2
PQ Urban Management Department	1
PQ Resource & Environment Department	1
PQ Management Board	1
PQ Economics Department	1
PQ Protection Forest Management Unit	1
PQ Land Budget Development Center	1
Cua Duong commune	1
Cua Can commune	1
PQ Finance & Planning Department	1
Kobe city	1
Kobelco Eco-Solutions Vietnam	5
JICA Survey Team	5
Total	31

In this stakeholder consultation, explanation of the outline of the project and the scoping draft was given by KGPPC. Subsequently, consultation by the attendants was held. Main discussion was focused on the impacts of Cua Can reservoir on the national park or downstream area of the river and on the location of STP. Accordingly, it was explained that; i) the reservoir would be located outside the national park, ii) the reservoir would give no impacts on downstream area, iii) the location of the STP was decided after detailed consideration and consultation. Find Table

3 to explore in greater details.

Table 3 Record of Stakeholder Consultations

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
1	Water supply and sewerage water are very important. JICA should explore more in 633 Master plan and coordinate with Ministry of Agricultural and Rural Development to have a close connection in planning.	PQ Resource & Environment Department	【Answer】(Survey Team) All items of the project are in accordance with Master plan.
2	Sewerage water is bigger than supply water. However, the system supply 20,000 m3/d but only 7,500 m3/d could be drained. Where does the remaining amount of waste water go?		【Answer】(Survey Team) Water supply system distributes water to everywhere with 2 WTP, Duong Dong 16.500m3/d and Cua Can 20.000m3/d. Waste water treatment system is only concentrated at crowded residential area, Duong Dong town. So WWTP is located at Duong Dong town with the capacity of 7,500 m3/d. The service areas for WTP and WWTP are different.
3	The project is allocated with the big area of forest. It's very vital to reconsider this issue.	Cua Duong commune	【Answer】(Survey Team) The project area is designated in the MP which was Prime Minister's decision. With the condition given, the team has been very careful about the construction. If reservoir is designed in a same place with river, the impacts are very huge. So JICA just design the reservoir next to the river. The height of reservoir is 4-8m in comparison with level sea. In addition if digging layer is so deep that it can touch clay, it will affect strongly on absorbent feature and environment. We issued a new design which is just taken a little bit digging soil to construct dam in order to limit the effects on forest.
4	How is sediment treated after long-term use without exist way?		【Answer】(was conducted at a later date) Sediment is not really a worrying problem because the intake water is taken by pump from Cua Can river with low sediment, clear and clean water.
5	What purposes could waste water be supposed to utilize after treatment process?		【Answer】(Survey Team) Treated waste water will be discharged into nearby small river and it's used for irrigating purpose in cultivating agricultural field and/or golf cources.
6	The amount of intake water is very big. Does JICA consider the invasion of sea water?	Phu Quoc National Park	【Answer】(Survey Team) Intake water speed is 0.4 m3/s. It is not big amount as we already explained. Survey team has already investigated and studied very carefully all neighboring areas about the invasion of sea water. Mangrove trees which can grow with water with salinity can be seen even in the river near the reservoir planned site. Invasion of sea water takes place already and we assume that is one of reasons they do not use water for irrigation or other purposes.
7	Sediment is unavoidable problem due to natural sediment. It's not feasible if we don't consider to design the exit way for sediment.		【Answer】(Survey Team) As discussed above, sediment is not a big problem. Sedimentation occurs in any reservoir. However, due to less turbid water of Cua Can river, the problem is rather smaller than others.

