7. Natural Condition Survey

7.1. Outline of Myanmar's Natural Condition

Myanmar is located in a tropical climate, and there are two seasons: South West (SW) monsoon and North East (NE) monsoon. Rainy season is from June to October under the SW monsoon and dry season is from November to March under the NE monsoon. April and May between the SW and NE monsoons are hot.

7.1.1. Climate Condition

Weather conditions are observed by the Department of Meteorology and Hydrology (DMH) under the Ministry of Transport (MOT). DMH has over 100 observation stations at the whole area of Myanmar. At the stations, many instruments, facilities and equipment were installed during the period of the rule by the United Kingdom, and these instruments are still being used today. DMH provides the following services:

- Observation of weather conditions, Hydraulic conditions and Earthquake
- Prevention of disaster, Issue of Alarm
- Information services to relevant organizations related to air, sea and river transport

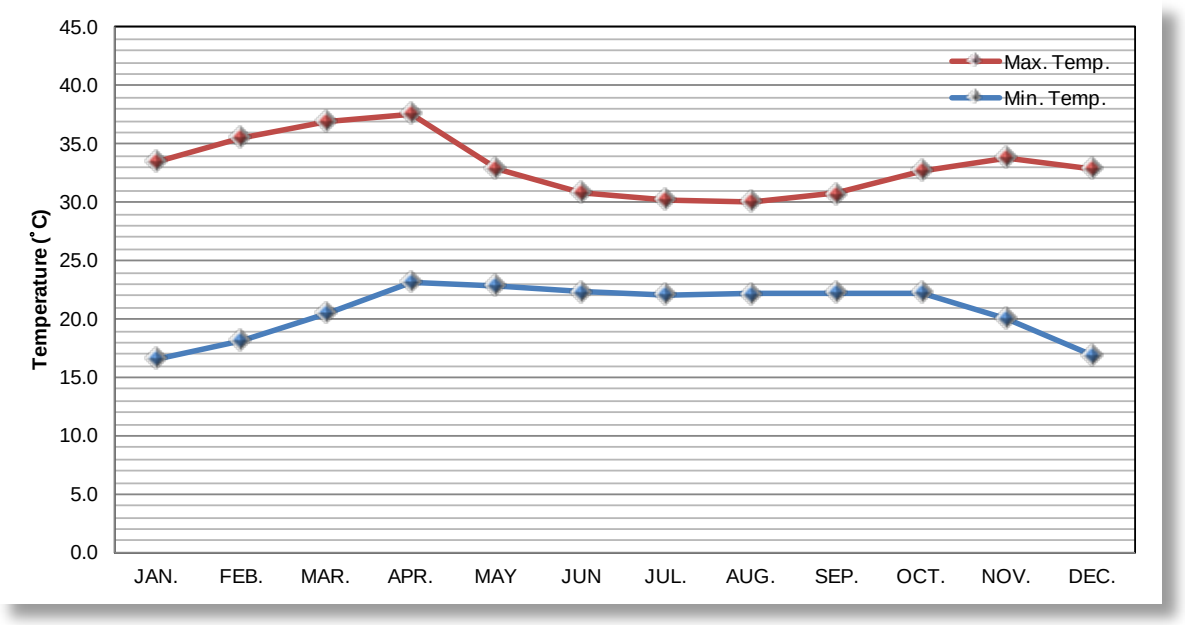
Weather conditions (temperature, rainfall, wind direction/speed and others) are not observed at Thilawa Area, but are observed at Yangon Airport and Yangon Branch Office of DMH (Lat: 16°52' N Long: 96°10' E) . However, hydraulic conditions such as current, water level and water volume are not observed by DMH.

From the observation data by DMH from 1999 to 2008, the characteristics of the weather station are summarized as follows:

Monthly average maximum temperature is highest in April. It is lowest from June to September because of heavy rain. Monthly average minimum temperature in December and January is lower, and day-night difference is larger than months (refer to Figure 7.2-1).

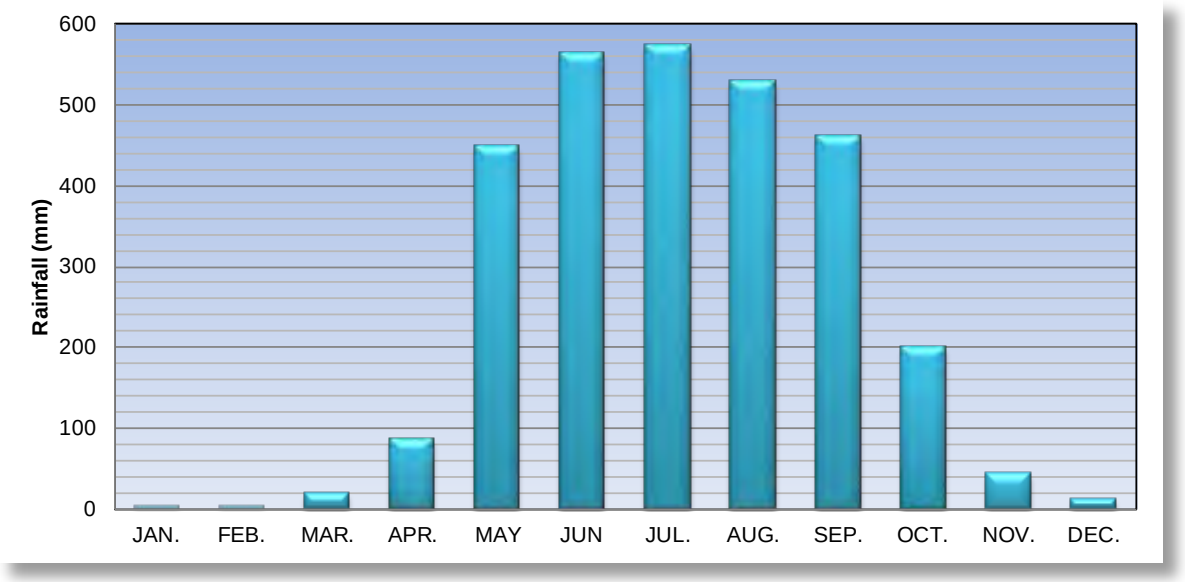
Yearly average of rainfall is about 3000mm in Yangon. There is often no rain in the dry season from December to February. Monthly rainfall is over 500mm in the rainy season from June to August (refer to Figure 7.2-2).

When cyclone Nargis attacked to Yangon on 3rd May 2008, wind speed was recorded at 96.0 mile/hour (=43m/s). Normally the maximum wind speed is 21.6 mile/hour (=10m/s) , and average wind speed in May is 2.5 to 3.5m/s only.



Souse: JICA Study Team based on DMH data

Figure 7.1-1 Monthly Average Maximum/Minimum Temperature (degrees C)



Souse: JICA Study Team based on DMH data

Figure 7.1-2 Monthly Rainfall (mm)

7.1.2. Hydraulic Condition

(1) Tide

Myanma Port Authority (MPA) and Navy issue the tide table for Yangon Port, respectively.

The table of MPA is made by India estimated by the observation data at Sule Pagoda Wharves and Elephant Point. The table of Navy is estimated by his own observation and analysis.

Because MPA observed the tide in daytime visually in Yangon, JICA procured and assisted with the installation of an automatic tide observation instrument at Monkey Point and Myanmar International Terminals Thilawa (MITT) in 2009. From the analyzed result of recorded data, the following has been clarified.

- Accuracy of MPA tide table is higher than Navy's one.
- Error at the high tide and low tide is several dozen centimeters and minutes.
- Deference of mean water level is 70cm between rainy season and dry season.

ATG by JICA (MITT)

Visual Observation (Monkey Point)

(Prepared by the Study Team)

Figure 7.1-3 Tide Observation Equipment

(2) Wave

Since there are no observed data offshore or along the Yangon River, estimated data referred to the data at the Yangon River mouth (16.172N, 96.680E) made by Met office in UK. It has estimated data for every three housr for one year from 1st January to 31th December in 2010. Since there are vast shallow areas at offshore of the Yangon River, wave height is not so large but the period is long.

Table 7.1-1 Wave Conditions

	Total significant wave (meters)	Peak period (seconds)	Mean period (seconds)
Max.	1.78	20.0	14.0
Min.	0.15	3.0	2.6
Average	0.64	13.1	7.1

Source : JICA Study Team based on Met Office

(3) Bathymetric Survey

Chart Maps issued for Yangon Port and approach channel are very old. MPA periodically carries out the bathymetric survey for maintenance dredging at approach channel, but it does not cover the entire area. Thus, exact water depth offshore and of the Yangon River are not known exactly.

(4) Current, Water Volume, Salinity

There are no issued data of the current, water volume, and salinity for the Yangon River. The Yangon River is a tidal river and the tidal range reaches 6m at spring tide, and the current is very fast: maximum 6 knots/hr.

7.1.3. Elevation

Referring elevation level used in port is not same as that of the land area, which is normal not only in Myanmar but also in many other countries. MPA uses Chart Datum Level (CDL) and others use Mean Sea Level (MSL). The difference between CDL and MSL is 2.979m in Yangon Port.

Control point for CDL is located between Pansodan Jetty and the MPA Head Quarter. Tide Table issued by MPA and Navy is based on the CDL. On the other hand, the MSL is similar to Japanese TP; it was established during the period of rule by the United Kingdom, based on the mean sea level observed around Molamyain in Mon States. The control point is distributed nationwide. But the observation point no longer remains. The control points are managed by Survey Department, Ministry of Agriculture and Irrigation.

In this report, the elevation refers to CDL without any notes, since this Study is port related.

7.2. Soil Investigation

7.2.1. Objective

Soil Investigation is carried out to obtain the necessary data and information used for the planning and design of Jetty, Yard, Channel and Offshore Pilot Station for the project. The work was performed by a local subcontractor. This report summarized the soil conditions based on the soil investigation results. The detailed result is described in the report submitted by a local subcontractor.

7.2.2. Location

The location of the soil investigation is mainly divided in three (4) areas, Jetty area (Figure7.2-1), Yard area (Figure7.2-2), Channel and Offshore Pilot Station area (Figure7.2-3). For the work of Jetty area, SEP (Self Elevated Platform) is used for 18 points in water work, and land platform is used for remaining 6 points. For the work of Yard area, land platform is used for all points. For the work of Channel and Offshore Pilot Station area, SEP is used for all points.

Figure 7.2-1 Location Map of Jetty Area

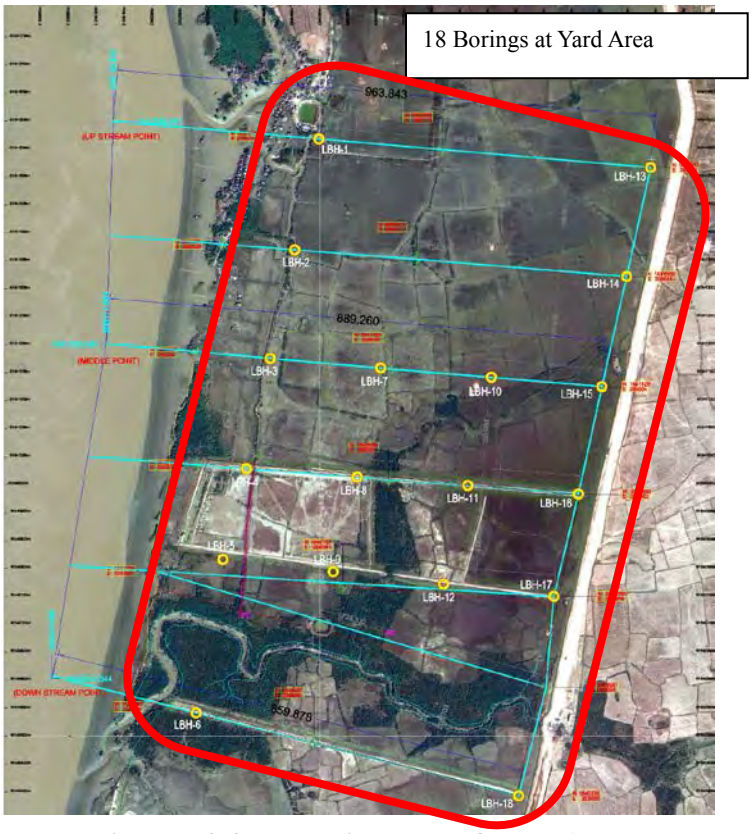


Figure 7.2-2 Location Map of Yard Area

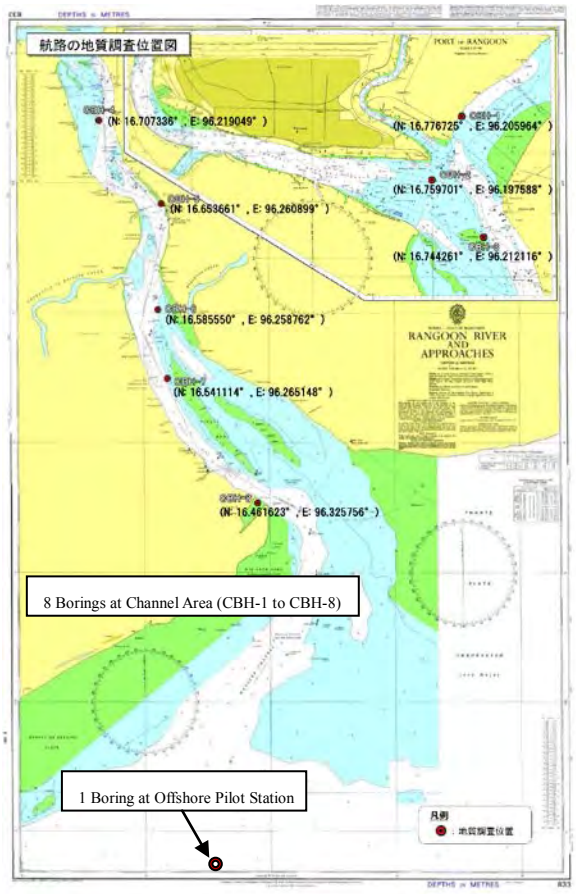


Figure 7.2-3 Location Map of Channel Area and Offshore Pilot Station

7.2.3. Item and Quantity of Soil Investigation

The item and quantity of soil investigated for Jetty area, Yard area, Channel area and Pilot Station are shown in Table7.2-1.

Table 7.2-1 Item and Quantity

NO	DESCRIPTION	UNIT	Quntity				REMARKS
			Jetty Area	Yard Area	Channel Area	Pilot Station	
A	**Boring and field investigation**						SEP (Self Elevated Platform) is used for offsore boring work
1	Rig set up	Point	24	18	8	1	
2	Boring 0 to 10m	meter	240	180	80	10	
3	Boring 10 to 20 m	meter	240	180	-	10	
4	Boring 20 to 30m	meter	240	180	-	10	
5	Boring 30 to 40m	meter	-	-	-	10	If required
6	Boring 40 to 50m	meter	-	-	-	7	If required
7	Standard Penetration Testing	Nos.	648	486	64	41	
8	Undisturbed sample taking in soft soil	Nos.	72	54	16	6	
9	Water level measuring and sample taking	Nos.	-	18	-	-	
B	**Laboratory Testing for Soil**						
1	Natural Moisture Content	Nos.	144	108	24	12	
3	Specific Gravity	Nos.	144	108	24	12	
4	Plastic Limit	Nos.	144	108	24	12	
5	Liquid Limit	Nos.	144	108	24	12	
6	Seive analysis	Nos.	216	152	32	12	
7	Hydrometer	Nos.	144	108	24	12	
8	Unit weight	Nos.	72	54	16	5	
9	Unconfined compressive strength	Nos.	72	54	16	5	
10	One-dimensional consolidation	Nos.	36	54	-	3	
11	Direct shear test (UU)	Nos.	24	18	5	2	
12	Water quality analysis	sample	-	6	-	-	

7.2.4. Results of Soil Investigation

In this report, the summary of soil investigation result, soil profile and soil characteristics is described based on obtained data for Jetty, Yard, Channel area and Offshore Pilot Station respectively. Representative soil profile at the objective area and soil property are described for each area, Jetty area and Yard area. The detailed of the results is described in the report submitted by a local subcontractor as attached.

(1) Soil profile

1) Jetty Area

Soil profile drawn based on soil investigation result carried at Jetty area is shown in Figure7.2-4~Figure7.2-6. Figure7.2-4 shows soil profile along the berth face line. Figure7.2-5 shows

soil profile along the revetment face line. Figure7.2-6 shows the cross section from land side to river side.

Soft clay layer is distributed over the top approximately horizontally with a thickness of 15m to 17m at the river side and 20m to 23m at the land side. The SPT N-value is 1 to 3, the clay is very soft to soft.

Under the soft clay layer, silty clay layer is distributed with a thickness of 3m to 6m. The N-value is approximately 10, the silty clay is medium stiff to stiff.

Under the silty clay layer, silty sand layer is distributed heterogeneously and sand layer is confirmed at the lowest layer. The sand layer mainly consists of fine sand. The N-value widely ranges from 20 to 50, the sand is medium dense to dense. The N-value tends to increase toward a deep direction.

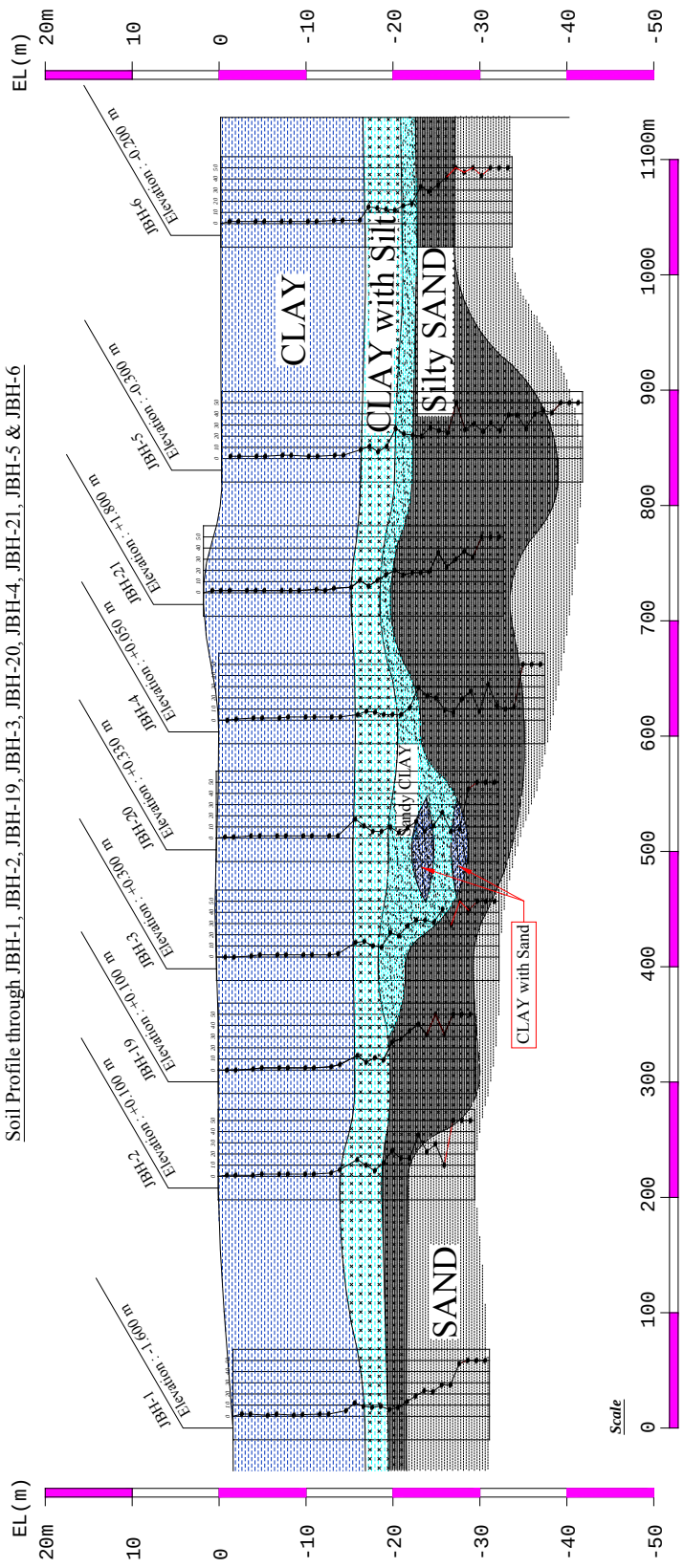


Figure 7.2-4 Soil Profile at Berth Front Line (Jetty area)

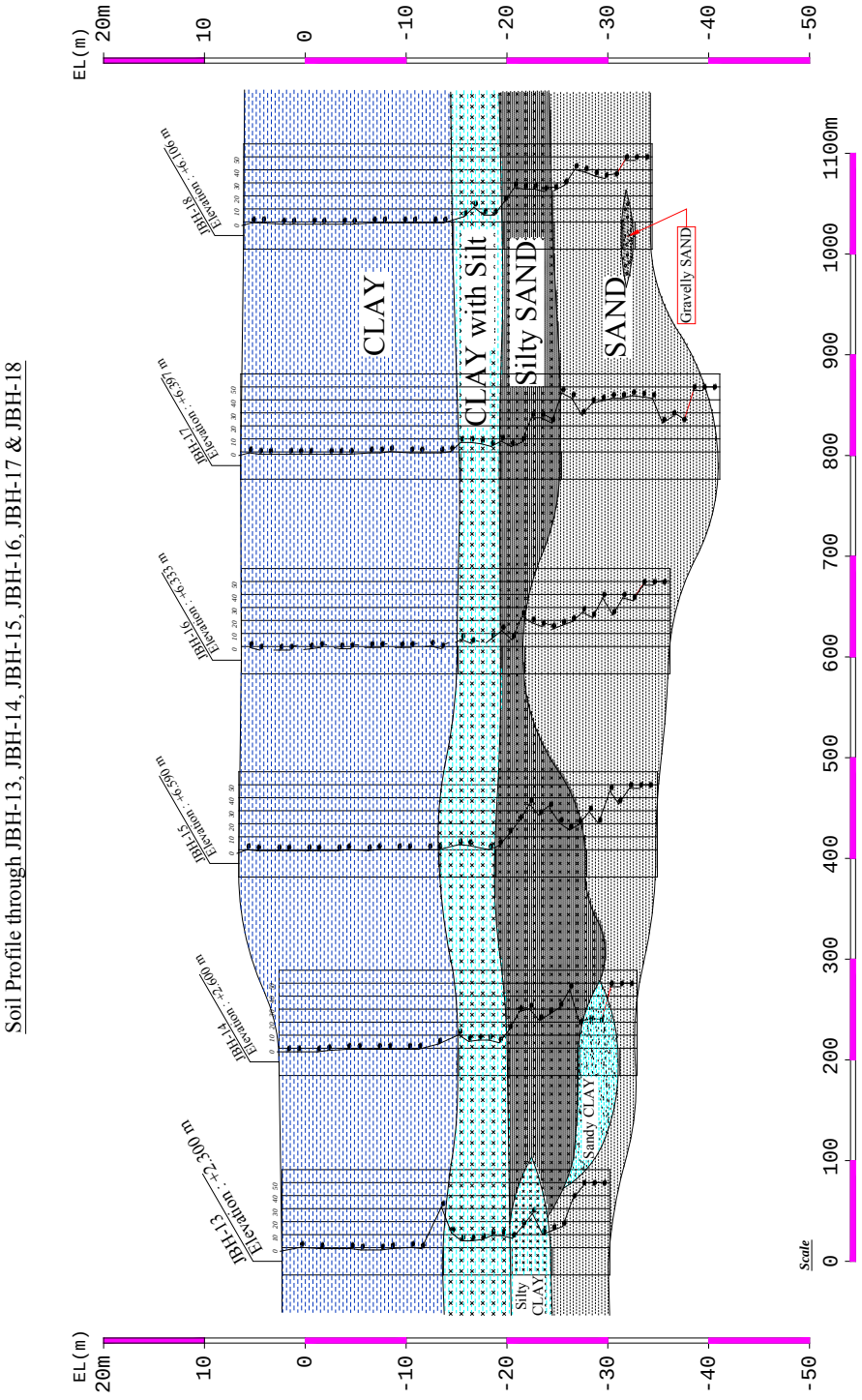


Figure 7.2-5 Soil Profile at Revetment Front Line (Jetty area)

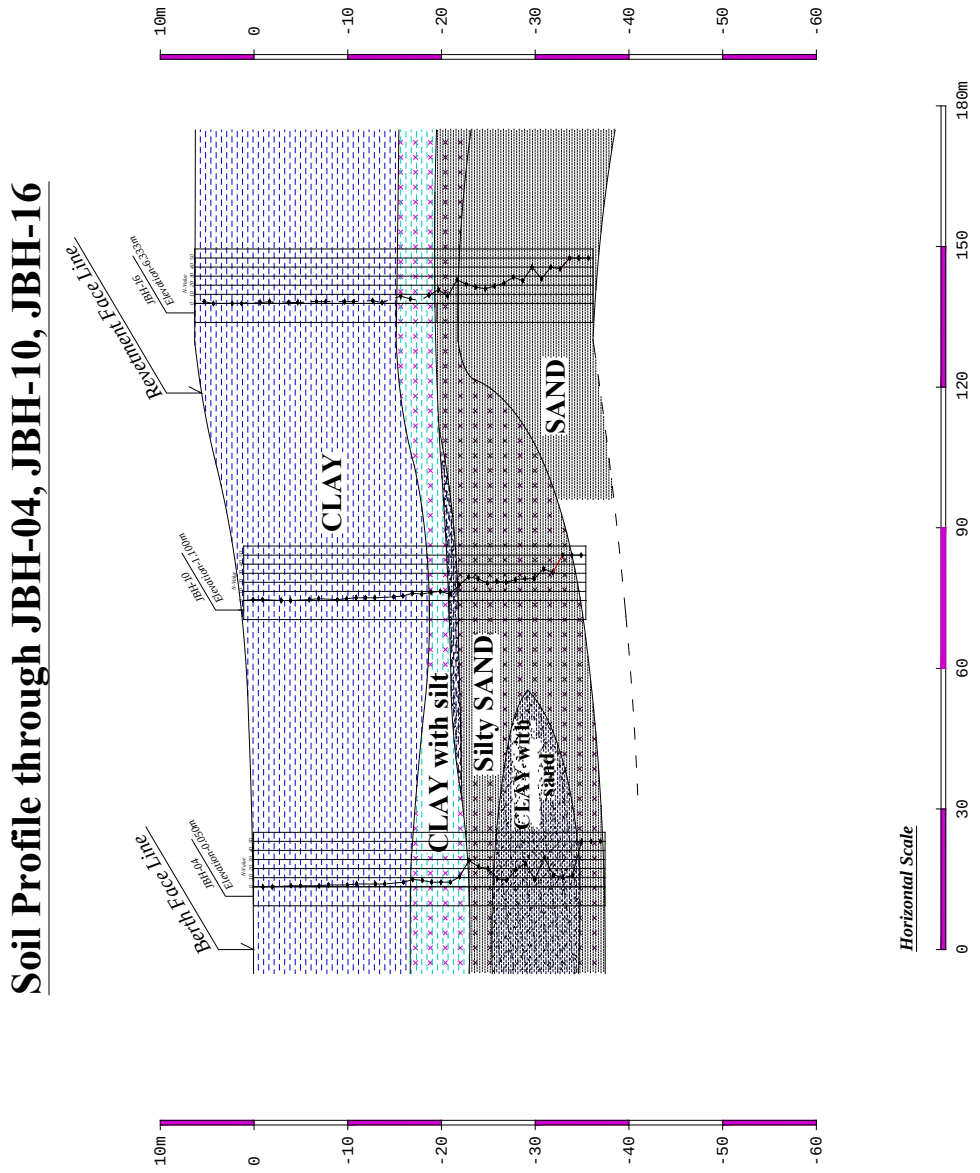


Figure 7.2-6 Soil Profile from Land to River (Jetty area)

2) Yard Area

The representative soil profile from land to river side drawn based on soil investigation result is shown in Figure7.2-7. The soil distributing condition is same as one of Jetty area. The upper layer is clay layer distributing approximately horizontally with a thickness of 19m to 23m. The N-value is 1 to 3, the clay is very soft to soft.

Under the clay layer, stiff silty clay layer is confirmed approximately horizontally with a thickness of 3m to 5m. The N-value is around 10, the silty clay is stiff.

Under the silty clay layer, silty sand layer is distributed heterogeneously. Since the silty sand layer consists of silt and sand, the layer boundary is not confirmed clearly. The N-value is 10 to 20.

The sand layer confirmed at the lowest layer. The sand layer mainly consists of fine sand. The N-value ranges from 20 to 50, the sand is medium dense to dense. The N-value tends to increase toward a deep direction.

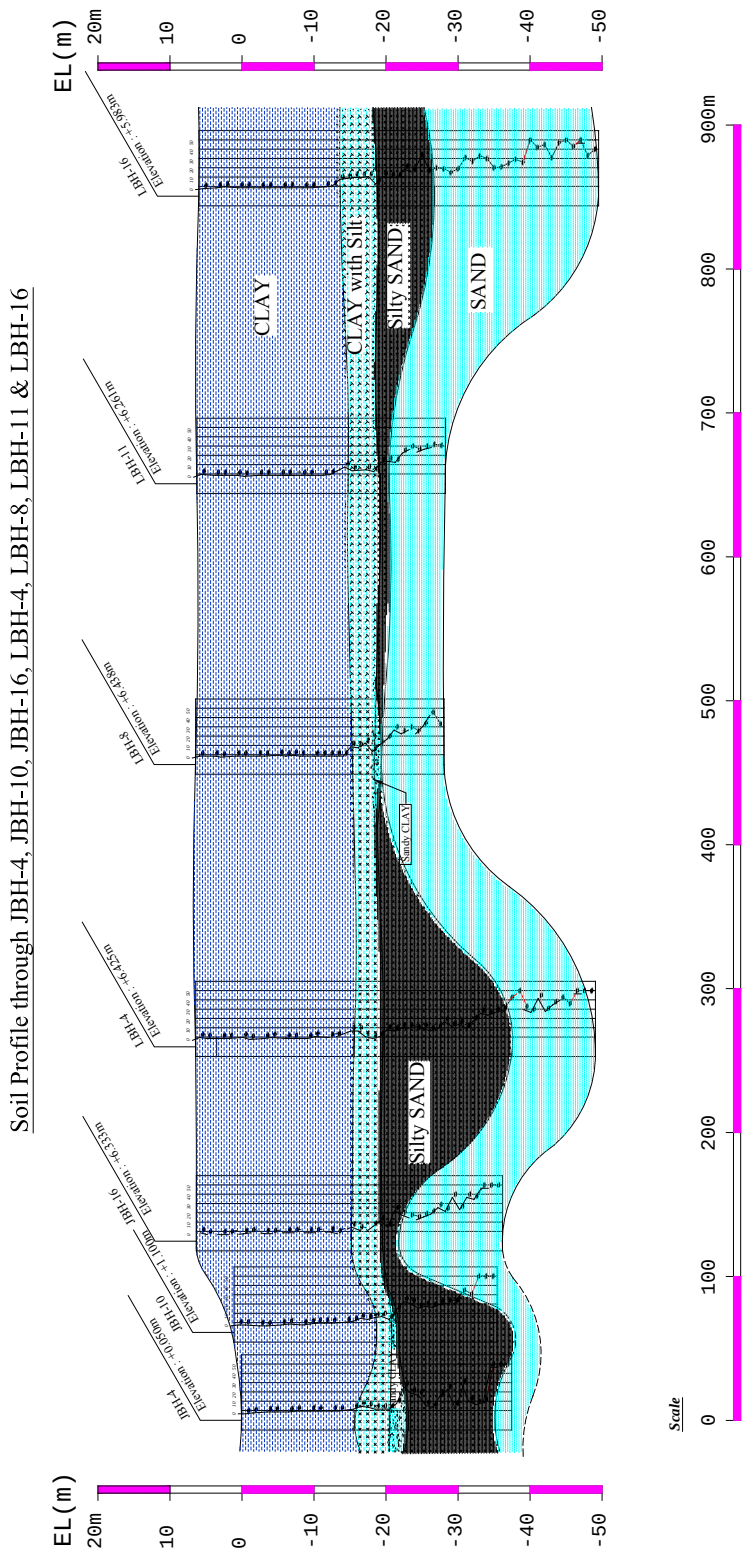


Figure 7.2-7 Soil Profile at Yard Area

3) Channel Area

Eight (8) pints of soil investigations in total were carried out for Channel area. The survey area is very wide, the drilling depth is very shallow and the ground height of each points are heterogeneous. Therefore, soil profile drawn based on those data is not useful. Just schematic view of the situation of the all points is shown in Figure7.2-8. Following soil type are confirmed.

- SAND
- CLAY
- Sandy CLAY
- CLAY with silt
- Silty SAND

As shown in Figure7.2-8, the difference of ground height between the survey points is up to around 5m and soil composition of each point is also not uniformed. For a tendency, sand is deposited mainly at upstream side and clay is mainly deposited at downstream side.

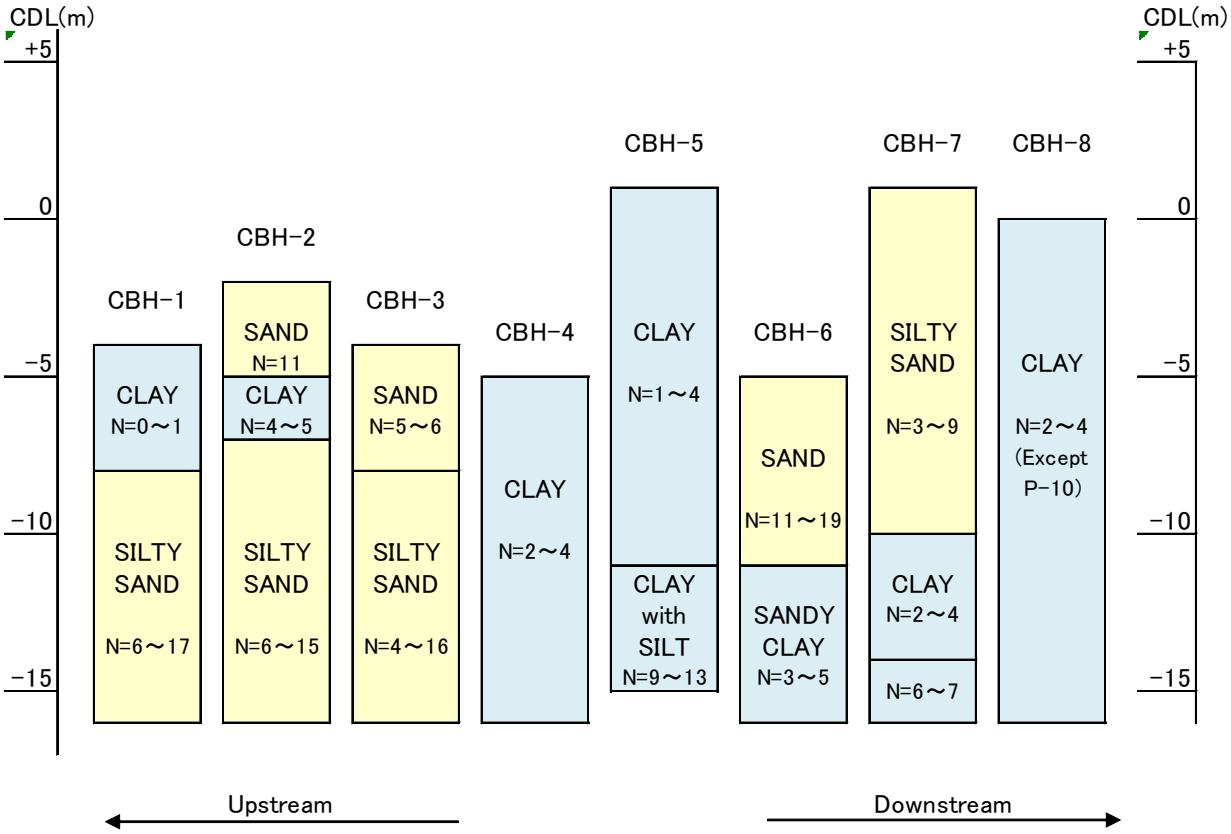
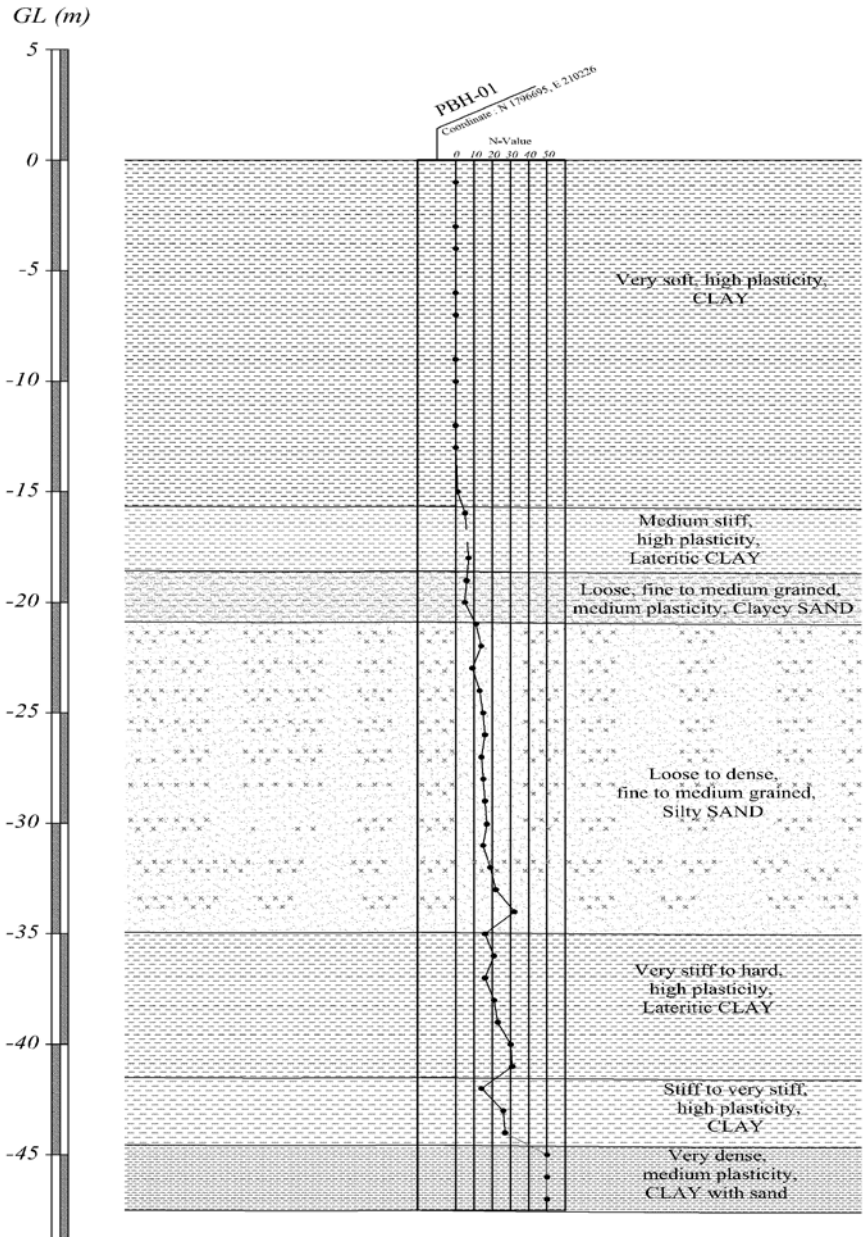


Figure 7.2-8 Schematic view of soil condition for Channel area

4) Offshore Pilot Station

One (1) number of soil investigation was carried out at Pilot Station area as shown in Fig 7.2-3. Soil profile is shown in Fig 7.2-9. Seven (7) numbers of soil layers are confirmed as followings.

- CLAY
- Lateritic CLAY
- Clayey SAND
- Silty SAND
- Lateritic CLAY (Lower)
- CLAY (Lower)
- CLAY with SAND



(Prepared by the Study Team)

Figure 7.2-9 Soil Profile at Offshore Pilot Station

(2) Soil laboratory Test Result

1) Jetty Area

The summary of soil laboratory test result carried out for boring sample is shown in Table7.2-2. Soil property is shown in Figure7.2-10 to Figure7.2-21.

Table 7.2-2 Summary of Soil Laboratory Test Result

Test Item	Description of Test Result	Figure No
Natural Water Content w(%)	For upper clay layer distributing widely at the area, water content ranges from 30% to 60%. For stiff silty clay layer, silty sand and sand layer, water content ranges from 20% to 30%.	7.2-10
Unit Weight γ(kN/m^3)	For upper clay layer, unit weight ranges from 16kN/m^3 to 18kN/m^3. For stiff silty clay layer, unit weigh is approximately 20kN/m^3.	7.2-11
Void Ratio (e)	For upper clay layer, void ratio ranges from 1.00~1.60. For lower clay layer, it ranges from 0.8 to 1.0.	7.2-12
Liquid Limit W_L (%)	For upper clay layer, Liquid limit is approximately 40% to 80%, a little bigger than natural water content. For stiff silty clay layer, Liquid limit ranges from 30% to 40%, a little low.	7.2-13
Plastic Limit W_P (%)	For upper clay layer, Plastic limit is approximately 25%. For stiff silty clay layer, it is approximately 15%, a little low.	7.2-14
Plasticity Index I_P	For upper clay layer, Plasticity index ranges 20 to 50. For stiff silty clay layer, it ranges from 15 to 25, a little low.	7.2-15
Grain size : Fine content Fc (%)	For gain size test, fine content (less than 74 μ m) is examined. For upper clay layer, fine content is 100%. For sand layer, fine content ranges from 10% to 40%.	7.2-16
Specific Gravity Gs	For clay layer, specific gravity ranges from 2.69~2.78, for sand layer, specific gravity is approximately 2.69.	7.2-17
Unconfined Compression Strength qu(kN/ m^2)	For upper clay layer, qu ranges from 50kN/ m^2 to 100 kN/ m^2 which tend to increase toward a deep direction. For stiff silty clay layer, qu ranges from 100kN/ m^2 to 130 kN/ m^2.	7.2-18
Direct Shear Strength Cuu (kN/m^2)	This test is carried out for upper clay layer with Un-drained condition. Cohesion (Cuu) ranges from 20kN/m^2 to 30kN/m^2.	7.2-19
Pre-consolidation Yield Stress Py (kN/m^2)	For upper clay layer, Py ranges from 100 kN/m^2 to 180 kN/m^2 which distribute with depth widely. For stiff silty clay layer, Py is 260 kN/m^2, very high.	7.2-20
Compression Index (Cc)	For upper clay layer, Cc ranges from 0.4 to 0.8. For stiff silty clay layer, Cc is approximately 0.2.	7.2-21

(Prepared by the Study Team)