No.	Questions/Comments	Stakeholder	Answer· Actions to be taken in the future
8	At Phu Quoc island, rainy season lasts 7 months, while 5 months is duration of dry season. The main intake water source is from river. Lacking of water in dry season is also unavoidable problem.		【Answer】(Survey Team) As explained in the presentation, the annual rainfall is very high. To maintein water for the reservoir, it's just necessary to take a small amount of water only in wet seasons, not in dry seasons.
9	It's necessary to consider water flow and process of water flow in the next 10 or 20 years. The capacity and longevity of facility is also important to be studied whether they can bear at least next 15 years.	KIWACO Phu Quoc	【Answer】(Survey Team) There are two phase of project. Phase 1 with capacity of 4 million m3 and phase 2 with 5 million m3. With this abundant source, it will be no problem to ensure the supply capacity for the project. The longevity will be more than 15 years.
10	Drained water system is planned from North to South but WWTP is set up at Duong Dong town. Survey team should pay more attention to altitude to determine if it's needed to use pump.		【Actions to be taken in the future】 Location for WWTP is a difficult question since almost land in Phu Quoc is occupied. The suggested place is the most feasible site where is large enough for WWTP and could assure to avoid bad odors thanks to buffer zone.
11	Resettlement is considerable issue due to the extremely big amount. Even though survey team chose the best optimum alternative, Cua Duong commune has a large area of pepper. This problem will affect strongly to cultivation and resettlement.	Phu Quoc Management Board	【Answer】(Survey Team) There are 49 household located in the planned area. JICA survey team just made the design which is in accordance with Master Plan. KGPPC will take care of construction, land acquisition and resettlement.
12	Does the border of project include all related items? It's important to ensure isolation feature in planning.		【Answer】(Survey Team) Project land border is just complied with strategic design, not specific design. Therefore it is unable to show if the border is for all project items or for reservoir only. Anyway the buffer zone between the river and the reservoir will be maintained.
13	WWTP is located close to a golf course. The difference in altitude between treatment area and Mr.Lang Beach is concerned. Does it create bad smell in this high-class eco-tourist area?		【Answer】(Survey Team) Investors at Mr.Lang Beach may have their own project of WWTP construction. JICA will implement this project a bit sooner than the investors' projects in order to create better conditions for the project owner to join in the public WWTP. To avoid bad smell, planting green tree and assuring buffer area are suggested.

In addition, anonymous opinions from attendants were collected in order to hear people who may have difficulty to give opinions at the meeting. See details in Table 4.