＜Jetty Area＞

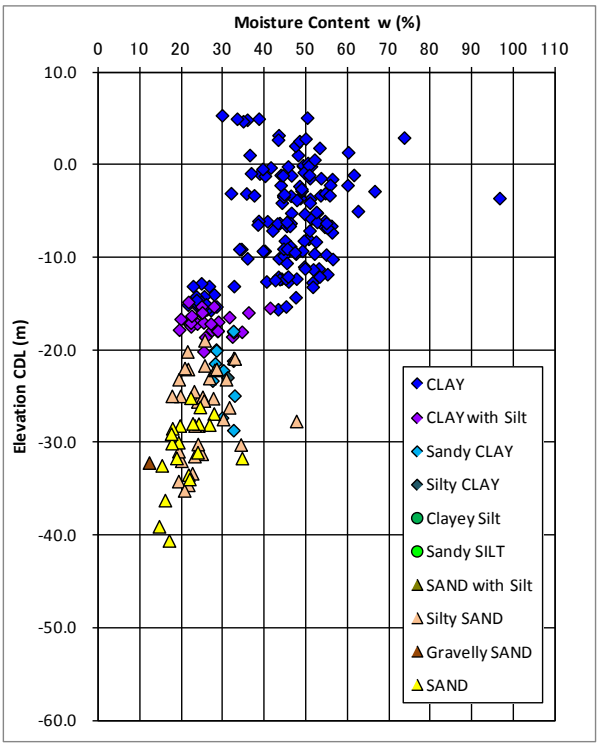


Figure 7.2-10 Water content (w) with Depth

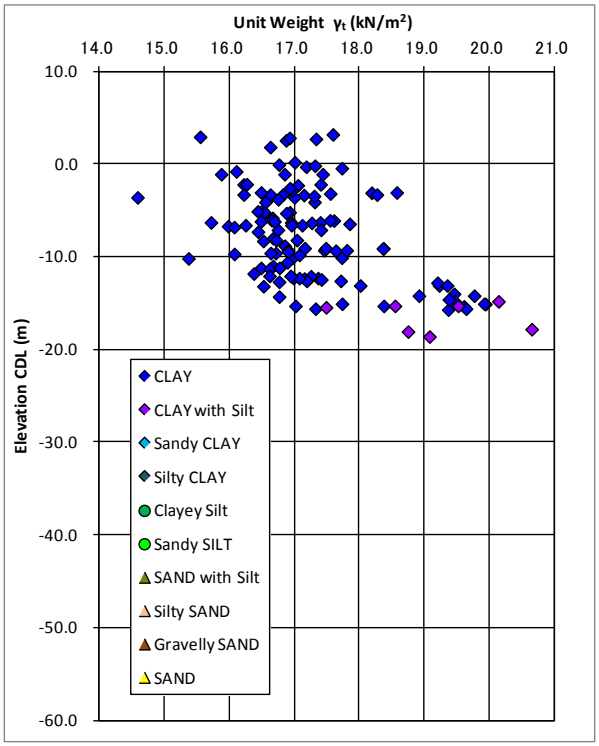


Figure 7.2-11 Unit weight(γ) with Depth

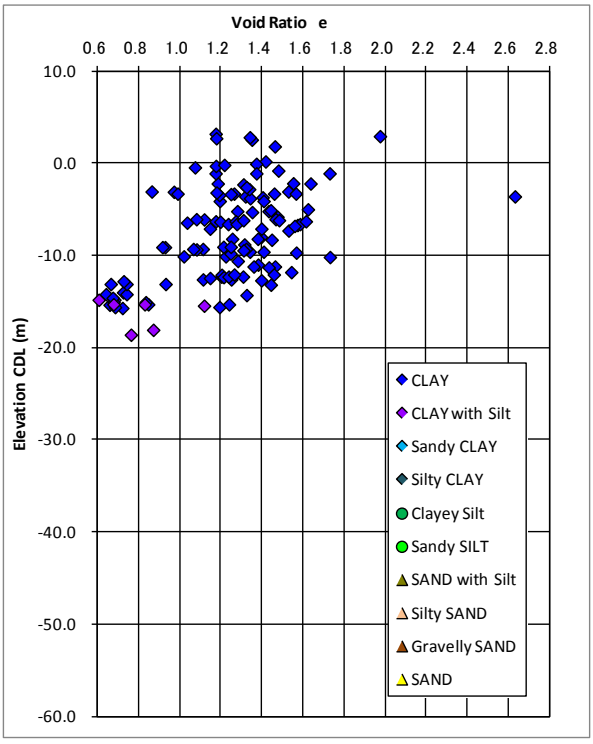


Figure 7.2-12 Void Ratio(e) with Depth

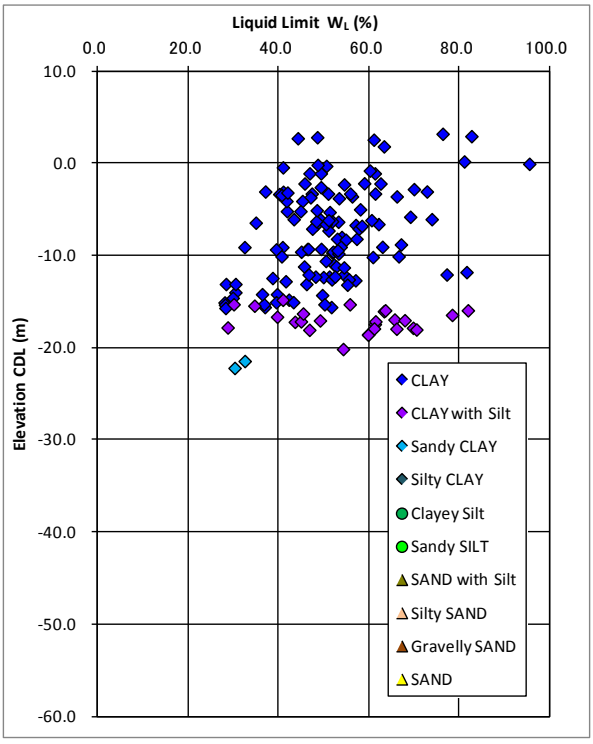


Figure 7.2-13 Liquid Limit(W_L) with Depth

＜Jetty Area＞

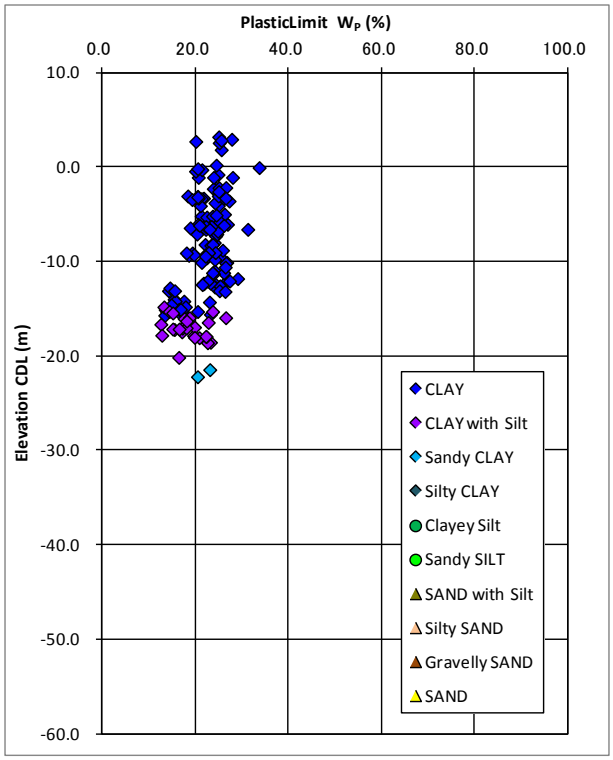


Figure 7.2-14 Plastic Limit(W_P) with Depth

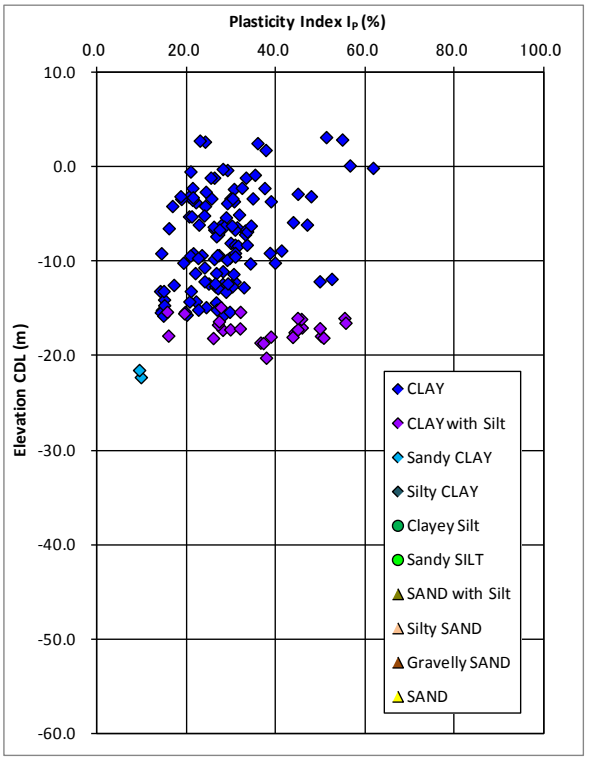


Figure 7.2-15 Plasticity Index(I_P) with Depth

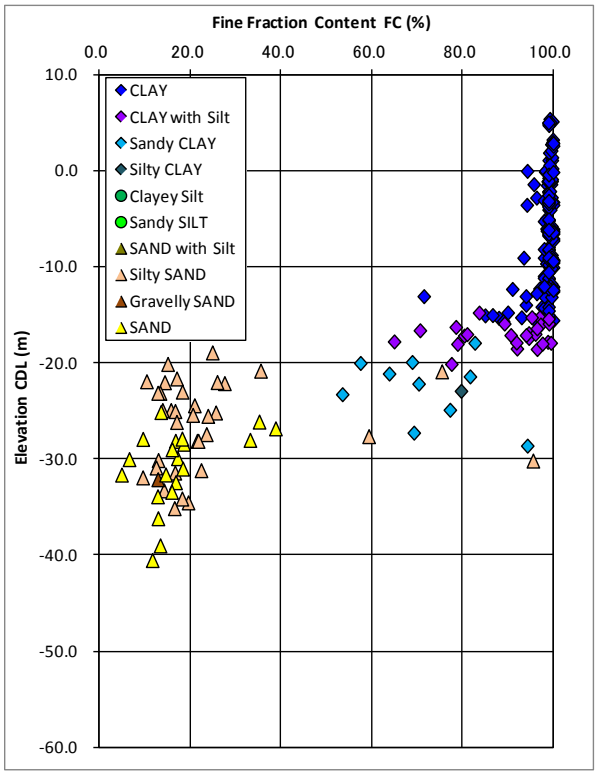


Figure 7.2-16 Fine Content(Fc) with Depth

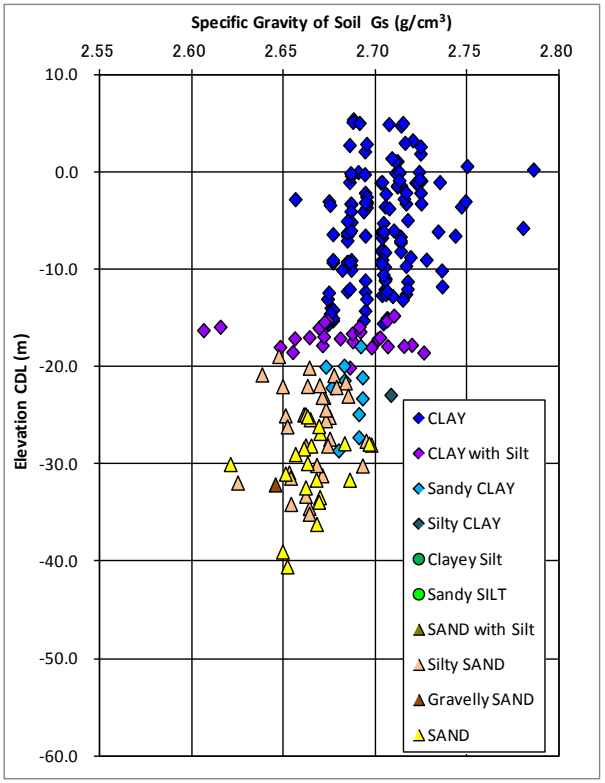


Figure 7.2-17 Specific Gravity(Gs) with Depth

＜Jetty Area＞

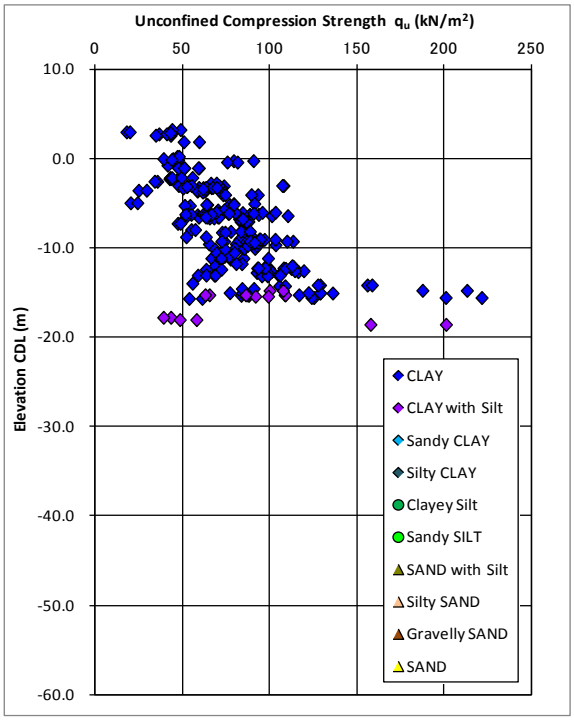


Figure 7.2-18 Unconfined Compression Strength (qu) with Depth

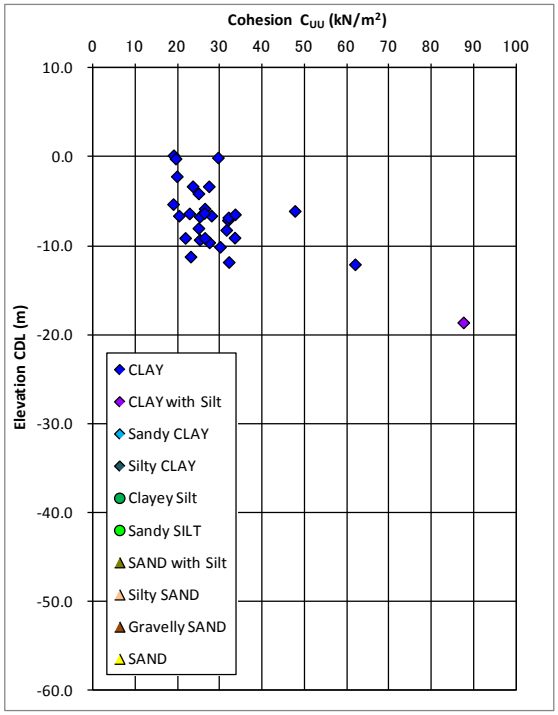


Figure 7.2-19 Cohesion (Cuu) with Depth

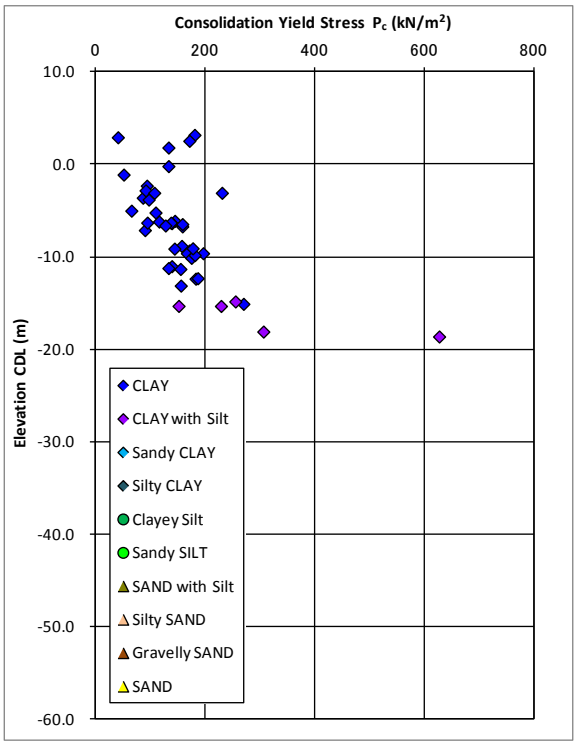


Figure 7.2-20 Pre-consolidation Yield Stress (Py) with Depth

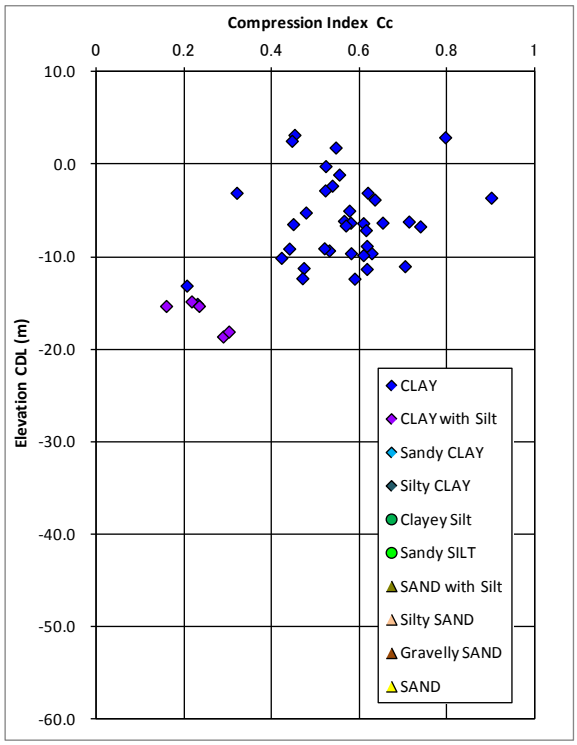


Figure 7.2-21 Compression Index(Cc) with Depth

2) Yard Area

The summary of soil laboratory test result carried out for boring sample is shown in Table 7.2-3. Soil property is shown in Figure 7.2-22 to Figure 7.2-33.

Table 7.2-3 Summary of Soil Laboratory Test

Test Item	Description of Test Result	Figure No
Natural Water Content w(%)	For upper clay layer distributing widely at the area, water content ranges from 30% to 70%. For stiff silty clay layer, silty sand layer, water content ranges from 20% to 30%. For sand layer, water content is approximately 20%.	7.2-22
Unit Weight γ(kN/m^3)	For upper clay layer, unit weight ranges from 16kN/m^3 to 18kN/m^3. For stiff silty clay layer, unit weight ranges from 19 kN/m^3 to 20kN/m^3.	7.2-23
Void Ratio (e)	For upper clay layer, void ratio ranges from 1.00~1.60. For stiff silty clay layer, void ratio ranges from 0.6 to 0.9.	7.2-24
Liquid Limit W_L (%)	For clay layer, Liquid limit ranges from 55% to 74%, a little bigger than natural water content. For lateritic clay layer, Liquid limit ranges from 30% to 40%, a little low.	7.2-25
Plastic Limit W_P (%)	For upper clay layer, Plastic limit is from 20% to 30%. For stiff silty clay layer, Plastic limit is from 15% to 20%..	7.2-26
Plasticity Index I_P	For upper clay layer, Plasticity Index ranges 20 to 60. For stiff silty clay layer, Plasticity Index is approximately 20.	7.2-27
Grain size : Fine content Fc (%)	For gain size test, fine content (less than 74 μ m) is examined. For upper clay layer, fine content ranges from 95% to 100%. For siff silty clay layer, fine content ranges from 90% to 95%. For sand layer, fine content ranges from 10% to 20%.	7.2-28
Specific Gravity Gs	For clay layer, specific gravity range from 2.70~2.75. For silty sand and sand layer, specific gravity ranges from 2.65 to 2.70.	7.2-29
Unconfined Compression Strength qu(kN/ m^2)	For upper clay layer, qu ranges from 50kN/ m^2 to 100 kN/ m^2 which tend to increase toward a deep direction. For stiff silty clay layer, qu ranges from 100kN/ m^2 to 200 kN/ m^2.	7.2-30
Direct Shear Strength Cuu (kN/m^2)	This test is carried out for upper clay layer with Un-drained condition. Cohesion (Cuu) is obtained from the test. Cuu ranges from 15 kN/m^2 to 30kN/m^2.	7.2-31
Pre-consolidation Yield Stress Py (kN/m^2)	For upper clay layer, Py ranges from 70 kN/m^2 to 200 kN/m^2 Which tend to increase toward a deep direction. For stiff silty clay layer, Py is more than 200 kN/m^2, very high.	7.2-32
Compression Index (Cc)	For upper clay layer, Cc ranges from 0.3 to 0.9. For stiff silty clay layer, Cc is approximately 0.2, very low.	7.2-33

＜Yard Area＞

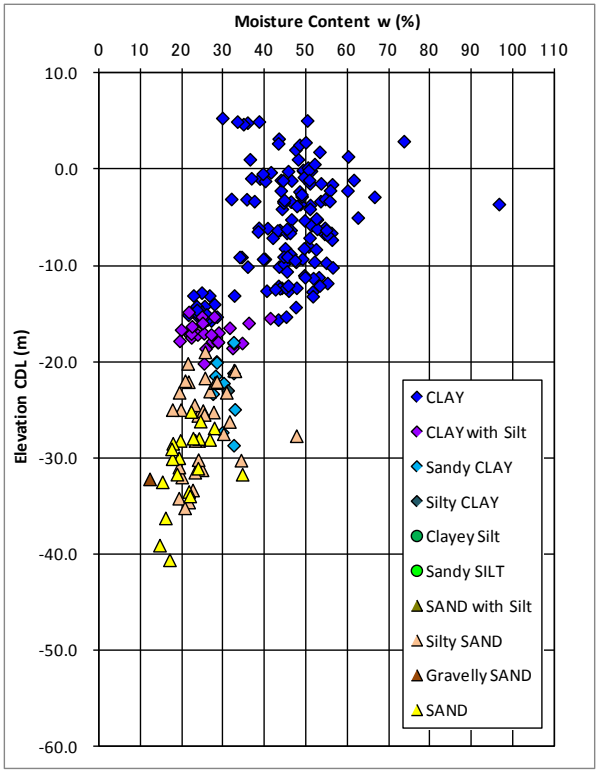


Figure 7.2-22 Water Content(w) with Depth

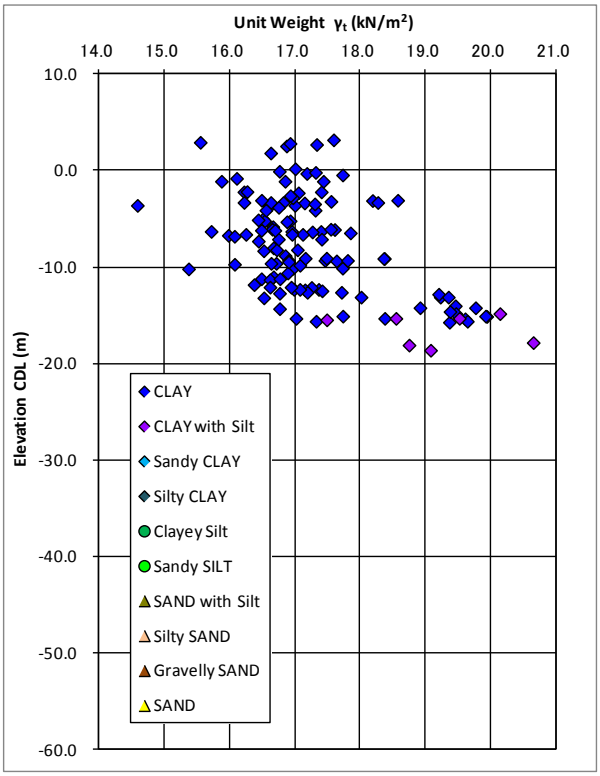


Figure 7.2-23 Unit weight(γ) with Depth

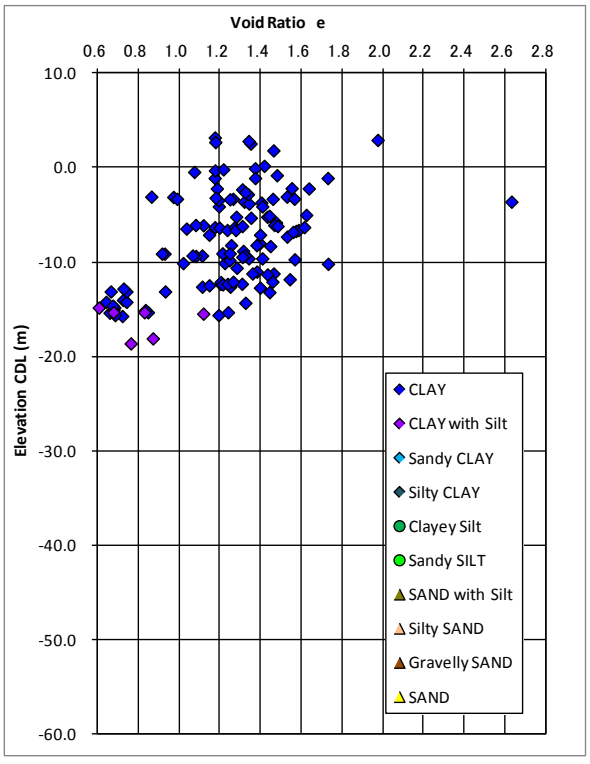


Figure 7.2-24 Void Ratio(e) with Depth

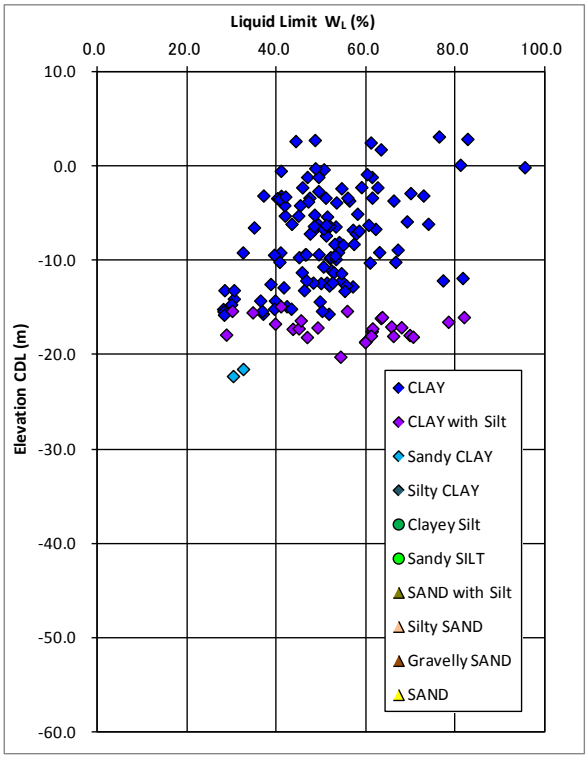


Figure 7.2-25 Liquid Limit (W_L) with Depth

＜Yard Area＞

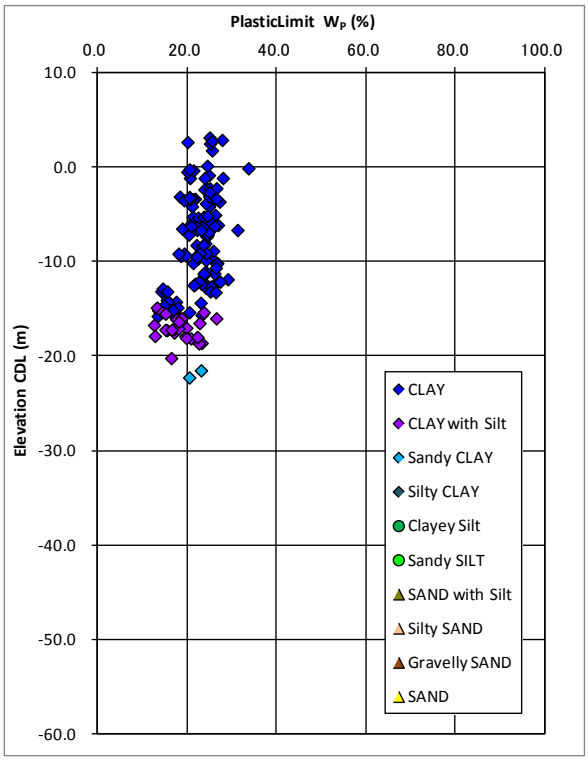


Figure 7.2-26 Plastic Limit (W_P) with Depth

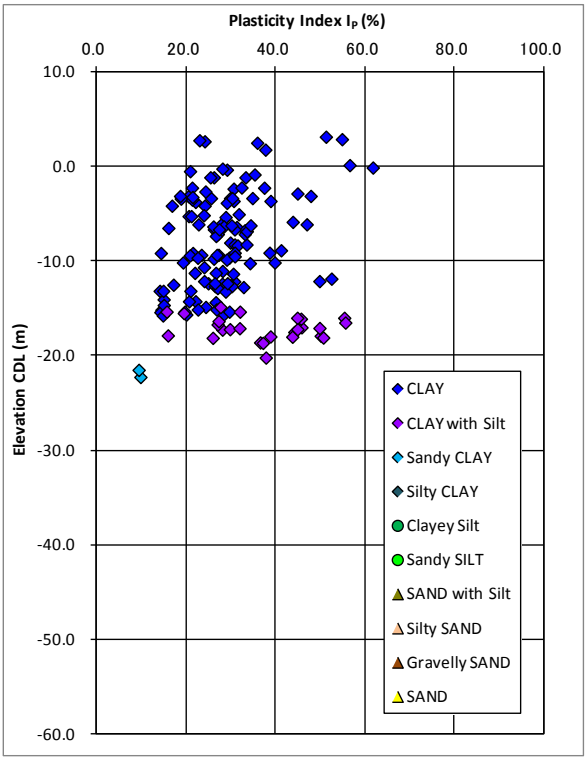


Figure 7.2-27 Plasticity Index(I_P) with Depth

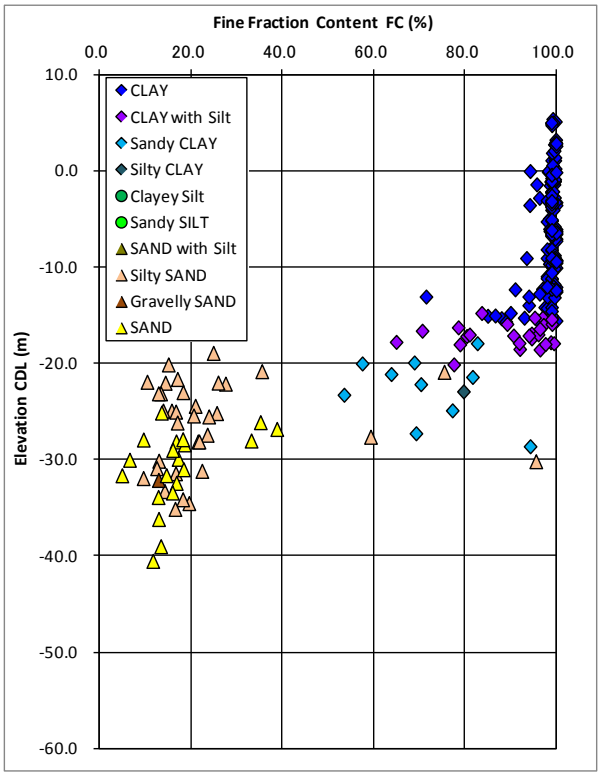


Figure 7.2-28 Fine Content (Fc) with Depth

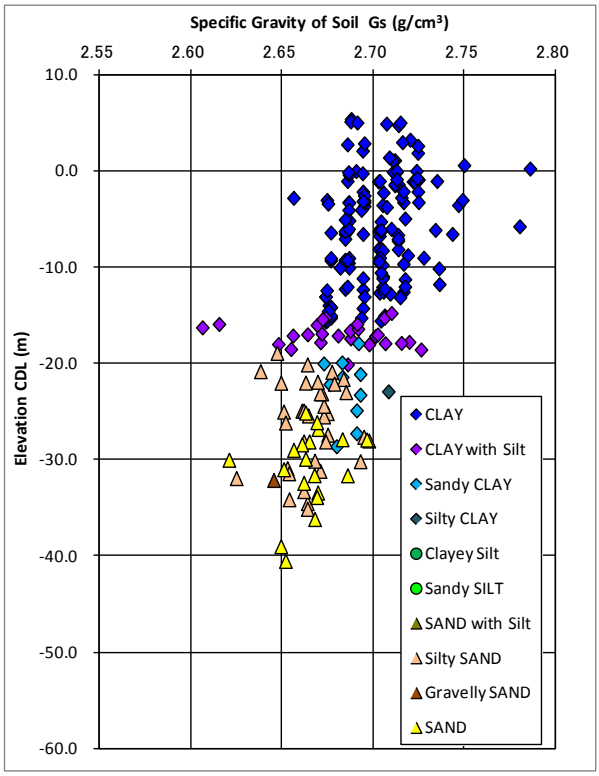


Figure 7.2-29 Specific Gravity(Gs) with Depth

＜Yard Area＞

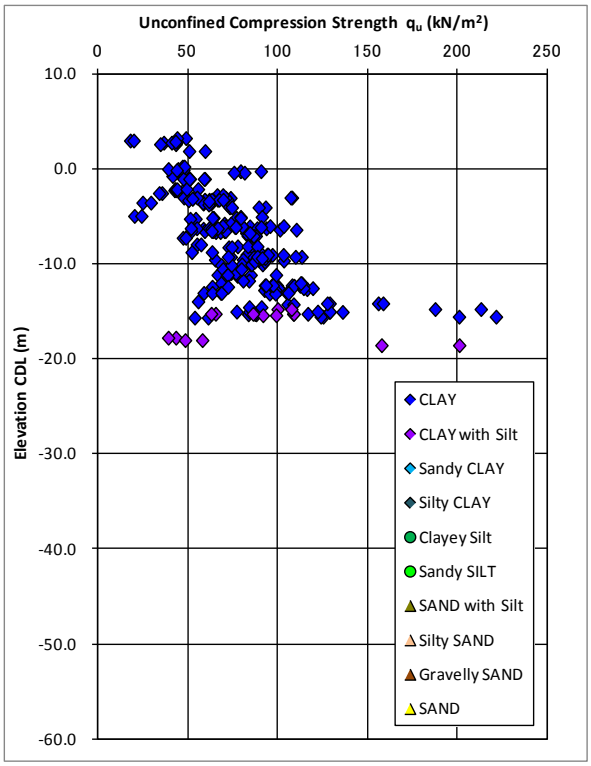


Figure 7.2-30 Unconfined Compression Strength (qu) with Depth

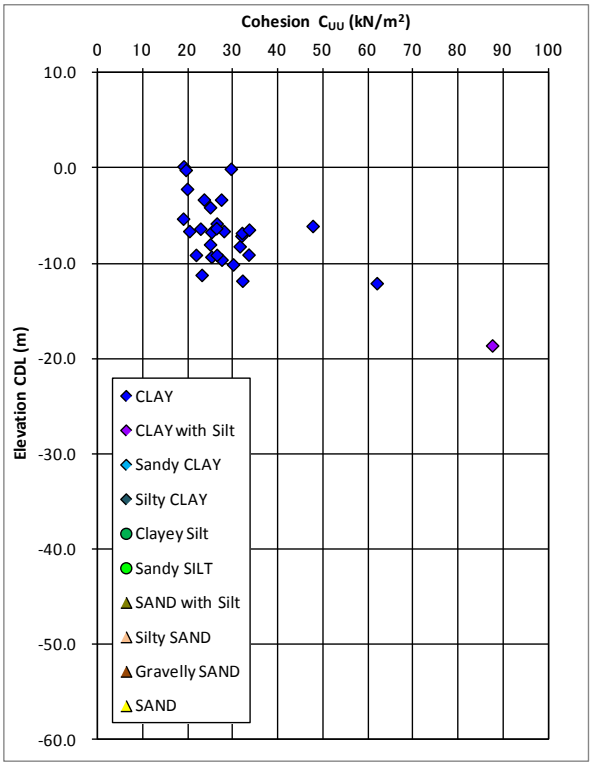


Figure 7.2-31 Cohesion (Cuu) with Depth

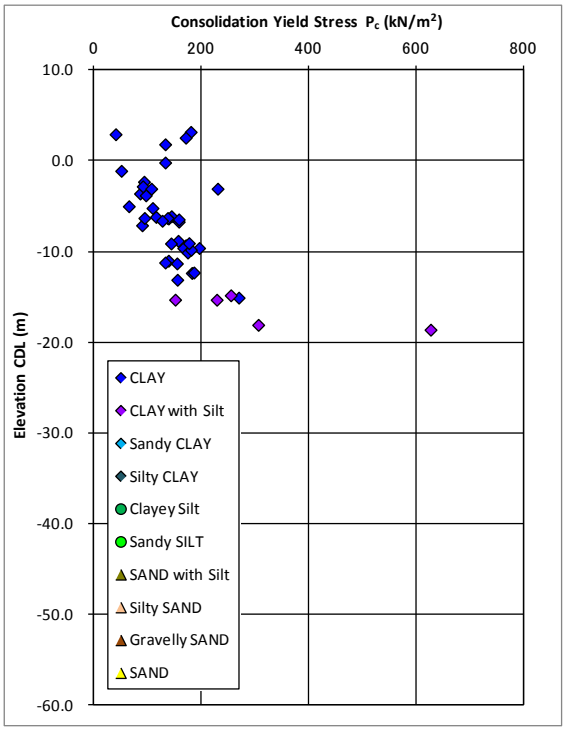


Figure 7.2-32 Pre-consolidation Yield Stress (Py) with Depth

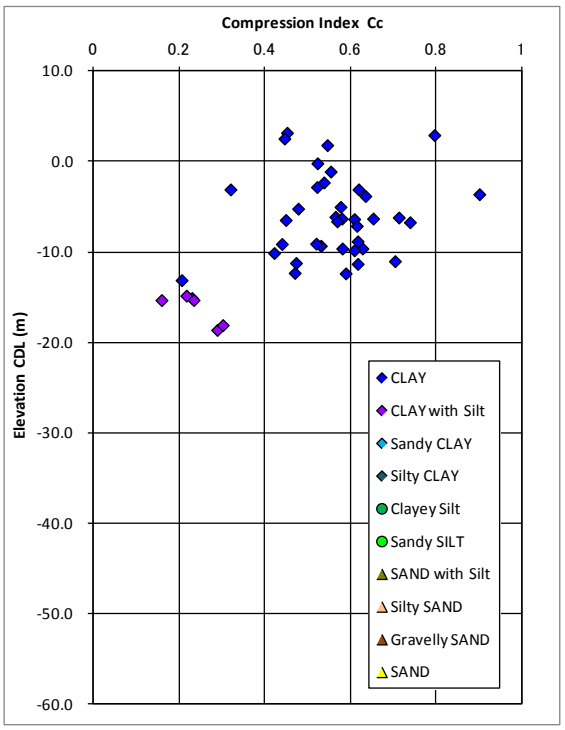


Figure 7.2-33 Compression Index (Cc) with Depth

3) Channel Area

The summary of soil laboratory test result carried out for boring sample is shown in Table 7.2-4. Soil property is shown in Figure 7.2-34 to Figure 7.2-37. For Channel area, Undisturbed sample (UD) is very few, therefore, Unconfined compression test result is not shown in the figure.

Table 7.2-4 Summary of Soil Laboratory Test (1)

Test Item	Description of Test Result	Figure No
Specific Gravity Gs	For clay layer, specific gravity range from 2.62~2.72. For sand layer, specific gravity ranges approximately 2.66.	7.2-35
Grain size : Fine content Fc (%)	For upper clay layer, fine content is 100%. For sand layer, fine content ranges from 5% to 30%.	7.2-37
Unit Weight γ(kN/m^3)	For upper clay layer, unit weight ranges from 16kN/m^3 to 17kN/m^3. For lower clay layer, it is approximately 20kN/m^3.	-
Unconfined Compression Strength qu(kN/ m^2)	For upper clay layer, qu ranges from 30kN/ m^2 to 100 kN/ m^2. For stiff silty clay layer, qu ranges from 150kN/ m^2 to 180 kN/ m^2.	-

(Prepared by the Study Team)

Table 7.2-5 Summary of Soil Laboratory Test (2) <Refer to Figure7.2-34>

No.	Soil Type	Natural Water Content (%)	
		Range	Average
1	SAND	22.51~ 24.42	23.50
2	CLAY	18.87 ~ 62.49	44.56
3	CLAY with silt	21.85 ~ 26.78	24.32
4	Sandy CLAY	30.38	30.38
5	Silty SAND	19.07 ~ 33.81	25.11

(Prepared by the Study Team

Table 7.2-6 Summary of Soil Laboratory Test (3) <Refer to Figure7.2-36>

	Soil Type	Liquid Limit (LL)		Plastic Limit (PL)	Plasticity Index (PI)
Atterberg's Limit Test	CLAY	Range	37.53 ~ 91.40	18.47 ~ 34.21	12.82 ~ 61.01
		Average	68.90	26.74	42.17
	CLAY with silt	Range	38.88 ~ 56.08	14.10 ~ 19.55	24.78 ~ 36.53
		Average	47.48	16.83	30.66
	Sandy CLAY	Range	29.06	18.49	10.57
		Average	29.06	18.49	10.57

(Prepared by the Study Team

＜Channel Area ＞

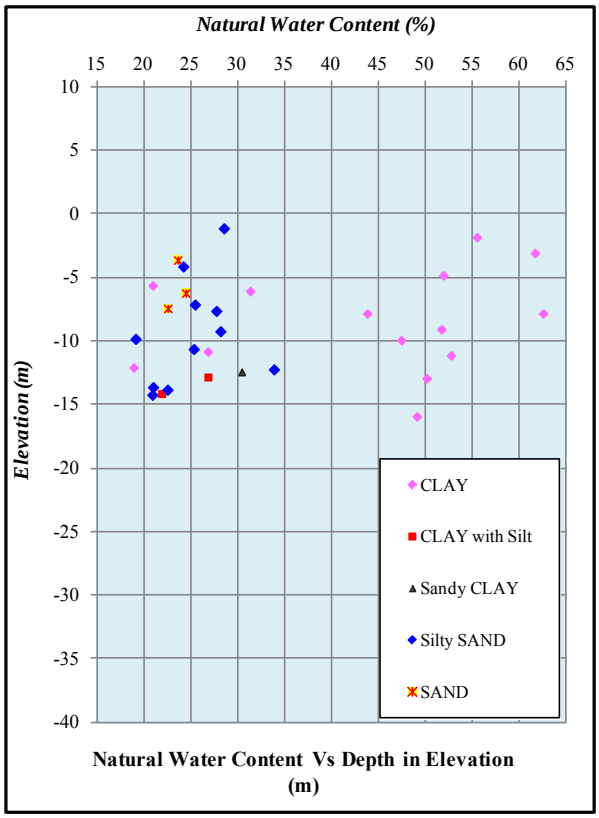


Figure 7.2-34 Water Content(w) with Depth

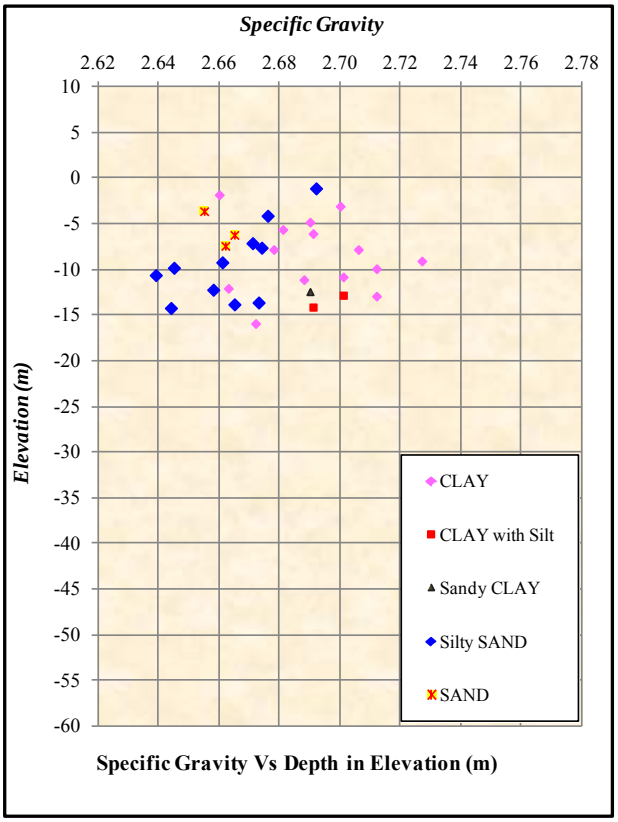


Figure 7.2-35 Specific Gravity(Gs) with Depth

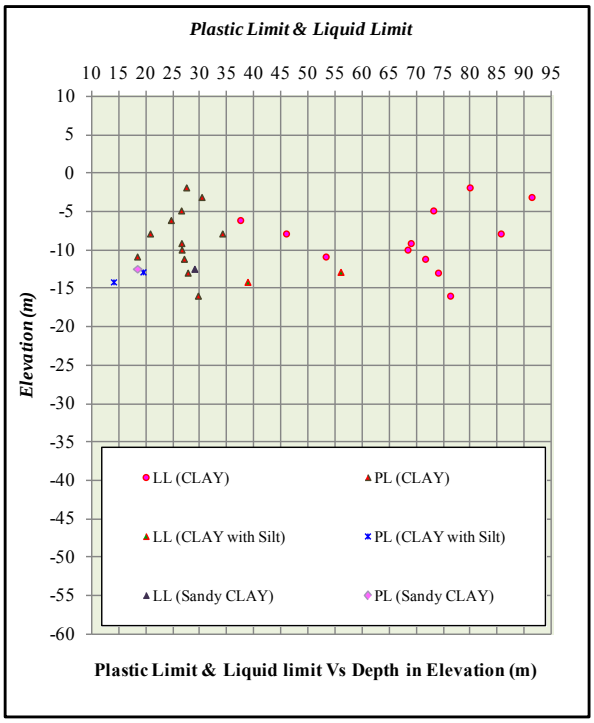


Figure 7.2-36 Plastic & Liquid Limit with Depth

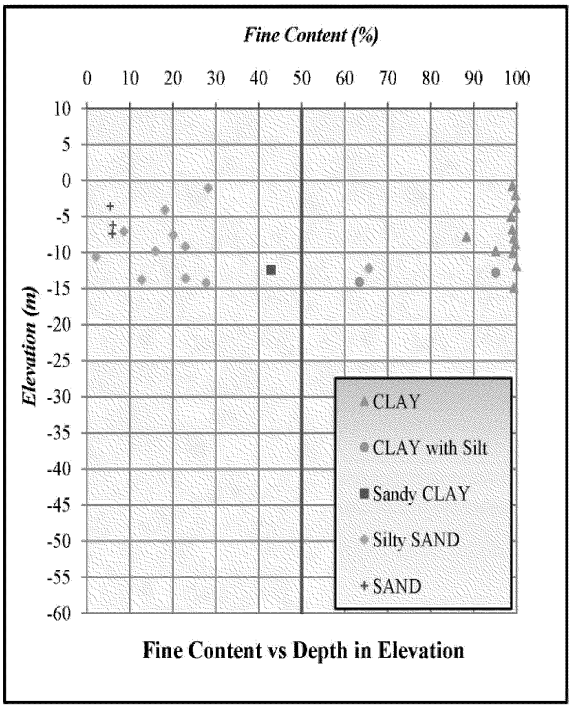


Figure 7.2-37 Fine Content with Depth

4) Offshore Pilot Station

The summary of soil laboratory test result carried out for boring sample is shown in Table 7.2-7. Soil property is shown in Figure 7.2-38 to Figure 7.2-49.

Table 7.2-7 Summary of Soil Laboratory Test

Test Item	Description of Test Result	Figure No
Natural Water Content w(%)	For clay layer, water content ranges from 49% to 72%. For clay layer (Lower), water content is about 40%. For other layers, water content ranges from 24% to 35%.	7.2-38
Unit Weight γ(kN/m^3)	For clay layer, unit weight ranges from 15.7kN/m^3 to 16.6kN/m^3. For lateritic clay layer, unit weight is about 20kN/m^3.	7.2-39
Void Ratio (e)	For clay layer, void ratio ranges from 1.41~1.93. For lateritic clay layer, void ratio is 0.69.	7.2-40
Liquid Limit W_L (%)	For clay layer, Liquid limit ranges from 55% to 73%, a little bigger than natural water content. For lateritic clay layer, Liquid limit is 47%.	7.2-41
Plastic Limit W_P (%)	For clay layer, Plastic limit ranges from 25% to 28%. For lateritic clay layer, Plastic limit is 18.5%.	7.2-42
Plasticity Index I_P	For clay layer, Plasticity Index ranges 30 to 46. For lateritic clay layer, Plasticity Index is approximately 29.	7.2-43
Grain size : Fine content Fc (%)	For gain size test, fine content (less than 74 μ m) is examined. For clay layer, fine content ranges from 95% to 100%. For lateritic clay layer, fine content is 65%. For sand layer, fine content ranges from 24% to 32%. For other clay layer, fine content ranges from 82% to 99%.	7.2-44
Specific Gravity Gs	For clay layer, specific gravity range from 2.71~2.76. For other layer, specific gravity ranges from 2.66 to 2.70.	7.2-45
Unconfined Compression Strength qu(kN/ m^2)	For clay layer, qu ranges from 15kN/ m^2 to 93 kN/ m^2 which tend to increase toward a deep direction. For lateritic clay layer, qu ranges from 50kN/ m^2 to 98 kN/ m^2.	7.2-46
Direct Shear Strength Cuu (kN/m^2)	This test is carried out for clay layer with Un-drained condition. Cohesion (Cuu) is obtained from the test. Cuu ranges from 23 kN/m^2 to 29kN/m^2.	7.2-47
Pre-consolidation Yield Stress Py (kN/m^2)	For upper clay layer, Py ranges from 32 kN/m^2 to 76 kN/m^2 Which tend to increase toward a deep direction. For lateritic clay layer, Py is more than 400 kN/m^2, very high.	7.2-48
Compression Index (Cc)	For upper clay layer, Cc ranges from 0.37 to 0.55. For lateritic clay layer, Cc is approximately 0.2, very low.	7.2-49

(Prepared by the Study Team)