Table 4 Anonymous Comments submitted after Stakeholder Consultations

Component	Comments	Actions to respond to Comments in the survey
Reservoir	According to the plan, water will be taken from river to support Water Treatment Plant within 7 months for 1 year. So we look at the chart of Annual Water Capacity that show gradually reduce to 2020 – 2030 does Water Treatment Plant have enough the amount to supply for reservoir due to this current situation? Especially Cua Can river is lower and lower the amount of water.	Water intake by the reservoir will occupy only a part of water amount flowing down the river even in years with lower amount and we do not see problems about that. The tendency of rain-water descent is not clear and it is rather a large-area climate issue.
Reservoir	How large area will be taken to build Cua Can reservoir? What kind of benefit of households in project area can take? Is it possible if we arrange household close to reservoir area?	The area will be approximately 200ha. The compensation to the displaced people should be given according to the regulation designated by the government of VN and KG. Urban planning after the reservoir construction is for other projects.
Other	The service area for Duong Dong reservoir is very large which limits residential allocation at Duong Dong town as people live into group and distribute high density along two sides of Duong Dong river. So the planning of these service areas has to be in accordance with Duong Dong master plan upgraded to 2500 ha (at present 800 ha). As Duong Dong residential area has high density of people, I suggest that the current status of Duong Dong town should be remained unchanged. The tentative areas to extend the town should be planned in the areas where population density is low and even no existing residential area in order that the daily life in Duong Dong town's inhabitants is not disordered.	As explained in the presentation, The project's service area does not include Duong Dong town. It will be covered World Bank Project but the support service for Duong Dong town is requested and the Project considers about it. Since the water pollution in Duong Dong River is obvious and introduction of sewer system is urgently needed. The adverse impact to residents will be temporary. In order to improve sanitary environment, cooperation of residents is necessary. As for extension of the town, it should be discussed in an urban planning.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs（1）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N/A (d) N	(a)(b) The reports are to be prepared by a prospected proponent. The draft EIA reports are already prepared. (c) No conditions are expected (d) Development projects in the Buffer Zone area will be admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed on the project components basically. (b) Comments and requests from the stakeholders are already considered and correspondednt in the suvey. The countermeasures are disclosed in reports.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans are explained in the stakeholder meeting and described in the report.
2 Pollution Control	(1) Water Quality	(a) Does the water quality of dam pond/reservoir comply with the country's ambient water quality standards? Is there a possibility that proliferation of phytoplankton and zooplankton will occur? (b) Does the quality of water discharged from the dam pond/reservoir comply with the country's ambient water quality standards? (c) Are adequate measures, such as clearance of woody vegetation from the inundation zone prior to flooding planned to prevent water quality degradation in the dam pond/reservoir? (d) Is there a possibility that reduced the river flow downstream will cause water quality degradation resulting in areas that do not comply with the country's ambient water quality standards? (e) Is the discharge of water from the lower portion of the dam pond/reservoir (the water temperature of the lower portion is generally lower than the water temperature of the upper portion) planned by considering the impacts to downstream areas?	(a) Y (b) N (c) Y (d) N (e) N/A	(a) According to the water quality test results, the water has good quality similar to rainwater. Thus, standards should be complied and nutrient enrichment is not likely to occur in the mean time. (b) Discharging water is not planned. (c) Clearance of vegetation is planned. (d) Intake amount is very limited and no impact is expected on the downstream ares. (e) Discharging water is not planned.
	(2) Wastes	(a) Are earth and sand generated by excavation properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) The excavated solid will be used to create the surrounding bank and large-scale waste is not expected to be produced. In addition, soil is insuficient and sellable in Phu Quoc.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs（2）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project sites are all outside of protected areas. No adverse impacts are expected by the project. The only procedure to be done is to get approval of utilizing areas in the buffer zone of the national park.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the project will adversely affect downstream aquatic organisms, animals, plants, and ecosystems? Are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that installation of structures, such as dams will block the movement of the migratory fish species (such as salmon, trout and eel those move between rivers and sea for spawning)? Are adequate measures taken to reduce the impacts on these species?	(a) N (b) N (c) N (d) N	(a) The sites are all within secondary forests or agricultural lands. (b) No protected habitats are expected and will be examined by field studies. (c) As above (d) The only facility affecting the river is a pumping station, not a weir or dam to impact aquatic creatures. In addition, the intake is planned only in wet season and the amount is limited. No significant impact is expected.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures, such as weirs will adversely affect the surface and groundwater flows (especially in "run of the river generation" projects)?	(a) N	(a) The only facility affecting the river is a pumping station, not a weir or dam to impact aquatic creatures. In addition, the intake is planned only in wet season and the amount is limited. No significant impact is expected.