＜Offshore Pilot Station＞

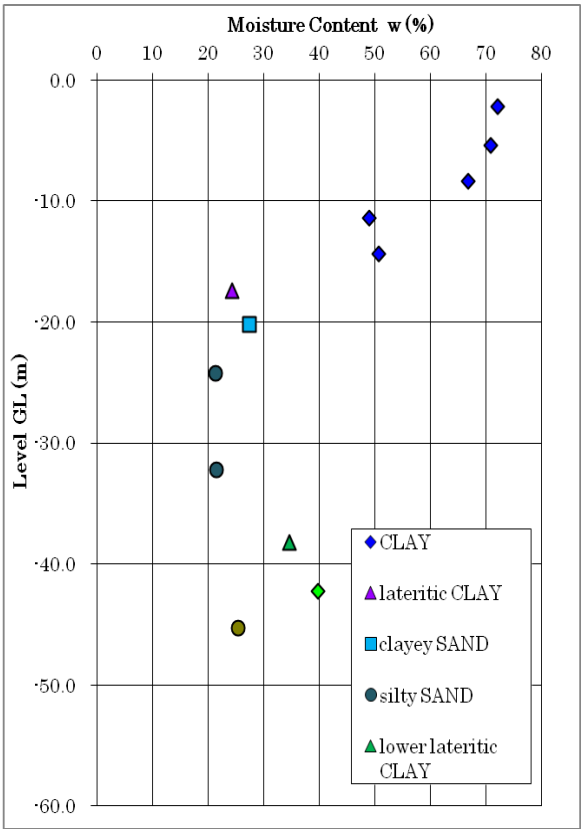


Figure 7.2-38 Water Content(w) with Depth

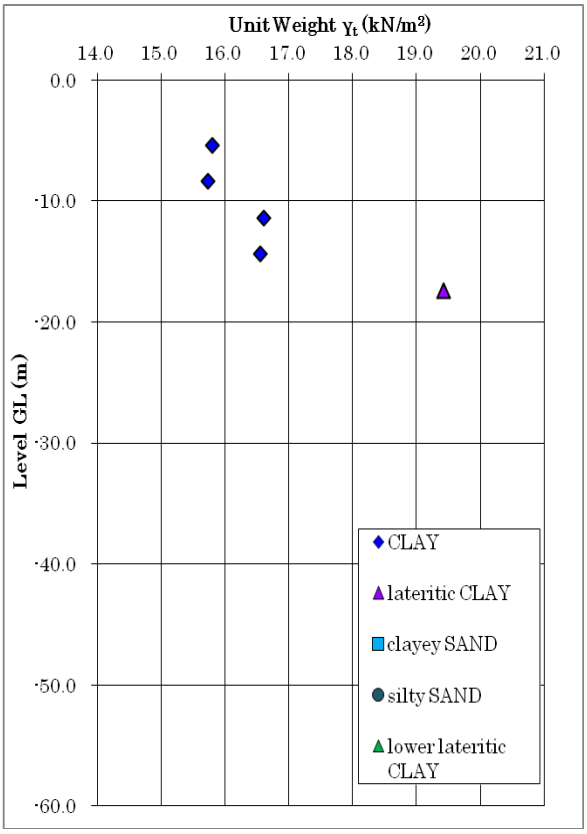


Figure 7.2-39 Unit weight(γ) with Depth

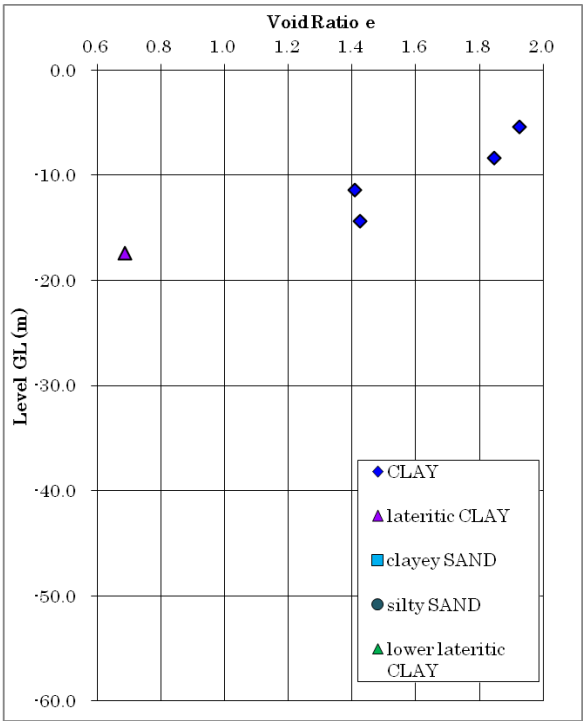


Figure 7.2-40 Void Ratio(e) with Depth

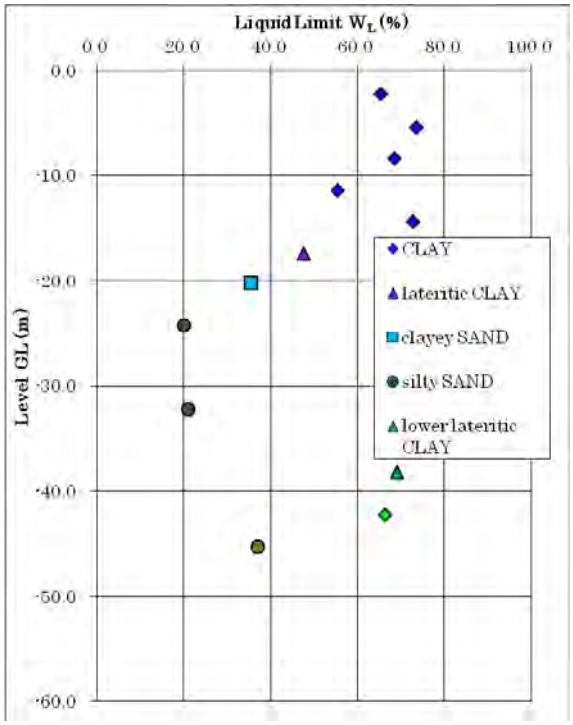


Figure 7.2-41 Liquid Limit (W_L) with Depth

＜Offshore Pilot Station＞

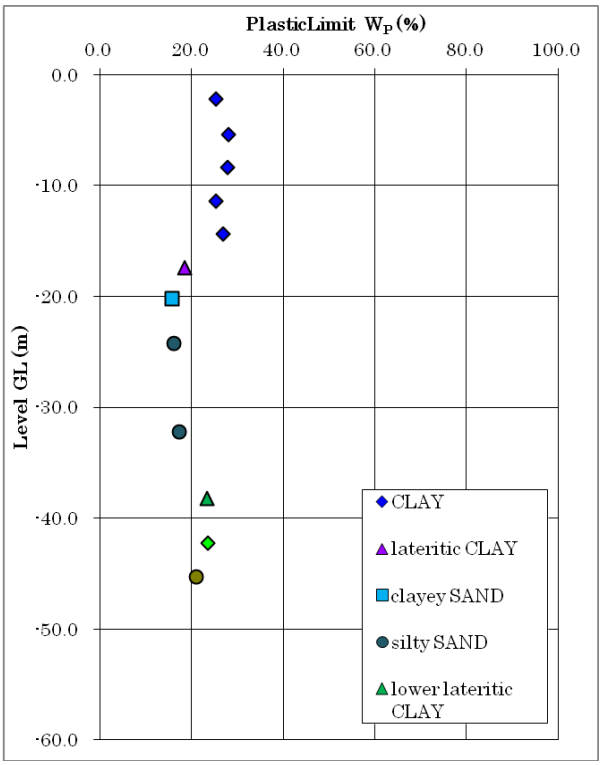


Figure 7.2-42 Plastic Limit (W_P) with Depth

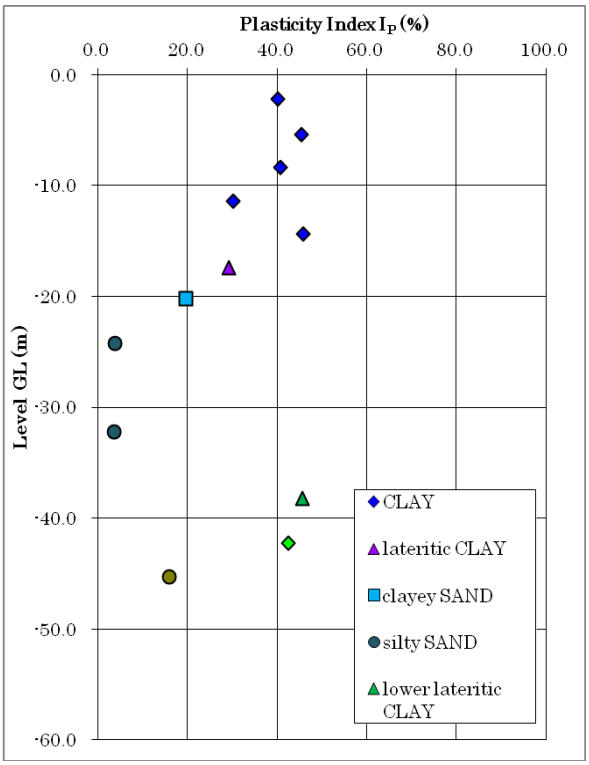


Figure 7.2-43 Plasticity Index(I_P) with Depth

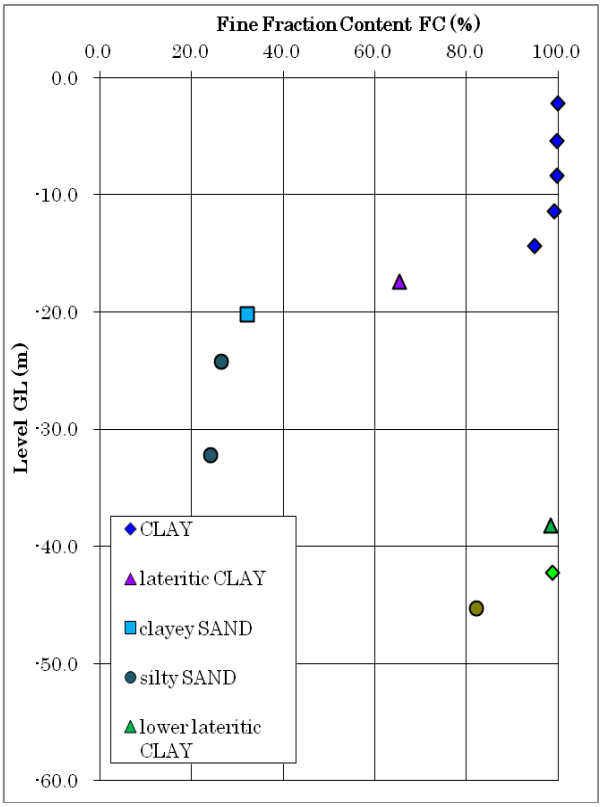


Figure 7.2-44 Fine Content (Fc) with Depth

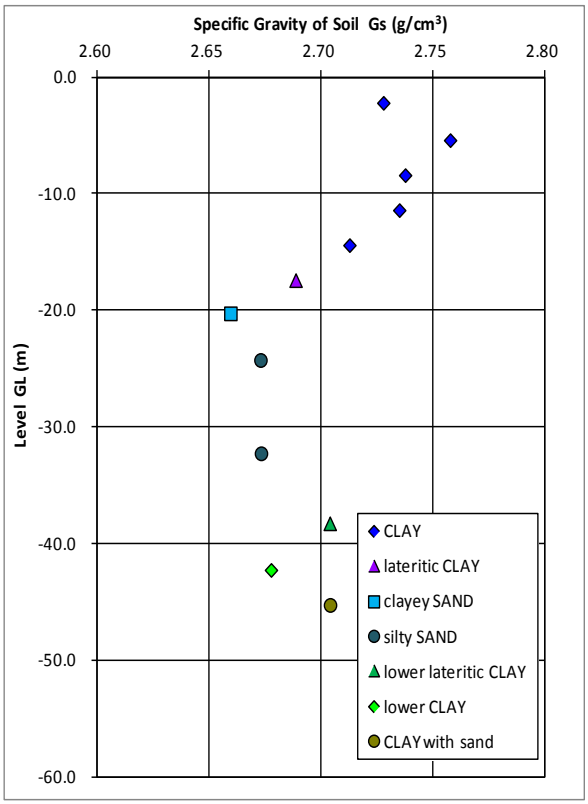


Figure 7.2-45 Specific Gravity(Gs) with Depth

＜Offshore Pilot Station＞

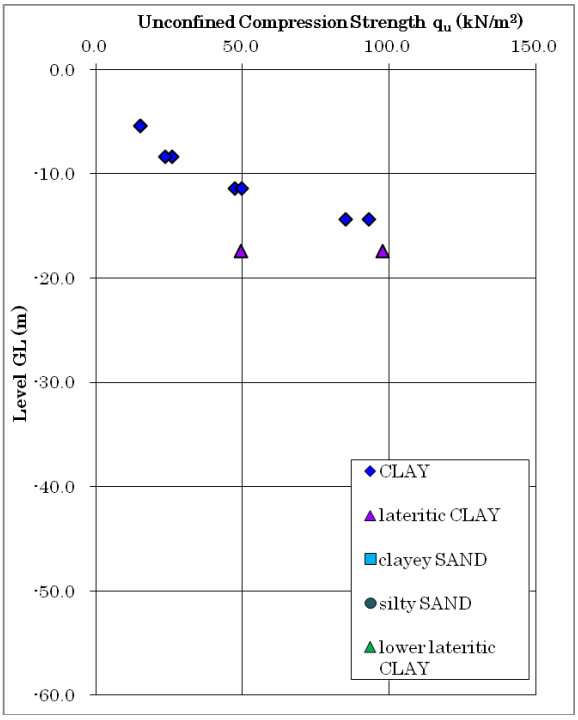


Figure 7.2-46 Unconfined Compression Strength (qu) with Depth

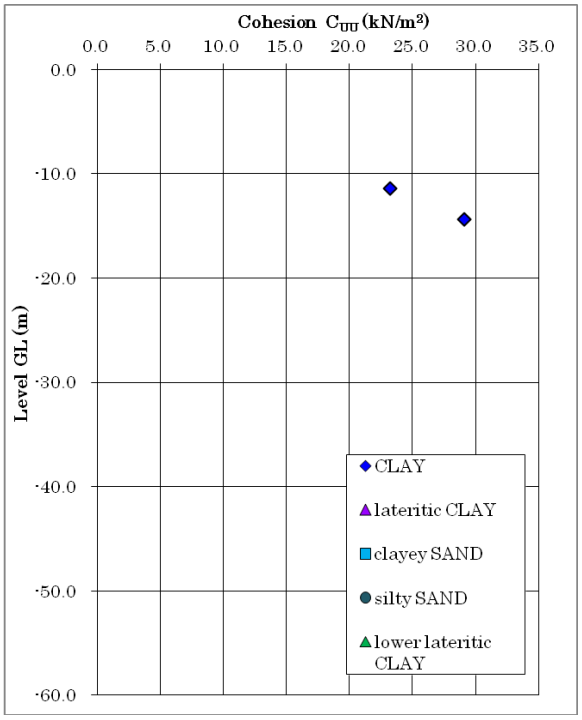


Figure 7.2-47 Cohesion (Cuu) with Depth

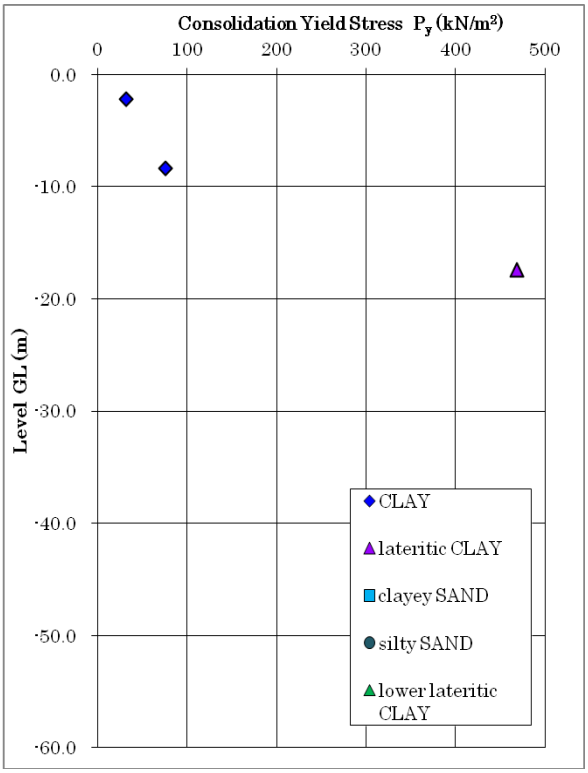


Figure 7.2-48 Pre-consolidation Yield Stress (Py) with Depth

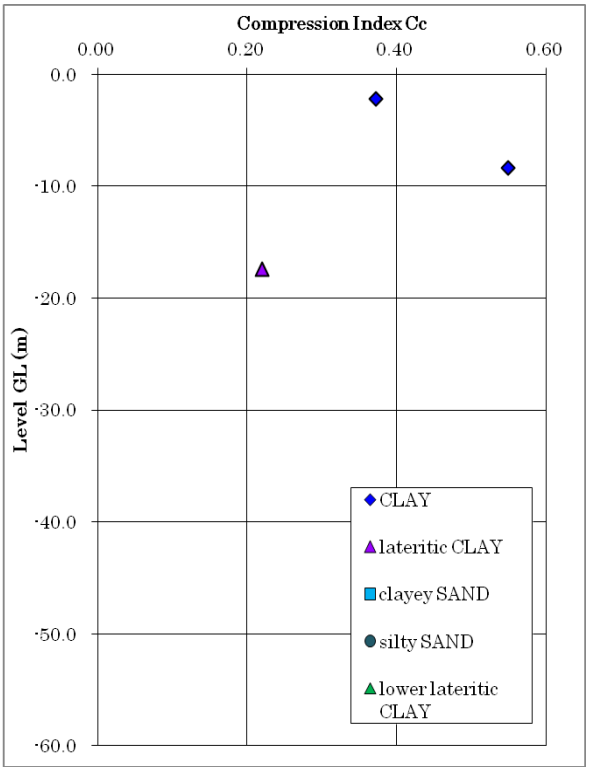


Figure 7.2-49 Compression Index (Cc) with Depth

(3) Standard Penetration Test (SPT) result

The result of SPT (V-value) for each area is shown in Figure 7.2-50 toFigure7.2 -53.

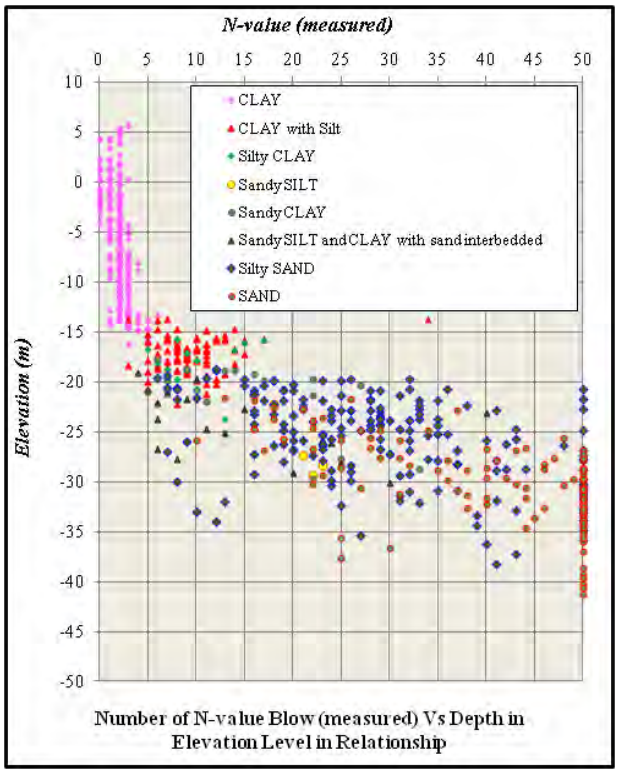


Figure 7.2-50 SPT Result (N-value) for Jetty

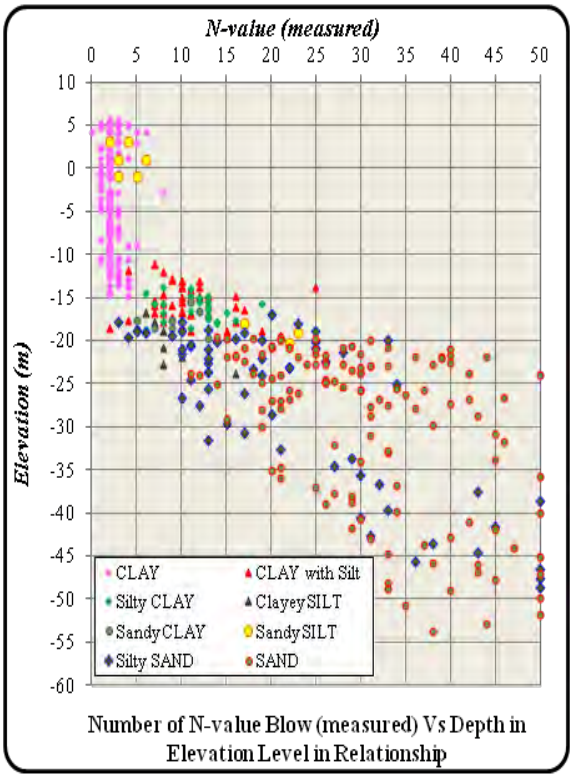


Figure 7.2-51 SPT Result (N-value) for Yard

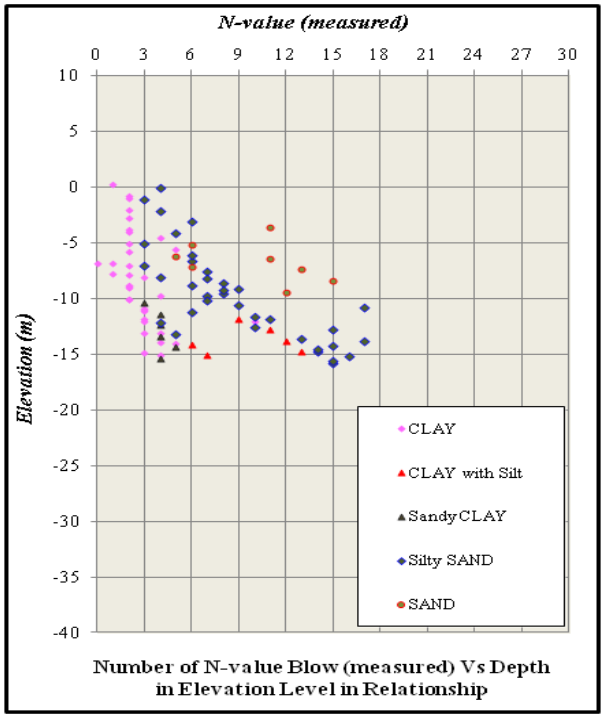


Figure 7.2-52 SPT Result for Channel

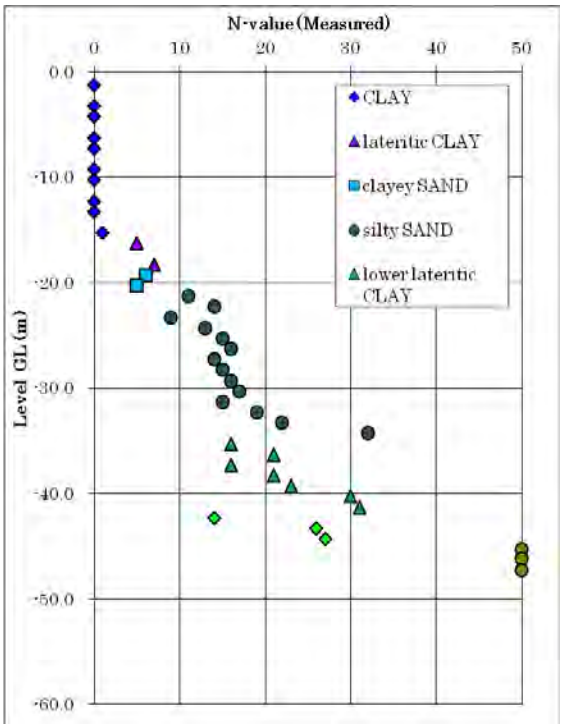


Figure 7.2-53 SPT Result for Offshore Pilot Station

7.3. Topographic and Bathometric Survey

7.3.1. Topographic and Bathymetric Survey

The target area of the Basic Development Plan of Yangon Port under this Study includes the existing area of Yangon Port, expansion area and along the Yangon River. Since the budget for the topographic and bathymetric survey for the overall area is limited, the survey in this Study is limited only to (a) planned terminal area, (b) planned jetty area, (c) existing channel area and (d) eight river cross sections. Tide is observed each 10 minutes during the bathymetric surveying. Eight temporary benchmarks are established in the planned terminal area by using both CDL and MSL. Output drawing size is 1:2000.

Bathymetric Survey Boat

Survey Equipment of DGPS

(Prepared by the Study Team)

Figure 7.3-1 Condition of Bathymetric Survey

(Prepared by the Study Team)

Figure 7.3-2 Location Map of Topographic and Bathymetric Survey

(1) Topographic Survey (around Proposed Terminal Area)

Line length parallel to the berth line from Plot No.22 to No.26 is around 1000m, line length perpendicular to the berth line from the river bank to existing road is around 1000m too. The total area is around 1.0km2 (100 hectare = 250acres). The survey results are used for the confirmation of existing topographic conditions, study for earth filling, revetment design and others.

(2) Bathymetric Survey (around Proposed Jetty Area)

Line length parallel to the berth line from Plot No.22 to No.26 is around 1000m, line length perpendicular to the berth line from the river bank to existing road is around 500m. The total area is around 0.5km2 (50 hectare = 125 acres). The survey results are used for the confirmation of exiting bathymetric conditions, study of jetty/trestle design, dredging/excavation, sedimentation/erosion and others.

(3) Bathymetric Survey (Existing Channel Area)

The length is 64km from the pilot station to the Monkey Point through the Elephant Point. The survey results are used for the confirmation of exiting channel conditions, study of future dredging plan and others.

(4) Bathymetric Survey (8 Sections in Yangon River)

Eight sections are located in the Yangon River from the Elephant Point to the Monkey Point as shown in the next chapter. The survey results are used for the water volume calculation and others.

7.3.2. Results of Topographic and Bathymetric Survey

(1) Topographic Survey (around Proposed Terminal Area)

The average elevation at the Plot No.22 to 26 is around +6.0m CDL. It is around 2 meters lower than the backside road. Differential of the elevations in the area is not so much. Because of the poor drainage, the area is muddy marsh in the rainy season. Presently, there is a village of 600 residents at Plot No.20 to 23. (Details of the village are found in Chapter 5.4.) A creek flows at the Plot No. 21 and flows out from Plot No.22. There are rice paddies at the Plot No. 22 to 24. There are traces of land reclamation in 2011 at the Plot No.25. At the Plot No.26, another creek flows and the creek bank is surrounded by natural vegetation (refer to Figure 7.3-3, 7.3-4 and 7.3-7).

(2) Bathymetric Survey (around Proposed Jetty Area)

There are two steep slopes from the river bank toward the center of the river as seen in the Figure 7.3-5 and 7.3-6, and summarized below:

- 0 to 50m (measured from the river bank): 1:10 slope from +6.5m to +1.5m CDL
- At around 150m: 1:1 slope from +0.0m to -20.0m CDL

Beyond the second slope, there is a deep area around -16m to -18m CDL of 300 to 400m, which is used for the channel.