	(4) Topography and Geology	(a) Is there a possibility that reductions in sediment loads downstream due to settling of suspended particles in the reservoir will cause impacts, such as scouring of the downstream riverbeds and soil erosion? Is there a possibility that sedimentation of the reservoir will cause loss of the storage capacity, water logging upstream, and formation of sediment deposits at the reservoir entrance? Are the possibilities of the impacts studied, and adequate prevention measures taken? (b) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas (especially in run of the river generation projects and geothermal power generation projects)?	(a) N (b) Y	(a) Large-scale sediment intake will not occur because the river water will be pumped up into the reservoir without a weir. (b) Topographic alteration will take place in a large area but impacts to geography environment such as ground water will be minimized by the geographic survey and the carefull designing.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs（3）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) Involuntary resettlement will take place inevitably. Mitigation measures to avoid impacts will be taken in the ARP and compensation will be given in order to minimize the impact to the DPs. (b) Public consultation will be held for PAPs with PMU and LFDC where Resettlement Plan is fully revealed. (c) LFDC usually has a survey about the price of the land, house, etc. every year. Compensation price and rehabilitation will be stipulated in ARP. (d)They pay compensation to the DPs before 30days or more in advance. (e) Compensation Policy is Included in the ARP (f) Special asistance,such as special allowance,vocational training and income restoration for the vulnerable groups are stipulated in ARP. (g) Publec consultation will be held for agreement. (h) PMU will be set up as a main institution. The PMU will be a permanent agency. The budget form PPC will include the cost estimation of ARP. (i) The Monitoring is planned. (j)The grievance redress mechanism will be established in each government levels.
	(2) Living and Livelihood	(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people? (c) Is there any possibility that the project facilities adversely affect the traffic systems? (d) Is there any possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (e) Is the minimum flow required for maintaining downstream water uses secured? (f) Is there any possibility that reductions in water flow downstream or seawater intrusion will have impacts on downstream water and land uses? (g) Is there any possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? (h) Is there any possibility that fishery rights, water usage rights, and common usage rights, etc. would be restricted?	(a) Y (b) Y (c) N (d) N (e) Y (f) N (g) N (h) N	(a) Resettlement will take place and adequate compensation will be given to DPs. (b) Change of land use will take place and adequate compensation will be given to PAPs. (c) The project area does not encompass public roads. (d) The project proponent will have consultation with the Department of Health who has special program for prevention of infectious diseases. (e) The minimum flow will not change. (f) The intake amount is very limited and no impacts are expected. (g) The reservoir is for water supply whose treatment methods include sanitation by chlorination. Water-related diseases will not be introduced. (h) No other water usage rights are approved. The intake amount is very limited and no impacts are expected.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs（4）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The sites are all within secondary forests, agricultural lands or public roads and no heritage exists there.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project is in accordance with the MP which emphasize landscape improvement.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) N/A (b) N/A	(a) One person from ethnic minority has to move out but no unique cuture or lifestyle exist. (b) No unique land or resources exist
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) TCVN 66: 1991: Safety requirements will be complied with. (b) The law mentioned above stipulates safety considerations as well. (c) Adequate program will be held thurough consultation with the authorities concerned from the local PCs. (d) As above
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	(a) Y (b) N/A (c) Y	(a) Any possible impacts are considered and mitigations are suggested in the EMP (b) The sites are all encompassed in secondary forests, agricultural lands or public roads and no impacts on ecosystem are expected. (c) Construction activities can cause inconvenience to inhabitants and the countermeasures are considered in the EMP
	(2) Accident Prevention Measures	(a) Is a warning system established to alert the inhabitants to water discharge from the dam?	(a) N/A	(a) No discharging is planned.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs（5）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan is suggested and described in the Final Report and the draft EIA report. (b) The contents of monitoring are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT (c) The monitoring framework will be fixed as the proponent is nominated and starts the project procedure. (d) Format and frequency of reports are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects in the mountains including large areas of deforestation). (b) In the case of dams and reservoirs, such as irrigation, water supply, and industrial water purposes, where necessary, pertinent items described in the Agriculture and Water Supply checklists should also be checked. (c) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	(a) Y (b) Y (c) N/A	(a) Forestry Projects checklist is also be checked. (b) Water Supply checklist is prepared but not Agriculture because the purpose is only for water supply. (c) Not applicable
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) The project does not have possiblity of significant adverse impacts on transboundary or global issues

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Environmental Checklist: 14. Water Supply（1）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N/A (b) N/A (c) N/A (d) N	(a)(b)(c) The reports are not necessary for this small scale WTP project (d) Development projects in the Buffer Zone area will be admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed on the project components basically. (b) Comments and requests from the stakeholders are already considered and correspondednt in the suvey. The countermeasures are disclosed in reports.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans are explained in the stakeholder meeting and described in the report.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) Y	(a) By complying safety standard concentration of chlorine (i.e. 0.02mg/m3), air pollution should not occur. (b) By using low concentration chlorine (solid type) and installing ventilators, the safety standard will be complied with.
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) N/A	(a) In the current design, no effluents are to be produced. (closed system)
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) The sludge can be disposed in accordance with the regulation but it is valuable resource in PQ or VN and sellable.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) The transmittion pump will be installed in the WTP site being covered with RC walls and noise will not reach the boundary of the site.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N/A	(a) No groundwater will be exploited.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project sites are all outside of protected areas. No adverse impacts are expected by the project. The only procedure to be done is to get approval of utilizing areas in the buffer zone of the national park.

Environmental Checklist: 14. Water Supply（2）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N (d) N	(a) The sites are all within secondary forests, agricultural lands or public roads. (b) No protected habitats are expected and will be examined by field studies. (c) As above (d) Intake is planned only in wet season and the amount is limited. No significant impact is expected.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) Intake is planned only in wet season and the amount is limited. No significant impact is expected and no impact to ground water is expected, either.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N/A (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a) This issue is included in the reservoir component. (b) As above (c) As above (d) As above (e) As above (f) As above (g) As above (h) As above (i) As above (j) As above

Environmental Checklist: 14. Water Supply（3）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	(a) Y (b) N	(a) There is a possiblity that large-scale excabation will affect changes in surrounding areas. In EMP, observation is planned to confirm the circumstances. (b) Intake is planned only in wet season and the amount is limited. The water usage in the downstream area is reported and no significant impact is expected.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The sites are all within secondary forests, agricultural lands or public roads and no heritage exists there.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) WTP will be constructed in a developed land and no necessity for consideration on landscape is expected.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) N/A	(a) One person from ethnic minority has to move out but no unique cuture or lifestyle exist. (b) No unique land or resources exist
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) TCVN 66: 1991: Safety requirements will be complied with. (b) The law mentioned above stipulates safety considerations as well. (c) Adequate program will be held thurough consultation with the authorities concerned from the local PCs. (d) As above
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) N/A (c) Y (d) Y	(a) Any possible impacts are considered and mitigations are suggested in the EMP (b) The sites are all encompassed in secondary forests, agricultural lands or public roads and no impacts on ecosystem are expected. (c) Construction activities can cause inconvenience to inhabitants and the countermeasures are considered in the EMP (d) Construction activities will not be in the town center and no significant traffic congestion is expected.

Environmental Checklist: 14. Water Supply（4）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan is suggested and described in the Final Report and the draft EIA report. (b) The contents of monitoring are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT (c) The monitoring framework will be fixed as the proponent is nominated and starts the project procedure. (d) Format and frequency of reports are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a) Y	(a) The Dam checklist is prepared for the planned reservoir. The River Project checklist is also refered but the project does not have significant impacts that the checklist describe.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) The project does not have possiblity of significant adverse impacts on transboundary or global issues

(1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience
(2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Environmental Checklist: 15. Waste Water Treatment（1）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N/A (d) N	(a)(b) The reports are to be prepared by a prospected proponent. The draft EIA reports are already prepared. (c) No conditions are expected (d) Development projects in the Buffer Zone area will be admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed on the project components basically. (b) Comments and requests from the stakeholders are already considered and correspondednt in the suvey. The countermeasures are disclosed in reports.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans are explained in the stakeholder meeting and described in the report.
2 Pollution Control	(1) Water Quality	(a) Do pollutants, such as SS, BOD, COD, pH contained in treated effluent from a sewage treatment plant comply with the country's effluent standards? (b) Does untreated water contain heavy metals?	(a) Y (b) N	(a) It is designed that the water quality of the effluent comply with the standard by adequate treatments. (b) It does not contain heavy metals because industrial wastewater is not a target.
	(2) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's standards?	(a) Y	(a) The sludge is planned to be treated to come into comliance with the standards.
	(3) Soil Contamination	(a) If wastes, such as sludge are suspected to contain heavy metals, are adequate measures taken to prevent contamination of soil and groundwater by leachates from the wastes?	(a) N/A	(a) Heavy metals will not be accepted.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as sludge treatment facilities and pumping stations comply with the country's standards?	(a) Y	(a) Noise and vibrations in the STP will be reduced enough by coverage and buffer zones. Pumping stations are small facilities built underground and no impacts are expected.
	(5) Odor	(a) Are adequate control measures taken for odor sources, such as sludge treatment facilities?	(a) Y	(a) Odor reduction is carefully considered including closed system.

Environmental Checklist: 15. Waste Water Treatment（2）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project sites are all outside of protected areas. No adverse impacts are expected by the project.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N (d) N	(a) The sites are all within secondary forests, agricultural lands or public roads. (b) No protected habitats are expected and will be examined by field studies. (c) As above (d) A stream to be discharged is so small that it is dry up in dry seasons and no aquatic organisms inhabit continuously. In addition, the effluent will be clean enough to comply the environmental standards.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N/A (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a) Resettlement is not expected in the meantime. (b) As above (c) As above (d) As above (e) As above (f) As above (g) As above (h) As above (i) As above (j) As above
	(2) Living and Livelihood	(a) Is there a possibility that changes in land uses and water uses due to the project will adversely affect the living conditions of inhabitants? (b) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(a) (b)	(a) Land use for STP is limited and in a developing area, a stream to be discharged is to small to use. Thus, changes does not affect the living conditions of inhavitants. (b) When construction, temporary impacts are expected and mitigation measures are considered in EMP.