(3) Bathymetric Survey (Existing Channel Area)

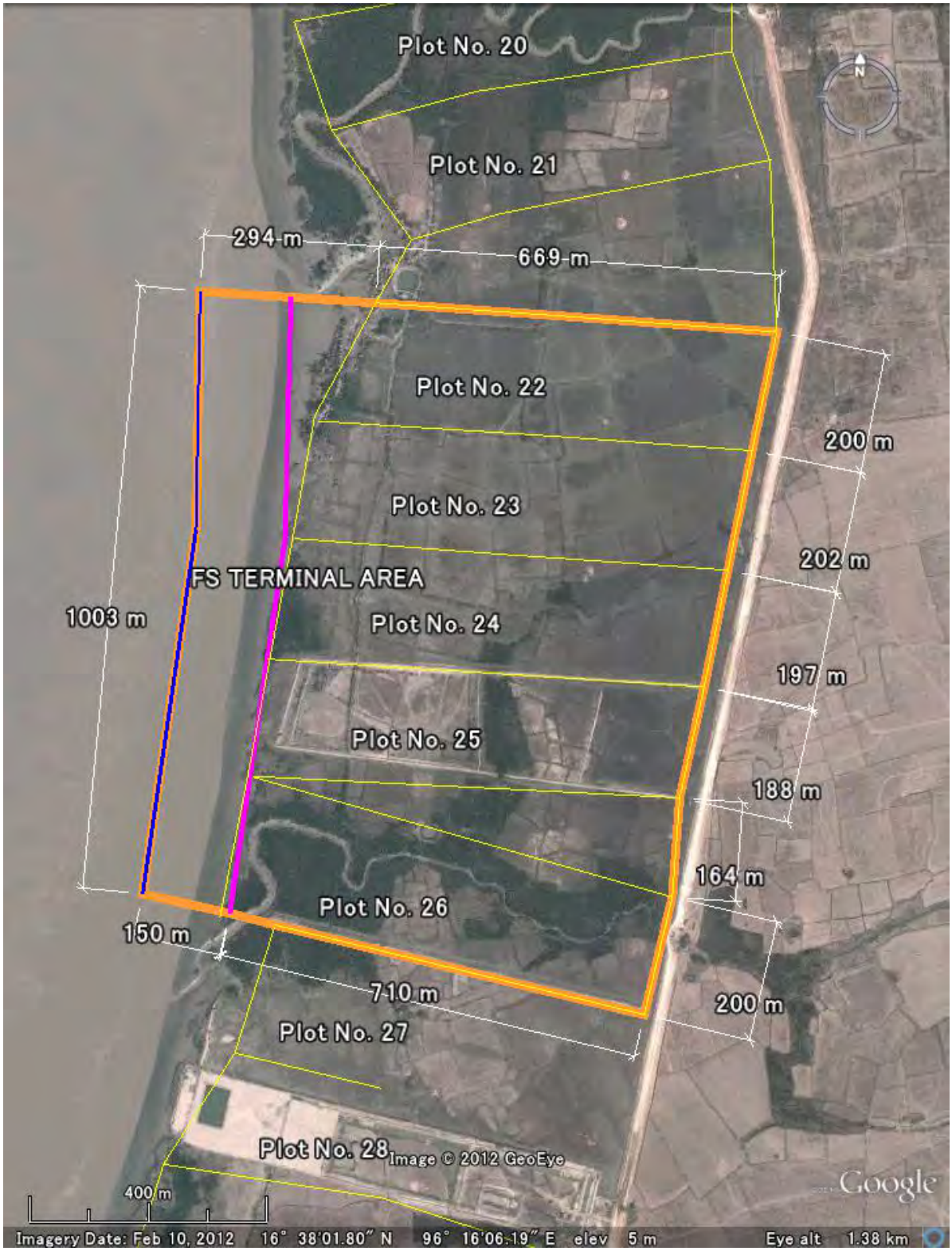
Channel width is defined to be 180m by MPA. The depth is only 4m at the Inner Bar near Monkey Point. There is a deep area from Monkey Point to Elephant Point, where the depth is maintained at -9.0m. Outside of Elephant Point, there is Outer Bar with -5.0 to -6.0m depth. Pilot Station is located at -9.0m depth.

The channel at the southern area of the Elephant Point is called “Western Channel”, and is maintained at -6.0m depth average. However, there are areas shallower than -5.0m depth. Pilot

Station Vessel was anchored beside the channel at -6.9m depth about 30km south from the Elephant Point in October 2012.

(4) Bathymetric Survey (8 Sections in Yangon River)

Cross sectional survey was carried out at the eight locations between the Elephant Point and the Monkey Point. The survey result was used to calculate the river flow rate. Generally, depths at the outsides of the river curve are deeper than those at the insides, and this tendency is amplified when the river curve becomes sharper. Among the eight cross sections, the river curve at the Plot No.22 is the sharpest, thus the water depth in front of the Plot No.22 is the deepest.

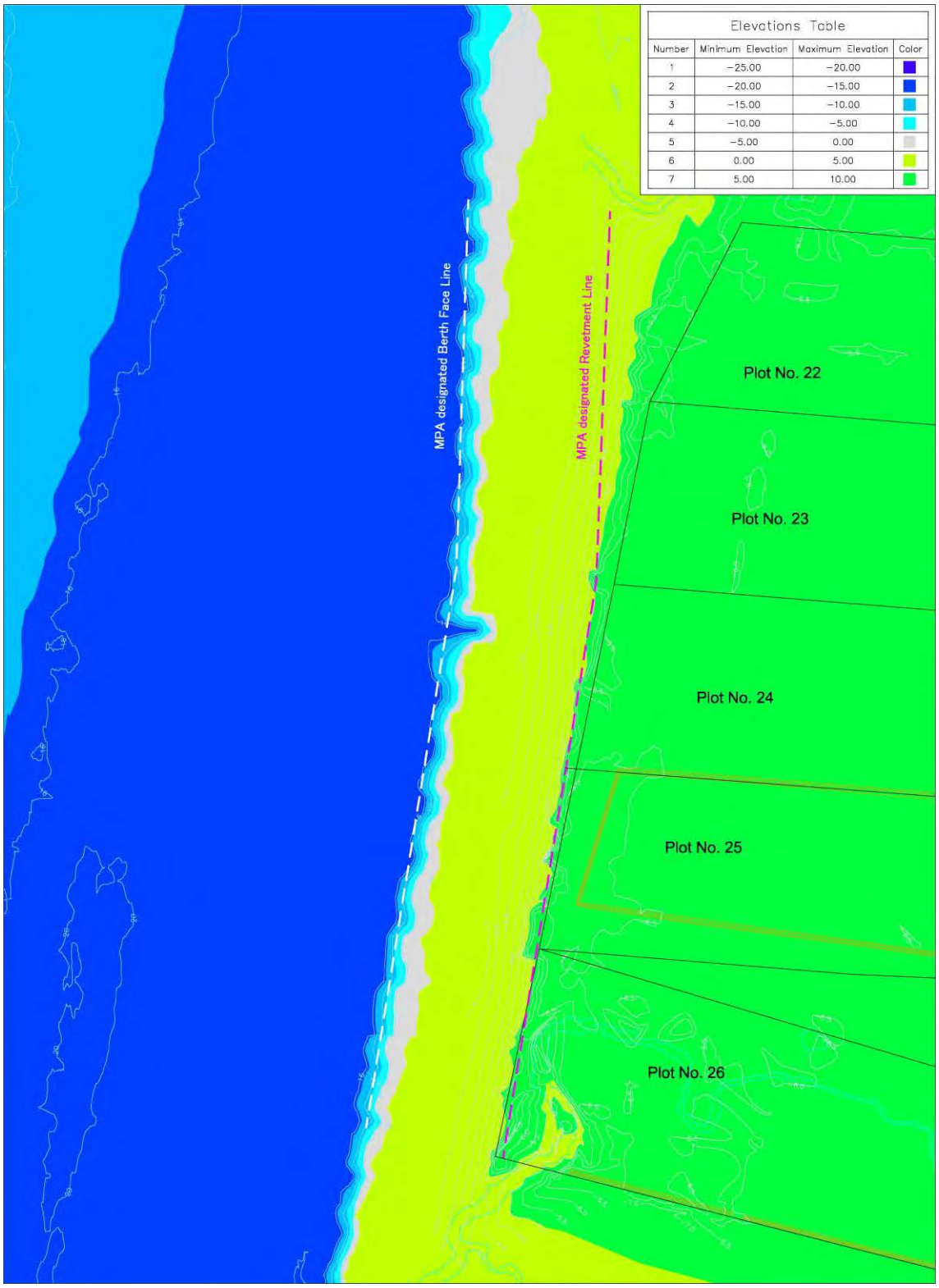


(Prepared by the Study Team)

Figure 7.3-3 Location Map of Topographic and Bathymetric Survey

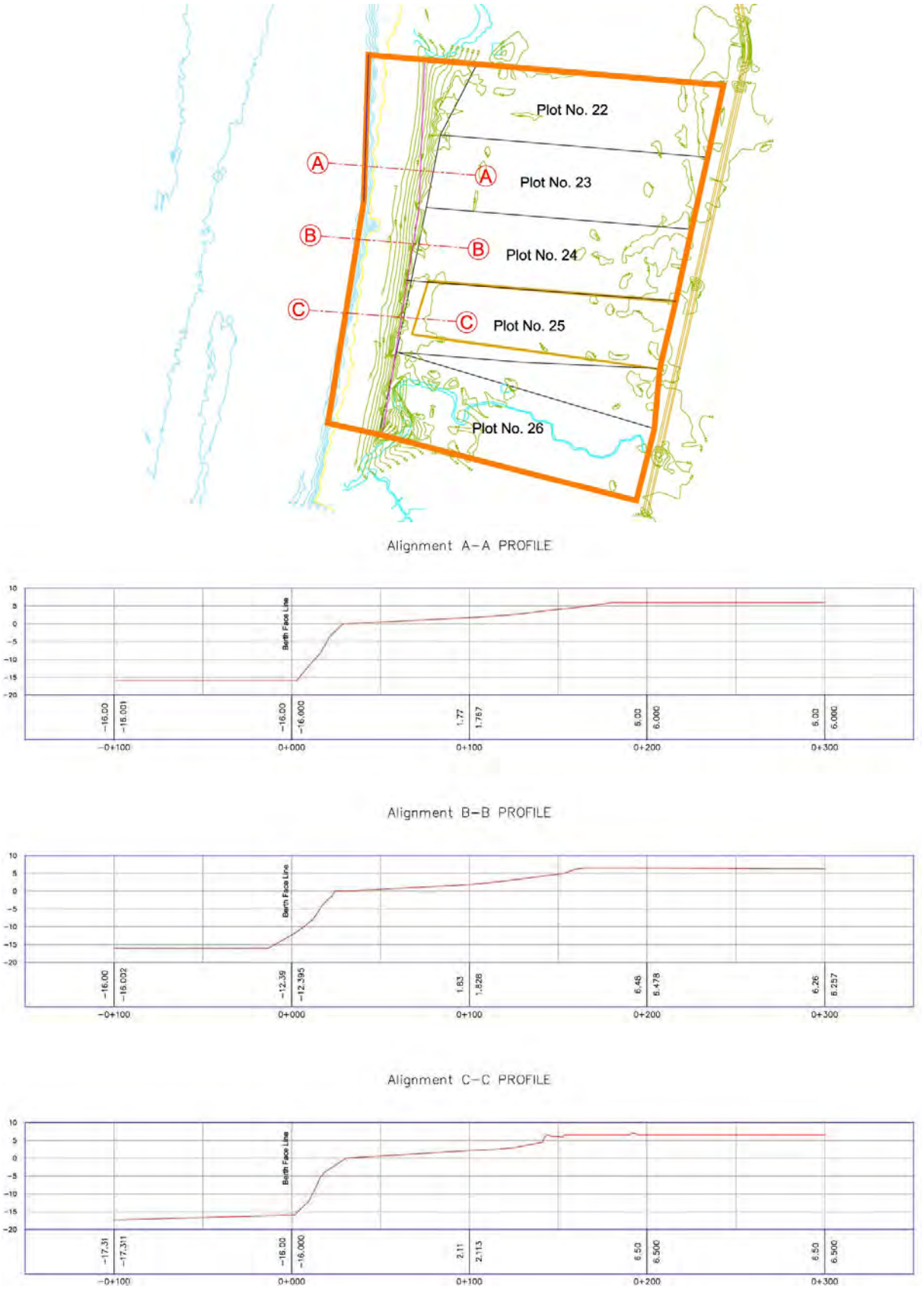
(Prepared by the Study Team)

Figure 7.3-4 Topographic Map at Proposed Terminal Area



(Prepared by the Study Team)

Figure 7.3-5 Bathymetric Map at Proposed Jetty Area



(Prepared by the Study Team)

Figure 7.3-6 Cross Section at River Bank

Condition of River Bank (No. 23)

Condition of River Bank (No. 25)

Condition of River Bank (No. 23)

Condition around road (No24,25)

(Prepared by the Study Team)

Figure 7.3-7 Condition of Target Area

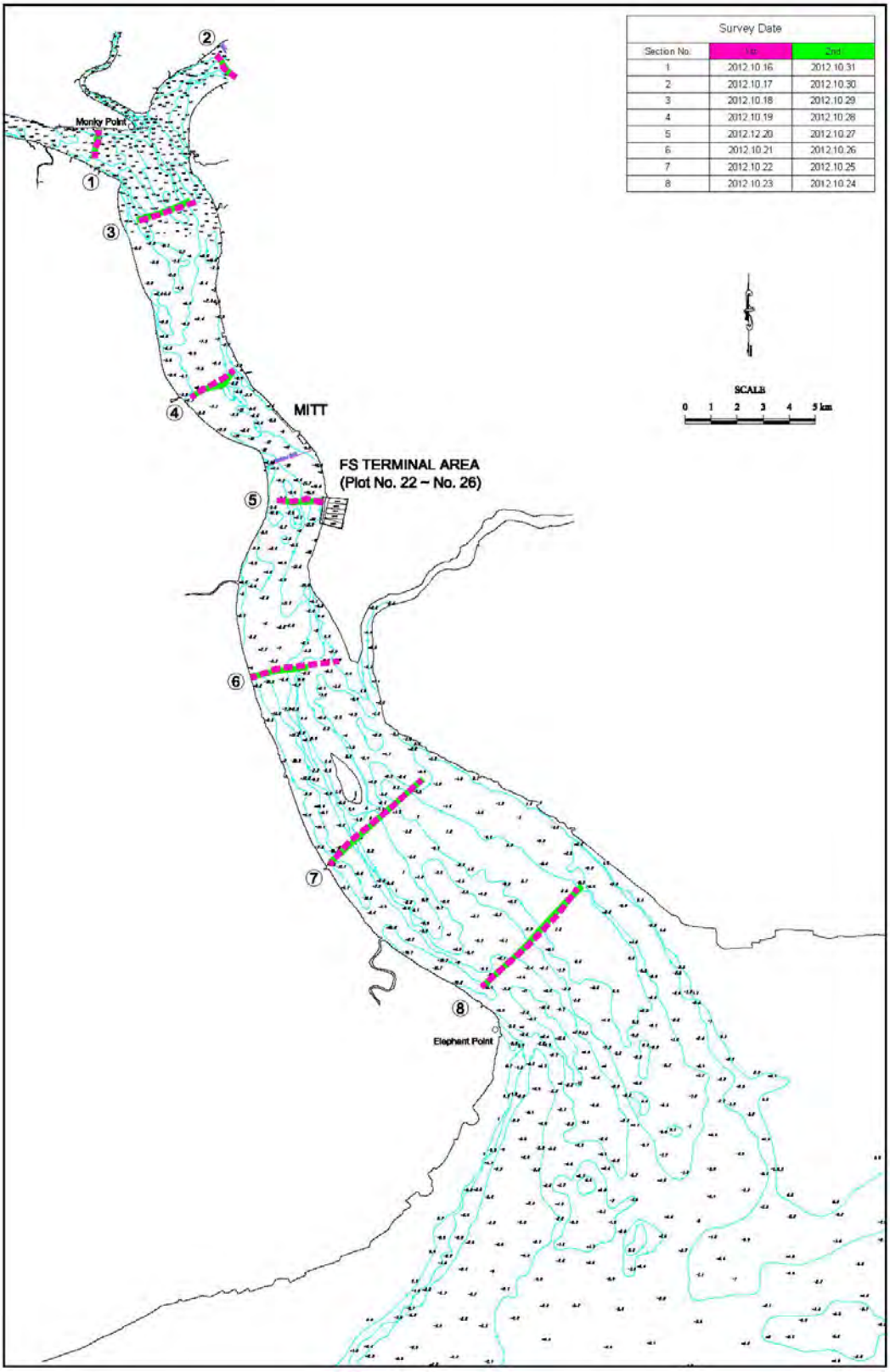
7.4. River Condition Survey

7.4.1. General of River Condition Survey

At the eight cross sections between the Elephant Point and the Monkey Point, current speed, depth, temperature, salinity and suspended solids (SS) were observed for 16 days from 16th to 31st of October 2012. Continuous 12 hour survey was conducted twice for each section (refer to Figure 7.3-1) at four (4) layers of surface: 2m depth, 5m depth and the bottom. The current was observed four (4) points at each section and the others were observed one point at each section.

As shown in the below figure, CS-1 is located in Yangon River at the west of Monkey point, CS-2 is in Bago River at the east of Monkey Point, and CS-3 to 8 are located in Yangon River between the Monkey Point and the Elephant Point. CS-5 is in front of Plot No.22 of target berth of the Project.

Tide observation was conducted around Elephant Point for 30 days from 10th of November to 9th December 2012. This river conditions survey was conducted by a Myanmar contractor.



(Prepared by the Study Team)

Figure 7.4-1 Location Map of River Condition Survey

Table 7.4-1 Location of River Condition Survey and Tide Condition

Date	River Condition Survey								Date	Elephant Point		Yangon	
	CS No.	Point	Coordinate (°, ', ")							Time	Height	Time	Height
			N			E				h:m	meters	h:m	meters
16-Oct	1	B	16	45	42	96	10	54	16-Oct	3:13	7.15	0:02	1.05
	1	C	16	45	32	96	10	49		10:48	0.78	4:11	6.41
	1	D	16	45	20	96	10	49		15:33	6.85	12:27	1.03
	1	A	16	45	55	96	10	53		23:02	0.77	16:27	6.17
17-Oct	2	B	16	47	24	96	13	30	17-Oct	3:51	7.23	0:40	1.06
	2	C	16	47	14	96	13	34		11:28	0.68	4:46	6.47
	2	D	16	47	3	96	13	50		16:13	6.81	13:11	1.05
	2	A	16	47	30	96	13	25		23:32	0.77	17:07	6.15
18-Oct	3	A	16	44	26	96	13	0	18-Oct	4:31	7.16	1:16	1.08
	3	B	16	44	15	96	12	27		12:05	0.62	5:28	6.43
	3	D	16	44	2	96	11	48		16:54	6.65	13:53	1.04
	3	C	16	44	9	96	12	11				17:53	6.03
19-Oct	4	B	16	40	45	96	13	37	19-Oct	0:05	0.87	1:54	1.12
	4	C	16	40	33	96	13	14		5:16	6.93	6:15	6.29
	4	D	16	40	22	96	12	58		12:40	0.66	14:35	1.02
	4	A	16	40	57	96	13	53		17:42	6.38	18:47	5.82
20-Oct	5	B	16	38	18	96	15	30	20-Oct	0:40	1.14	2:31	1.22
	5	C	16	38	14	96	15	12		6:07	6.55	7:09	6.01
	5	D	16	38	15	96	14	51		13:15	0.88	15:14	1.06
	5	A	16	38	13	96	15	50		18:37	6.01	19:47	5.52
21-Oct	6	C	16	34	45	96	14	54	21-Oct	1:24	1.59	3:10	1.42
	6	B	16	34	50	96	15	35		7:04	6.05	8:07	5.61
	6	A	16	34	55	96	16	14		13:58	1.29	15:54	1.2
	6	D	16	34	33	96	14	21		19:48	5.62	20:56	5.18
22-Oct	7	C	16	31	9	96	16	30	22-Oct	2:22	2.15	3:57	1.69
	7	B	16	31	51	96	17	22		8:16	5.52	9:14	5.16
	7	D	16	30	41	96	16	6		15:01	1.76	16:49	1.41
	7	A	16	32	28	96	18	3		21:18	5.32	22:20	4.91
23-Oct	8	D	16	28	11	96	19	25	23-Oct	3:47	2.61	5:12	1.94
	8	C	16	29	2	96	20	23		9:50	5.14	10:43	4.8
	8	A	16	30	15	96	21	27		16:31	2.05	18:10	1.51
	8	B	16	29	42	96	21	2		22:57	5.26	23:52	4.87
24-Oct	8	D	16	28	11	96	19	26	24-Oct	5:34	2.68	6:52	1.92
	8	B	16	29	44	96	20	59		11:30	5.07	12:21	4.73

	8	A	16	30	18	96	21	33		18:02	2.02	19:34	1.43
	8	C	16	29	0	96	20	19					
25-Oct	7	C	16	31	11	96	16	37	25-Oct	0:22	5.45	1:13	5.06
	7	B	16	31	50	96	17	20		7:02	2.34	8:19	1.64
	7	A	16	32	29	96	18	5		12:43	5.3	13:37	4.93
	7	D	16	30	43	96	16	6		19:13	1.79	20:42	1.28
26-Oct	6	C	16	34	42	96	14	54	26-Oct	1:18	5.78	2:09	5.36
	6	A	16	34	52	96	16	20		8:04	1.86	9:27	1.32
	6	D	16	34	35	96	14	22		13:29	5.63	14:29	5.22
	6	B	16	34	47	96	15	34		20:11	1.53	21:41	1.16
27-Oct	5	B	16	38	14	96	15	31	27-Oct	1:53	6.1	2:49	5.65
	5	D	16	38	15	96	14	52		8:54	1.44	10:23	1.08
	5	C	16	38	13	96	15	14		14:03	5.93	15:09	5.47
	5	A	16	38	16	96	15	50		21:00	1.33	22:32	1.11
28-Oct	4	B	16	40	39	96	13	40	28-Oct	2:23	6.33	3:22	5.84
	4	A	16	40	56	96	13	52		9:32	1.17	11:08	0.96
	4	D	16	40	24	96	13	0		14:34	6.12	15:41	5.62
	4	C	16	40	33	96	13	15		21:40	1.22	23:14	1.09
29-Oct	3	A	16	44	28	96	12	53	29-Oct	2:50	6.47	3:51	5.94
	3	D	16	44	3	96	11	45		10:07	1.04	11:46	0.93
	3	C	16	44	10	96	12	9		15:06	6.23	16:11	5.69
	3	B	16	44	18	96	12	32		22:12	1.18	23:49	1.08
30-Oct	2	B	16	47	21	96	13	33	30-Oct	3:18	6.54	4:19	5.96
	2	D	16	47	7	96	13	43		10:35	0.99	12:17	0.94
	2	C	16	47	14	96	13	37		15:39	6.25	16:41	5.69
	2	A	16	47	30	96	13	26		22:36	1.16		
31-Oct	1	B	16	45	42	96	10	51	31-Oct	3:46	6.55	0:16	1.06
	1	D	16	45	20	96	10	47		11:01	0.97	4:48	5.96
	1	C	16	45	30	96	10	49		16:11	6.23	12:46	0.93
	1	A	16	45	56	96	10	54		22:56	1.15	17:12	5.65

Source: River Condition: JICA Study Team, Tide: MPA

7.4.2. Result of River Condition Survey

(1) Pre-survey

The Agreement with the Contractor for the river condition survey was made on 24th August. Their field survey was completed at the beginning of November. The final report of the survey will be submitted by the end of November.

For the trial, pre-survey of current was done on the 15th September 2012 from 12:00 to 18:00 at the front of the F/S target area (N : 16º37' 57.3", E : 96 º 15' 49.3"). From the results of the pre-survey the following points are confirmed.