Environmental Checklist: 15. Waste Water Treatment（3）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The sites are all within secondary forests, agricultural lands or public roads and no heritage exists there.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The STP will be built in woods and buffer zones, so it does not affect the landscape.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to lands and resources respected?	(a) N (b) N/A	(a) The sewer system project does not have any impact to ethnic minority or indigenous peoples. (b) No unique land or resources exist
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) TCVN 66: 1991: Safety requirements will be complied with. (b) The law mentioned above stipulates safety considerations as well. (c) Adequate program will be held thurough consultation with the authorities concerned from the local PCs. (d) As above

Environmental Checklist: 15. Waste Water Treatment（4）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) N/A (c) Y (d) Y	(a) Any possible impacts are considered and mitigations are suggested in the EMP (b) The sites are all encompassed in secondary forests, agricultural lands or public roads and no impacts on ecosystem are expected. (c) Construction activities can cause inconvenience to inhabitants and the countermeasures are considered in the EMP (d) The roads in the targeted town are wide enough to keep space for trafic and no significant traffic congestion is expected.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan is suggested and described in the Final Report and the draft EIA report. (b) The contents of monitoring are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT (c) The monitoring framework will be fixed as the proponent is nominated and starts the project procedure. (d) Format and frequency of reports are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT
6 Note	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) The project does not have possiblity of significant adverse impacts on transboundary or global issues

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropria environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Environmental Checklist: 17. Forestry（1）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N/A (d) N	(a)(b) The reports are to be prepared by a prospected proponent. The draft EIA reports are already prepared. (c) No conditions are expected (d) Development projects in the Buffer Zone area will be admitted by Decree No.23/2006/ND-CP and the approval shall be given through application by NPMB and local PC.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed on the project components basically. (b) Comments and requests from the stakeholders are already considered and correspondednt in the suvey. The countermeasures are disclosed in reports.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans are explained in the stakeholder meeting and described in the report.
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as dust, soot and dust, sulfur oxides (SOx), nitrogen oxides (NOx), and organic chemical substances emitted from various sources, such as logging operations, forest products manufacturing processes, and incinerators comply with the country's emission standards and ambient air quality standards? Are any mitigating measures taken?	(a) N	(a) Limited exhaust gas from maxhines for logging is expected but not influential in light of the large area. logs are planned to be sold and not to be producted or incinerated to emit harmful substances.
	(2) Water Quality	(a) Is there a possibility that the use of chemicals, such as fertilizers, and agrochemicals will cause water pollution? (b) Where facilities, such as forest products manufacturing facilities are installed, do effluents from the facilities comply with the country's effluent standards and ambient water quality standards?	(a) N (b) N	(a) There are limited livestooks and fields in the target area and no significant chemical usage are found. (b) There is no manufacturing facility in the area.
	(3) Wastes	(a) Are wastes properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) The logs are to be sold and the soil is to be used for building banks. No significant wastes are expected but if any, they will be disposed in dumping sites to legally.
	(4) Soil Contamination	(a) Are adequate measures taken to prevent contamination of soil and groundwater by use of chemicals, such as agrochemicals? (b) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans?	(a) N (b) N/A	(a) It is not planned to use chemicals. (b) As above