- Current direction is North-South and changes 180 degrees from the flood tide to ebb tide.
- Maximum current is 1.3m/sec at the ebb tide after 3 hours from HWL.
- Average current is 0.7m/sec of upper and middle layer and 0.6m/sec of bottom layer.
- Water temperature is maximum 29.20ºC and minimum 28.43 ºC

River Condition Survey

River Condition Survey

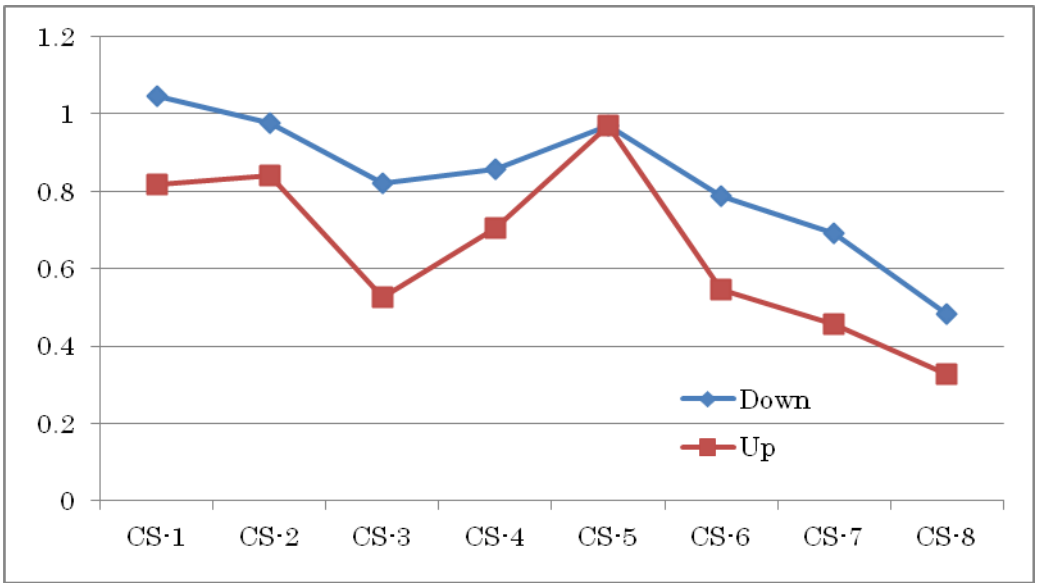
(Prepared by the Study Team)

Figure 7.4-2 Condition of River Condition Survey

(1) Current

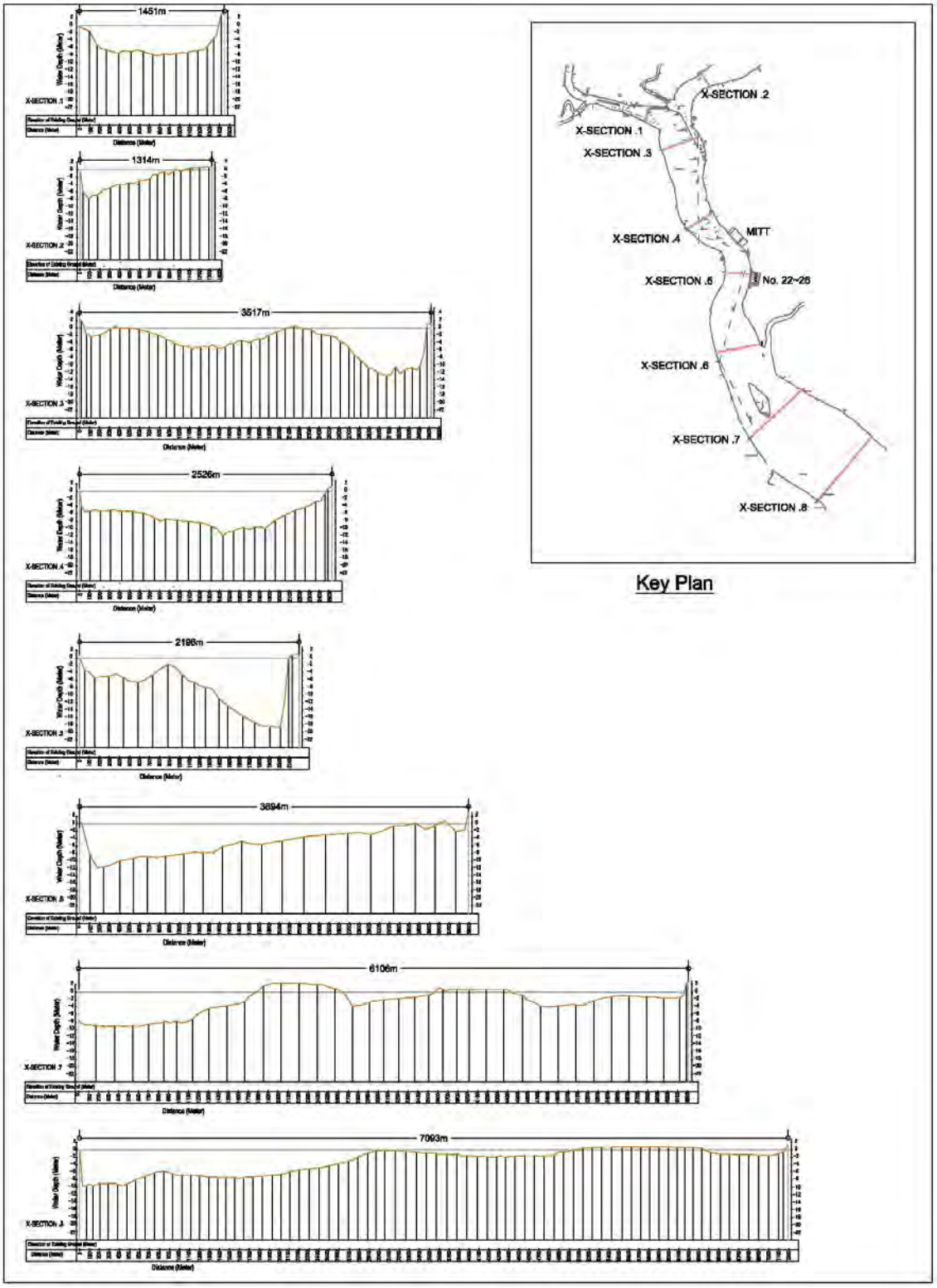
As shown in Figure 7.4 -3, average river current of downstream direction was faster than upstream direction, and the current at upstream area was faster than downstream area. Figure 7.3-4 shows the cross sections of the observation locations. River flow volume was calculated by multiplying the current speed and cross section area. The flow volume of downstream direction was found to be around 21,000 cubic meters per second (m3/sec) and that of upstream direction was around 18,000m3/sec at CS-3 to CS-8 in Yangon River. Comparing CS-1 (Yangon River at the east side of Monkey Point) and CS-2 (Bago River at the west side of Monkey Point), the flow volume at CS-1 was twice of that of CS-2. According to the calculation results, the flow volume

varies at the cross sections, which implies the accuracy of the survey is not so high. In order to obtain more accurate flow volume, long term observation would be necessary.



(Prepared by the Study Team)

Figure 7.4-3 Average River Current (m/sec)



(Prepared by the Study Team)

Figure 7.4-4 Cross Sections of River

(2) Salinity

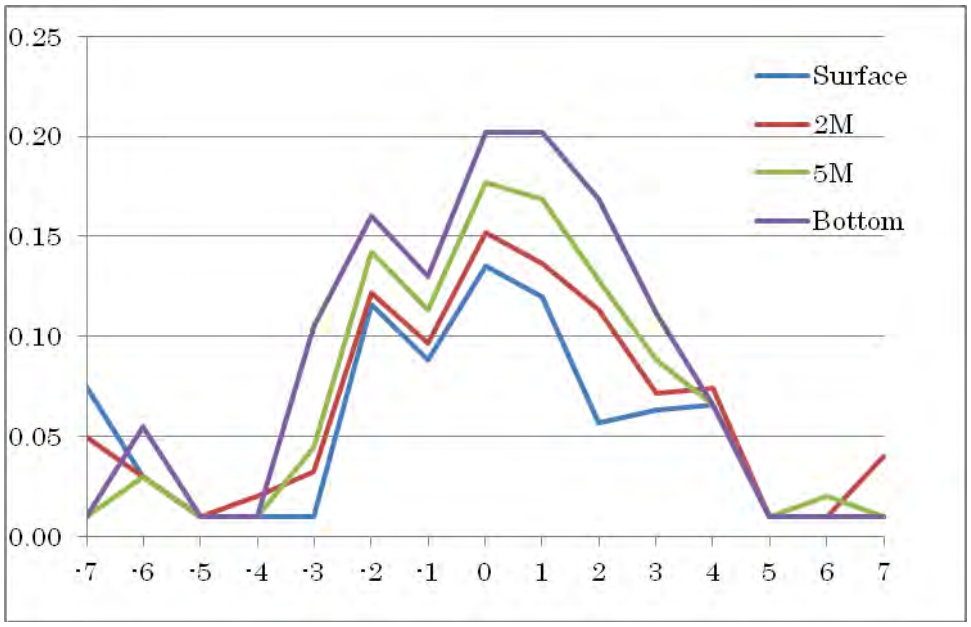
As shown in Table 7.3-2, salinity at CS-1 to CS-5 (from around Monkey Point to target berth for the Project) was constant level at 0.01% regardless of depth and stream direction. Salinity at CS-8 (around elephant point) was higher than that at CS-6 (15km far from the river mouth). Average salinity was higher at the deeper layer. The highest value was observed at the surface of CS-8 (around 5km from the river mouth), which was only 0.5% smaller than the ordinal sea water value of 3.5%

Figure 7.3-5 depicts the hourly change of the salinity at each depth of average value of CS-6, CS-7, and CS-8. As seen in the figure, salinity is high at the high tide, and low at the low tide. Figure 7.3-6 depicts the hourly change of the salinity at the surface at CS-6, CS-7, and CS-8. As seen in the figure, the time of the peak of the high salinity delays as the observation location becomes farther from the river mouth. It is to be noted that there are no differences of the salinity characters at spring and neap tides.

Table 7.4-2 Salinity (%)

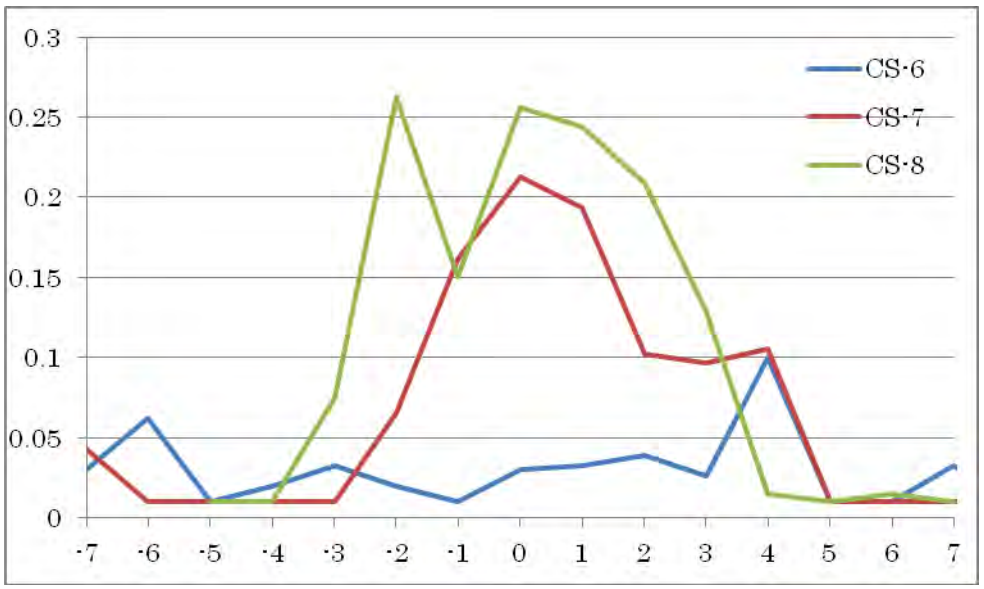
(%)	Average				Max				Min			
	CS-1~5	CS-6	CS-7	CS-8	CS-1~5	CS-6	CS-7	CS-8	CS-1~5	CS-6	CS-7	CS-8
SURFACE	0.01	0.02	0.07	0.09	0.01	0.10	0.35	0.50	0.01	0.01	0.01	0.01
2 M	0.01	0.03	0.07	0.11	0.01	0.15	0.30	0.40	0.01	0.01	0.01	0.01
5 M	0.01	0.02	0.09	0.13	0.01	0.10	0.30	0.40	0.01	0.01	0.01	0.01
BOTTOM	0.01	0.04	0.11	0.14	0.01	0.10	0.40	0.40	0.01	0.01	0.01	0.01
TOTAL	0.01	0.03	0.08	0.12	0.01	0.15	0.40	0.50	0.01	0.01	0.01	0.01

(Prepared by the Study Team)



(Prepared by the Study Team)

Figure 7.4-5 Hourly Change of Salinity (%) at Each Depth (Average of CS-6 to CS-8)



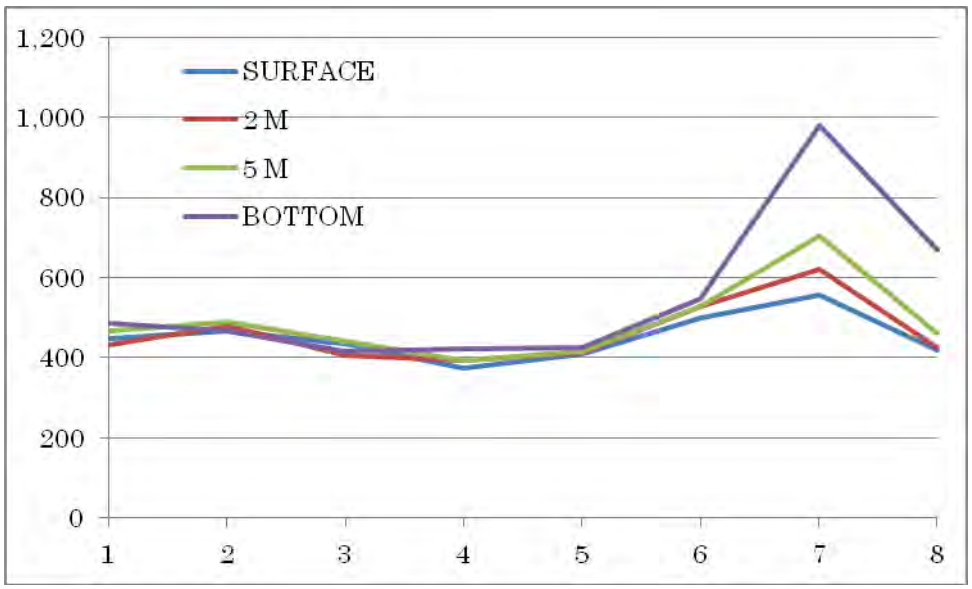
(Prepared by the Study Team)

Figure 7.4-6 Hourly Change of Salinity (%) at CS-6 to CS-8

(3) Suspended Solids (SS)

Suspended solids (SS) is collective term of irresolvability material smaller than 2mm in suspension, and is one of the water quality index described by milligram per little(mg/L). SS inter-correlates with turbidity and is inverse of transparency. SS was observed at 2962mg/L maximum and 488mg/L average. Based on the practical equation by Okinawa Prefectural Institute

of Health and Environment (http://www.eikanken-okinawa.jp/), the transparency is merely 2.2cm by average. SS at CS-1 to CS-5 were constant regardless of depth or stream direction same. SS is higher at downstream and at deeper layer at CS-6 to CS-8. It was found in this survey that the observed SS had no relation to the tide time.



(Prepared by the Study Team)

Figure 7.4-7 Suspended Solids (mg/L) for each observation location

(4) Tide

As mentioned in the previous sections, MPA does not observe the tide level at the Elephant Point now, but purchases the tide table from the India. The tide observation survey was conducted for the check of the tide table for 30 days from 10th November to 9th of December 2012. Comparison of tides between Tide Table and observation is summarized in Table 7.3-2. Tide time of observation delays at 10 minutes average and 2 hours maximum than that of tide table. Tide level of observation is higher 50cm on average and one meter maximum in comparison with the Tide Table. Tide delay time of the Tide Table is larger at H.W.L. than at L.W.L. The error is similarly observed at Monkey Point (32km far from the river mouth). The errors of the Tide Table from the actual tide levels could be attributable to the wedge shape tide wave profile, which is the nature of the tidal river. Long term observation of tides at the river mouth will be needed for the future port planning.

Table 7.4-3 Comparison of Tide (Tide Table - Observation)

	HWL+LWL		LWL only		HWL only	
	Delay (minutes)	Height (meters)	Delay (minutes)	Height (meters)	Delay (minutes)	Height (meters)
Max	35	0.97	31	0.85	35	0.97
Min	-129	-0.6	-129	0.22	-69	-0.57
Ave	-9.9	0.53	-13	0.51	-6.44	0.55

(Prepared by the Study Team)

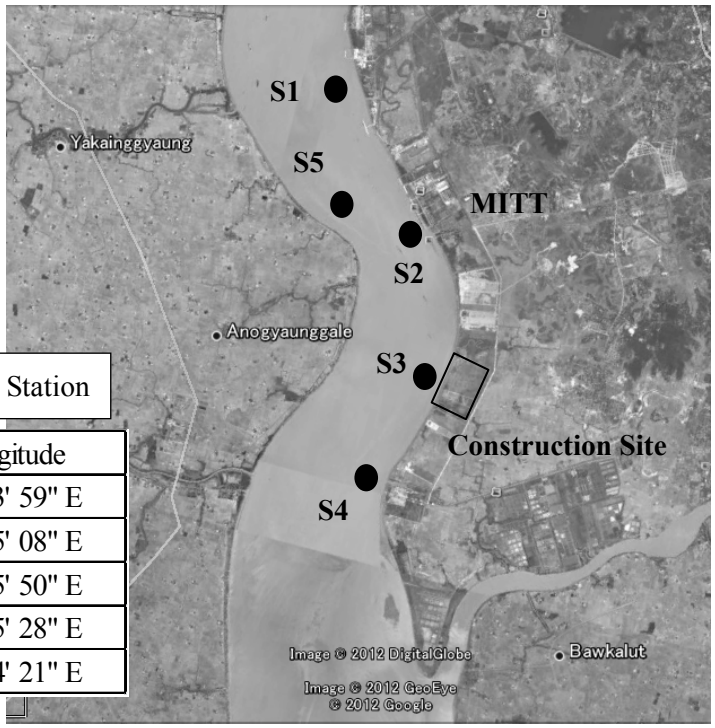
7.5. Environmental Survey

7.5.1. Water quality

(1) Methodology

To understand the water quality status around Yangon Port in Thilawa Area, water quality survey was conducted during low tide from 13th to 15th August 2012 at the locations shown in Figure 7.5-1. Measured parameters were as shown in Table 7.5-1. Water samples were collected from surface layer and bottom layer (1m above the bottom). Water temperature was measured by stick thermometer, salinity by Sekisui SS 31A (made in Japan), pH by handy pH meter Model pH6011 (made in Taiwan), Dissolved Oxygen (DO) by test kit Aqua D.O (made in Thailand). The others were analyzed in laboratories.

S1 is located upper stream as background. S2 is located in front of MITT which is already operating in Yangon Port in Thilawa.S3 is located in front of the study area. S4 is located lower stream as background. S5 is located as the dumping site of dredging soil.



Water and Sediment Quality Station

Sta.	Latitude	Longitude
S1	16°40' 59" N	96°13' 59" E
S2	16°39' 36" N	96°15' 08" E
S3	16°38' 01" N	96°15' 50" E
S4	16°36' 54" N	96°15' 28" E
S5	16°39' 38" N	96°14' 21" E

Source: Google

Figure 7.5-1 Location of Water and Sediment Quality Survey Sites

Table 7.5-1 Parameters of Water Quality Survey

Item	Site/Layer	Parameter
Water quality	5 sites 2 layers（surface, bottom）	Water temp., salinity, pH, suspended solids(SS), turbidity, dissolved oxygen, biochemical oxygen demand(BOD), coliform bacteria, oil content, total nitrogen(T-N), total phosphorus(T-P)

(2) Results

The results of the water quality survey are shown in Table 7.5-2.

Water temperature ranged between 24.0-25.6 °C. Slightly lower value was measured at S3, which may be due to the difference of measurement time. Higher values were measured at bottom layer at S2 and S3, which may be because these samples were collected on 30th August.

Salinity showed zero value at all sites and both layers.

pH ranged between 6.1-7.9 and no clear differences between sites and layers were shown.

SS showed high values at all sites ranging from 260-320mg/L. SS at the bottom layer tended to be higher value than at the surface layer, which may be due to resuspension of sediment by strong current.

Turbidity ranged between 240 - 316 NTU, which showed similar trend to SS.

DO ranged between 5.5-9.0 mg/L. Benthos, it is said to be required for 4mg/L or more DO, may be able to live in this area.

BOD showed high values at all sites ranging from 128-288mg/L. The values differed from site to site and no specific trend emerged.

Coliform bacteria ranged >16-21 MPN/100mL, which were lower than the standard for treated sanitary sewage discharges in IFC Guidelines*.

*: International Finance corporation, Environmental, Health, and Safety Guidelines

No oil contents were detected at any of the sites.

T-N ranged 0.51-0.86mg/L and T-P ranged 0.170-0.323mg/L. T-N and T-P showed higher values at bottom layers.

Table 7.5-2 Results of Water Quality Survey

Site		S1	S2	S3	S4	S5
Date		14-8-2012	14-8-2012*1	13-8-2012	13-8-2012*1	15-8-2012
Hour		7:30	8:00	6:50	7:30	9:00
Depth(m)	-	6	13	3	24	8
Water temp. ℃	Surface.	24.0	24.2	22.8	24.0	24.5
	Bottom	24.0	24.4	22.8	25.6	24.4
Salinity	Surface.	0	0	0	0	0
	Bottom	0	0	0	0	0
pH	Surface.	7.6	7.8	7.8	6.1	7.5
	Bottom	7.5	7.7	6.5	7.8	7.6
SS (mg/L)	Surface.	310	325	260	290	282
	Bottom	300	330	288	308	320
Turbidity (NTU)	Surface.	250	268	240	270	265
	Bottom	245	316	250	300	288
DO (mg/L)	Surface.	6.0	8.0	7.0	6.0	6.0
	Bottom	8.0	7.6	5.5	7.5	9.0
BOD (mg/L)	Surface.	288	160	192	128	240
	Bottom	192	288	160	240	288
Coliform bacteria MPN/100mL	Surface.	>16	>16	>16	>16	>16
	Bottom	>16	21	>16	17	>16
Oil content (mg/L)	Surface.	ND*2	ND*2	ND*2	ND*2	ND*2
	Bottom	ND*2	ND*2	ND*2	ND*2	ND*2
T-N (mg/L)	Surface.	0.55	0.61	0.55	0.55	0.54
	Bottom	0.77	0.75	0.51	0.86	0.59
T-P (mg/L)	Surface.	0.185	0.170	0.173	0.184	0.189
	Bottom	0.303	0.298	0.204	0.323	0.271

*1: Water samples at bottom layer were collected on 30th August at S2 and S4
*2: ND; Not detectable
(Prepared by the Study Team)

(3) Discussion

Strong current causes the resuspension of sediment, which causes high turbidity around Yangon Port in Thilawa Organic contamination occurs with high BOD concentrations between 128-288mg/L. If water pollution is caused from port operation, water quality could be worse at S2 in front of MITT which is already operating in Yangon Port in Thilawa but no such trend is shown in this survey. Considering this, water pollution could be caused from pollutant load from upper stream.

7.5.2. Sediment quality

(1) Methodology

To understand the sediment quality status around Yangon Port in Thilawa Area, sediment quality survey was conducted from 13th to 15th August 2012 at same locations as the water quality shown in Figure 7.5-1. Measured parameters were as shown in Table 7.5-3 and sediment samples were collected by diver and analyzed in laboratories. As there are no sediment qualities standards in Myanmar or in Southeast Asia, the dredged material disposal standards (dumping at sea) in Australia which belongs to moderate climate and has an organized-dredging guideline are used for assessment of sediment pollution. Concentration above the screening level would mean that be toxic effects on organisms could be expected.

Table 7.5-3 Parameters of Sediment Quality Survey

Item	Site/Layer	Parameter
Sediment quality	5 sites 1 layers（surface）	Specific gravity, water content, grain size, total organic carbon, total petroleum hydrocarbon, arsenic, cadmium, chromium, lead, mercury, copper, nickel, silver, zinc, PCBs, DDT, dieldrin, endrin, TBT

(2) Results

The results of the sediment quality survey are shown in Table 7.5-4 and Table 7.5-5.

Physical characteristics

Grain size distributions consisted of more than 60% of silt at S1 - S4, and 56% of clay at S5. Specific gravity ranged between 2.67 - 2.70, and water content ranged between 51.14 -69.44%.

Heavy metals

Copper at S3-S5 and Nickel at S1-S5 exceeded screening levels of dredged material disposal in Australia.

Organic Pollutants

DDT exceeded screening levels of dredged material disposal in Australia at S2-S5.