Environmental Checklist: 17. Forestry（2）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project sites are all outside of protected areas. No adverse impacts are expected by the project. The only procedure to be done is to get approval of utilizing areas in the buffer zone of the national park.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation? (d) Is there a possibility that a large-scale timber harvesting will result in loss of breeding and feeding grounds for wildlife? (e) In the case of reforestation projects, is there a possibility that mono-species plantations will adversely affect wildlife habitats? Is there a possibility that mono-species plantations will cause outbreaks of pests? (f) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (g) Isn't an illegal deforestation associated with the project being carried out, or is an acquisition of the forest certification by the project proponent being carried out?	(a) N (b) N (c) Y (d) N (e) N/A (f) N (g) N	(a) The sites are all within secondary forests, agricultural lands or public roads. (b) No protected habitats are expected and will be examined by field studies. (c) The issue should be studied in the EIA. (d) Wildlife is not expected and will be examined by field (e) No reforestation is planned. (f) No protected habitats are expected and will be examined by field studies. (g) Deforestation will be conducted by the project proponent after legal land acquisition.
	(3) Hydrology	(a) Is there a possibility that alteration of rainwater runoff and runoff characteristics due to a large-scale timber harvesting and access road construction will cause impacts on the hydrology of the surrounding areas? (b) Is there a possibility that decreased water retention capacity due to deforestation will affect the existing drainage patterns of the forest?	(a) N/A (b) N/A	(a) Building a reservoir does not cause rainwater runoff (b) Building a reservoir does not cause dexreasing water retention capacity.
	(4) Topography and Geology	(a) Is there a possibility that loss of forest stability due to timber harvesting will cause slope failures or landslides?	(a) N/A	(a) The site is flat and has no slopes.
	(5) Management of Abandoned Sites	(a) Are adequate restoration and revegetation plans considered for the harvested areas? In particular, are adequate measures taken to prevent soil runoff from the harvested areas? (b) Is a sustainable management system for the harvested areas established? (c) Are adequate financial provisions secured to manage the harvested areas?	(a) Y (b) Y (c) Y	(a) The reservoir is a permanent land use and managed by PMU (b) As above (c) As above

Environmental Checklist: 17. Forestry（3）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) Involuntary resettlement will take place inevitably. Mitigation measures to avoid impacts will be taken in the ARP and compensation will be given in order to minimize the impact to the DPs. (b) Public consultation will be held for PAPs with PMU and LFDC where Resettlement Plan is fully revealed. (c) LFDC usually has a survey about the price of the land, house, etc. every year. Compensation price and rehabilitation will be stipulated in ARP. (d)They pay compensation to the DPs before 30days or more in advance. (e) Compensation Policy is Included in the ARP (f) Special asistance,such as special allowance,vocational training and income restoration for the vulnerable groups are stipulated in ARP. (g) Publec consultation will be held for agreement. (h) PMU will be set up as a main institution. The PMU will be a permanent agency. The budget form PPC will include the cost estimation of ARP. (i) The Monitoring is planned. (j)The grievance redress mechanism will be established in each government levels.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? Is particular attention paid to the inhabitants whose livelihoods are based on primary industries, such as farming, raising livestock, or hunting and gathering in the forests? (b) Are adequate measures taken to prevent illegal entry into the forestry resource areas from the outside through newly constructed access roads? (c) Is there a possibility that the forest right of common is obstructed? (d) Are considerations given to life of residents before implementation of project?	(a) Y (b) Y (c) N/A (d) Y	(a) Resettlement will take place and adequate compensation will be given to DPs. (b) Securities are considered in the EMP and will be conducted. (c) The forest will change into a reservoir. (d) ARP will manage all necessary action for PAPs in advance of the project implementation.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The sites are all within secondary forests, agricultural lands or public roads and no heritage exists there.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project is in accordance with the MP which emphasize landscape improvement.

Environmental Checklist: 17. Forestry（4）

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) One person from ethnic minority has to move out but no unique cuture or lifestyle exist. (b) No unique land or resources exist
4 Social Environment	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) TCVN 66: 1991: Safety requirements will be complied with. (b) The law mentioned above stipulates safety considerations as well. (c) Adequate program will be held thurough consultation with the authorities concerned from the local PCs. (d) As above
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) N/A (c) Y	(a) Any possible impacts are considered and mitigations are suggested in the EMP (b) The sites are all encompassed in secondary forests, agricultural lands or public roads and no impacts on ecosystem are expected. (c) Construction activities can cause inconvenience to inhabitants and the countermeasures are considered in the EMP
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan is suggested and described in the Final Report and the draft EIA report. (b) The contents of monitoring are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT (c) The monitoring framework will be fixed as the proponent is nominated and starts the project procedure. (d) Format and frequency of reports are specified at Article 25 [11]; Circular 12/2011/TT-BTNMT
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Agriculture checklist should also be checked.	(a) N/A	(a) The reservoir is only for water supply, not for agriculture.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) The project does not have possiblity of significant adverse impacts on transboundary or global issues

1) Regarding the term “Country's Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.