Table 7.5-4 Results of Sediment Quality Survey (grain size)

Site	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
S1	37.0	61.0	2.0	0.0
S2	21.5	76.5	2.0	0.0
S3	33.5	65.5	1.0	0.0
S4	36.5	61.5	2.0	0.0
S5	56.0	43.0	1.0	0.0

Table 7.5-5 Results of Sediment Quality Survey

Site		S1	S2	S3	S4	S5	Screening Level[*1]
Date		14-8-2012	14-8-2012[*1]	13-8-2012	13-8-2012[*1]	15-8-2012	
Hour		7:30	8:00	6:50	7:30	9:00	-
Depth	m	6	13	3	24	8	-
Physical properties							
Specific gravity	-	2.69	2.67	2.69	2.67	2.70	-
Water content	%	56.42	69.44	61.20	61.73	51.14	-
Heavy metals							
Arsenic	mg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	20
Cadmium	mg/kg	0.3	0.4	0.42	0.5	0.35	1.5
Chromium	mg/kg	31.1	19.9	24.42	20.82	22.57	80
Lead	mg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	50
Mercury	mg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	0.15
Copper	mg/kg	40	10	**100**	**100**	**100**	65
Nickel	mg/kg	**99.22**	**96**	**118.97**	**112**	**113.17**	21
Silver	mg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	1.0
Zinc	mg/kg	10	100	10	20	10	200
Organic Pollutants[*3]							
Total organic carbon	mg/g	16.0	8.1	9.4	8.9	4.9	-
PCBs	µg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	23
DDT	µg/kg	ND[*2]	**5.4 (6.6)**	**7.6 (8.0)**	**12.7 (14.2)**	**14.0 (28.5)**	1.6
Dieldrin	µg/kg	ND[*2]	6.4 (7.9)	9.9 (10.5)	ND[*2]	ND[*2]	280
Endrin	µg/kg	ND[*2]	0.0032 (0.0039)	ND[*2]	ND[*2]	ND[*2]	10
Total petroleum hydrocarbon	mg/kg	77.6 (48.5)	13.8 (17.0)	45.8 (48.7)	31.4 (35.2)	100 (204)	550
TBT	µg/kg	ND[*2]	ND[*2]	ND[*2]	ND[*2]	ND[*2]	9

*1: National Assessment Guidelines for Dredging 2009, Australian Government

*2: ND; Not detectable

*3: The values in parentheses are normalized to 1% total organic carbon, as required by the National Assessment Guidelines for Dredging

(Prepared by the Study Team)

(3) Comparison with standard in other countries

To confirm appropriateness of the Australian screening levels, comparison of the screening level with the assessment criteria for dredging material on the North Sea Region(Germany, The Netherlands, Belgium, France, United Kingdom, Ireland, Norway, Denmark, Spain) (Table 7.5-6).

Screening level in Australia is generally intermediate of criteria (Level1) in the North Sea region. Copper and nickel which exceed screening level doesn't exceed maximum value of Level2 nevertheless exceed Level1.

Table 7.5-6 Comparison with the assessment criteria on the North Sea Region

Item		Myanmar	Australia*1	North Sea Region*2	
		The Survey results	Screening Level	Level 1 *3	Level 2 *3
Arsenic	mg/kg	ND	20	9~80	29~200
Cadmium	mg/kg	0.3~0.5	1.5	0.4~2.6	2.4~15
Chromium	mg/kg	19.9~31.1	80	40~560	120~5900
Lead	mg/kg	ND	50	40~100	100~500
Mercury	mg/kg	ND	0.15	0.2~0.63	0.7~3
Copper	mg/kg	10~100	65	20~100	60~400
Nickel	mg/kg	96~113.17	21	20~100	45~400
Silver	mg/kg	ND	1	-	-
Zinc	mg/kg	10~100	200	130~500	365~3000
PCBs	µg/kg	ND	23	7~250	40~1260
DDT	µg/kg	5.4~14.0	1.6	-	-
Dieldrin	µg/kg	ND~9.9	280	-	-
Endrin	µg/kg	ND~0.0032	10	-	-
Total petroleum hydrocarbon	mg/kg	17~204	550	-	-
TBT	µg/kg	ND	9	0.2~0.63	0.7~3

*1: National Assessment Guidelines for Dredging 2009, Australian Government

*2: Assessment Criteria for Dredged Material with special focus on the North Sea Region

*3: General definitions are shown below but they differ by country.
Below Level1: There is no concern with disposal to cause pollution
Between Level1 and Level2: Further impact assessment by disposal is necessary
Above Level2: Unsuitable for sea disposal, additional investigation and consideration are required

(Prepared by the Study Team)

(4) Discussion

Sediments around Yangon Port in Thilawa Area mainly consist of silt. Copper and Nickel in Heavy metals, and DDT in Organic pollutants exceeded screening levels of dredged material disposal in Australia. These values were not especially high in front of the project site but were similar all around survey sites. If sediment pollution is caused from port operation, sediment quality could be worse at S2 in front of MITT which is already operating in Yangon Port in

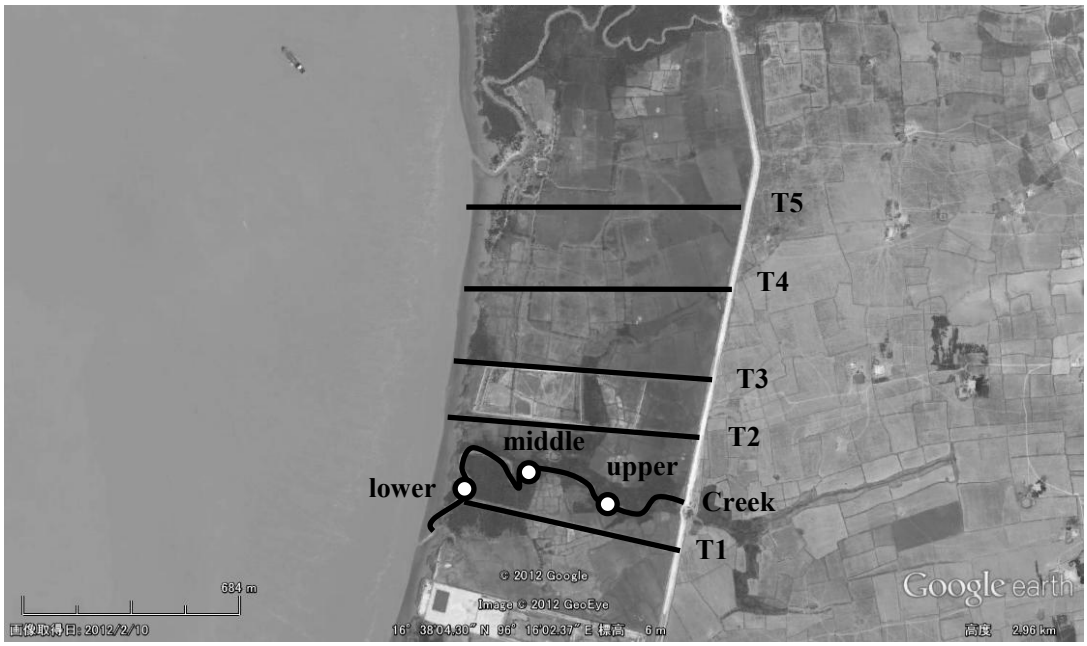
Thilawa but no such trend is shown in this survey. Considering this, sediment quality could be similar all around Yangon Port in Thilawa by the effect of upper stream or surroundings.

7.5.3. Ecosystem

(1) Methodology

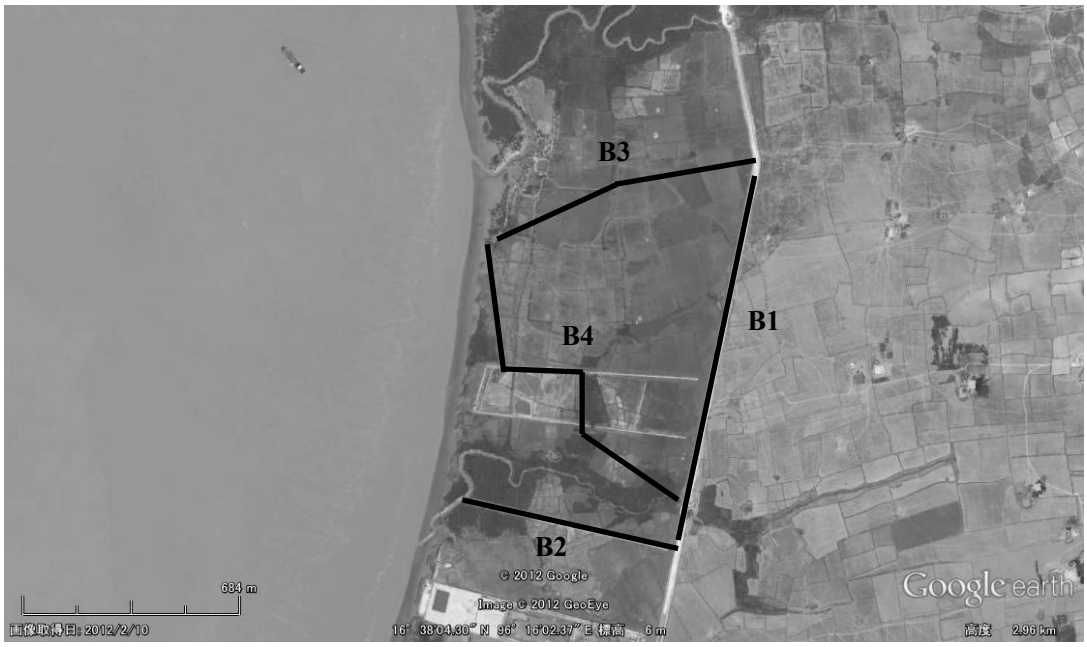
Flora, birds, mammals, reptiles and amphibians, fishes and tidal-flat organisms were surveyed from 11th to 15th August 2012 in the study site.

Flora survey was conducted at transects of T1-T5 and Creek (Figure 7.5-2), reptiles and amphibians survey at transects of T1-T5 (Figure 7.5-2), and birds survey at transects of B1-B4 (Figure 7.5-3) by line-transect method. Mammal survey was conducted by interview survey with local people because no mammals were recorded by sighting. Fish survey was conducted by drift net and beach seine net at S1-S5, the same sites as the water and sediment quality surveys (see Figure 7.5-1 for the location), and by cast net at upper, middle, lower stream in the creek as shown in Figure 7.5-2. The cast net was thrown three times at each site. Tidal-flat organisms were observed on the tidal flat in the Study site.



Source: Google

Figure 7.5-2 Location of Flora, Reptile and Amphibian and Fish Survey Sites



Source: Google

Figure 7.5-3 Location of Bird Survey Sites

Threatened species were determined based on the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List, because there is no national Red List in Myanmar. According to IUCN Red List, species are classified into eight groups as follows. In the IUCN Red List, the official term “threatened” is a grouping of three categories: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU). Species were classified ten groups including, “NL”; Not Listed in IUCN Red List and “UN”, some species are listed under the IUCN Red list but it is uncertain whether the observed species are included as it was not possible to identify to the species level, in addition to IUCN Red List categories.

- EX (Extinct): No individuals remaining.
- EW (Extinct in the Wild): Known only to survive in captivity, or as a naturalized population outside its historic range.
- CR (Critically Endangered): Extremely high risk of extinction in the wild.
- EN (Endangered): High risk of extinction in the wild.
- VU (Vulnerable): High risk of endangerment in the wild.
- NT (Near threatened): Likely to become endangered in the near future.
- LC (Least concern): Lowest risk. Widespread and abundant taxa are included in this category.
- DD (Data Deficient): Not enough data to make an assessment of its risk of extinction.

(2) Results

1) Flora

The results of the flora survey are shown in Table 7.5-7. The plants of 37 families and 67 species were found in this survey. There were no threatened species in IUCN Red List. As near threatened species, *Phoenix paladosa Roxb* and *Ceriops decandra (Griff) Ding Hou* were found. Mangroves were found mainly along the creek and around the river bank. In reference to Tomlinson (1986), five species of the major mangroves, three species of Minor mangroves and six species of Mangrove associates were found in this survey.

The plants of 16 families and 21 species were found along the creek. As to mangroves, three species of the major mangroves, one species of minor mangroves and five species of Mangrove associates were found. Mangroves and bushy trees inhabited together along the creek.

Vegetation and mangrove area in this site are calculated based on the satellite image of the Google Earth (October 2012). Mangrove area is defined as the vegetation area which is flooded at high tide (+6.2m). (Particularity of mangrove is considered although some mangrove may live in the upper part of the high tide level). There are 14.20ha of vegetation area and 1.20ha of mangrove area in the project site with 63.37ha (Table 7.5-8).

Table 7.5-7 Results of flora survey

No.	Family Name	Scientific Name	Common Name	Habit	T1	T2	T3	T4	T5	Creek	IUCN	Mangrove*
1	Acanthaceae	*Acanthus ilicifolius* L.	Kha-yar	S	O	O	O	O	O	O	LC	A
2		*Ruellia tuberosa* L.	Byauk	S		O	O	O		O	NL	
3	Amaranthaceae	*Alternanthera sessilis* (L.)R.Br.	Pa-zunsa-yaing	H	O						LC	
4	Amaryllidaceae	*Crinum asiaticum* L.	Ko-yan-gyi	H						O	NL	
5		*Crinum* sp.	Not known	H						O	UN	
6	Araceae	*Alocasia macrorrhizos* G.Don	Pein	H	O						NL	
7	Arecaceae	*Nypa fruticans* Wurmb	Da-ni	ST		O				O	LC	Ma
8		*Phoenix paludosa* Roxb.	Thin-paung	S		O	O			O	NT	
9	Asclepiadaceae	*Calotropis gigantea* (L.)Dryand.ex W.,T.Aiton	Ma-yoe	S					O		NL	
10		*Hoya burmanica* Rolfe	Kha-mon	CL		O	O	O		O	NL	
11	Asteraceae	*Eclipta alba (L.)Hassk*	Kyeik-hman	H	O				O		NL	
12		*Enhydra fluctuans* Lour.	Ka-na-phaw	H			O		O		NL	
13		*Melanthera biflora* (L.) Wild	Not known	CL		O	O			O	NL	
14		*Pluchea indica* (L.)Less.	Kha-ru	S		O	O	O		O	NL	
15	Avicenniaceae	*Avicennia marina* (Forsk)Vierh.	Tha-met-ywet-leik	ST	O						LC	Ma
16		*Avicennia officinalis* L.	That-met-wyine	ST						O	LC	Ma
17	Bignoniaceae	*Dolichandrone spathacea* (L. f.) K. Schum.	Kywe-hna-khaung	ST	O						LC	A
18	Boraginaceae	*Heliotropium indicum* L.	Sin-hna-maung	H	O						NL	
19	Caesalpiniaceae	*Caesalpinia crista* L.	A-loe-lay	CL						O	NL	A
20		*Senna tora* (L.)Roxb.	Dan-gywe	S		O	O			O	NL	
21	Convolvulaceae	*Hewittia* sp.	Not known	CL	O	O					UN	
22		*Ipomoea* sp.	Ka-zun	H	O				O		UN	
23		*Ipomoea* sp.	Taw-kyet-thon	CL						O	UN	
24	Costaceae	*Costus speciosus* Sm.	Pha-lan-taung-hmwe	H					O		NL	
25	Cucurbitaceae	*Luffa aegyptiaca* Mill.	Tha-but-khar	CL					O		NL	
26		*Momordica charantia* L.	Kyet-hin-khar	CL					O		NL	
27	Cyperaceae	*Cyperus exaltatus* Retz	Not known	H		O		O			NL	
28		*Cyperus malaccensis* Lam.	Not known	S	O			O	O		NL	
29		*Eleocharis dulcis* Trin.	Not known	G	O		O				NL	
30		*Eleocharis* sp.	Not known	H			O		O		UN	
31		*Fimbristylis ferruginea* Vahl.	Not known	H				O	O		LC	
32		*Schoenoplectus muricinux* L.	Not known	H	O		O	O			LC	
33	Dioscoreaceae	*Dioscorea sativa* L.	Myauk-u	CL		O	O	O			NL	
34	Euphorbiaceae	*Excoecaria agallocha* L.	Tha-yaw	ST		O	O			O	LC	Mi
35	Fabaceae	*Alysicarpus vaginalis* (L.)DC.	Than-manaing-kyauk-manaing	H					O		NL	
36		*Canavalia cathartica*	Not known	CL	O				O		NL	
37		*Dalbergia spinosa* Roxb.	Byaik	ST			O	O	O	O	NL	
38		*Derris trifoliata* Lour.	Mi-chaung-pan	CL						O	NL	A
39		*Desmodium triflorum* (L.) DC.	Not known	H		O	O				NL	
40		*Desmodium velutinum* (Willd.)DC.	Not known	S	O						NL	
41		*Erythrina* sp.	Ka-thit	ST	O		O				UN	
42		*Geissaspis cristata* Wight & Arn.	Not known	H			O	O			LC	
43		*Sesbania paludosa* Roxb.	Nyan	S	O	O	O				NL	
44		*Tadehagi triquetrum* (L.)H.Ohashi	Lauk-thay	H				O			NL	
45	Lauraceae	*Cassytha filiformis* L.	Shwe-nwee	Parasitic H						O	NL	
46	Malvaceae	*Hibiscus tiliaceus* L.	Thin-ban	ST		O	O	O		O	NL	A
47		*Sida acuta* Burm.f.	Ta-byet-si-ywet-shae	S						O	NL	
48		*Urena lobata* L.	Ket-se-nae-gyi	S	O						NL	
49	Mimosaceae	*Albizia lebbek* (L.) Benth.	Bama-kokko	ST	O				O		NL	
50		*Mimosa pudica* L.	Hti-ka-yon	H	O	O	O	O	O		NL	
51	Moraceae	*Ficus religiosa* L.	Baw-di--nyaung	ST						O	NL	
52	Musaceae	*Musa* sp.	Nget-pyaw	H		O					UN	
53	Myrsinaceae	*Aegiceras corniculatum* (L.)Blanco	Ye-kayar	ST	O		O				LC	Mi
54	Onagraceae	*Jussiaea suffruticosa* L.	Lay-nyin	H	O						NL	
55	Poaceae	*Cynodon dactylon* Pers.	Myay-sar-myet	G	O	O	O				NL	
56		*Echinochloa colona* Link.	Be-sar-myet	H	O		O				NL	
57		*Eragrostis tremula* Hochst. ex. Steud.	Not known	G	O				O		NL	
58	Polygonaceae	*Polygonum* sp.	Kywe-hna-khaung-gate	H		O			O		UN	
59	Pontederiaceae	*Eichhornia crassipes* (Mart.)Solms	Bae-da	Aquatic H	O				O		NL	
60		*Monochoria hastata* Solms	Ka-dauk-sat	Aquatic H					O		LC	
61		*Pontederia* sp.	Not known	Aquatic					O	O	UN	
62	Pteridaceae	*Acrostichum speciosum*	Nget-kyi-taung	Aquatic Fern					O		LC	Mi
63	Rhizophoraceae	*Ceriops decandra* (Griff.)Ding Hou	Ma-da-ma	ST	O	O	O			O	NT	Ma
64	Rubiaceae	*Borreria distans* (H.B.K.)Cham.& Schlecht.	Not known	H	O						NL	
65	Scrophulariaceae	*Lindernia crustacea*	Not known	H	O						LC	
66	Sonneratiaceae	*Sonneratia caseolaris* (L.)Engl.	La-mu	ST	O	O	O				LC	Ma
67	Sterculiaceae	*Melochia corchorifolia* L.	Pilaw-agyi	H	O						NL	
68	Typhaceae	*Typha angustifolia* Chaub. & Bory	Paik-swel	Aquatic							LC	
69	Verbenaceae	*Clerodendrum inerme* Gaertn.	Taw-kyaung-pan	S		O	O	O	O	O	NL	A
70	Vitaceae	*Cayratia trifolia* (L.) Domin	Not known	CL	O						NL	

(Prepared by the Study Team)

*: Tomlinson,P.B. (1986),The botany of Mangroves ,Cambridge University Press, Cambridge.

Table 7.5-8 Vegetation and Mangrove area

(Unit: ha)

Area	Plot 23	Plot 24	Plot 25	Plot 25-26 Delta	Plot 26	Total
Project site	14.29	14.30	13.76	5.60	15.42	63.37
Vegetation	0.00	1.49	1.24	1.31	10.16	14.20
Mangrove	0.00	0.16	0.00	0.05	0.99	1.20

(Prepared by the Study Team)

2) Birds

The results of the bird survey are shown in Table 7.5-9. The birds of 23 families and 40 species were found in this survey. There were no threatened species in IUCN Red List. As near threatened species, *Mycteria leucocephala* were found.

Table 7.5-9 Results of Bird Survey

No.	Family name	Scientific name	Common name	B1	B2	B3	B4	IUCN
1	Anatidae	*Dendrocygna javanica*	Lesser Whistling-duck	1				LC
2	Ciconiidae	*Mycteria leucocephala*	Painted Stork	2	2	6	2	NT
3	Phalacrocoracidae	*Phalacrocorax niger*	Little Cormorant			1		LC
4	Ardeidae	*Butorides striata*	Little Heron	2	3	1	3	LC
5		*Ardea cinerea*	Grey Heron	1	1			LC
6		*Ardeola bacchus*	Chinese Pond-heron	4	5	5	3	LC
7		*Bubulcus coromandus*	Eastern Cattle-egret	5	10	2	2	NL
8		*Ardea alba*	Great Egret	4	7	3	5	NL
9		*Mesophoyx intermedia*	Intermediate Egret	7	8	8	2	LC
10		*Egretta garzetta*	Little Egret	30	13	5	7	LC
11	Falconidae	*Haliastur indus*	Brahminy Kite				1	LC
12	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		1			LC
13	Charadriidae	*Charadrius mongolus*	Lesser Sand-plover	3	6	5	10	LC
14	Pluvialidae	*Pluvialis fulva*	Pacific Golden Plover	1		15	10	LC
15	Scolopacidae	*Numenius phaeopus*	Whimbrel		13	4	3	LC
16		*Actitis hypoleucos*	Common Sandpiper	2				LC
17		*Tringa nebularia*	Common Greenshank	15	4		5	LC
18		*Tringa totanus*	Common Redshank	20	12	8	10	LC
19	Sternidae	*Sterna albifrons*	Little Tern			6	3	LC
20	Columbidae	*Columba livia*	Rock Pigeon				3	LC
21		*Streptopelia chinensis*	Spotted Dove	8	50	8	35	NL
22	Cuculidae	*Clamator coromandus*	Chestnut-winged Cuckoo		1			LC
23		*Cacomantis merulinus*	Plaintive Cuckoo	1	2			LC
24		*Centropus sinensis*	Greater Coucal				1	LC
25	Apodidae	*Cypsiurus balasiensis*	Asian Palm-swift	2	20	8	10	LC
26	Alcedinidae	*Halcyon smyrnensis*	White-throated Kingfisher		1			LC
27	Rhipiduridae	*Rhipidura albicollis*	White-throated Fantail		1			LC
28	Corvidae	*Corvus splendens*	House Crow	10	10	16	15	LC
29		*Corvus japonensis*	Large-billed Crow				1	NL
30	Aegithininae	*Aegithina tiphia*	Common Iora		3			LC
31	Passeridae	*Passer domesticus*	House Sparrow	53	25			LC
32		*Passer montanus*	Eurasian Tree-sparrow				5	LC
33	Ploceidae	*Ploceus manyar*	Streaked Weaver	6				LC
34		*Ploceus philippinus*	Baya Weaver	30	60		8	LC
35	Sturnidae	*Acridotheres fuscus*	Jungle Myna	12	20	10	15	LC
36		*Acridotheres tristis*	Common Myna	9	15			LC
37	Muscicapidae	*Copsychus saularis*	Oriental Magpie-robin			1		LC
38	Hirundinidae	*Hirundo rustica*	Barn Swallow	1				LC
39	Cisticolidae	*Prinia flaviventris*	Yellow-bellied Prinia		30	2	5	LC
40		*Prinia inornata*	Plain Prinia		20		3	LC

(Prepared by the Study Team)

Note: Numbers in the table show the numbers of individuals recorded

3) Mammals

No mammals were recorded by sighting. No mammal species were recorded except rodents according to the interview with local people. During this survey, dead *Bandicota indica* was founded by the local people (Table 7.5-10).

Table 7.5-10 Results of Mammals Survey

No.	Family name	Scientific name	Common name	IUCN
1	Muridae	*Bandicota indica*	Greater Bandicoat Rat	LC

(Prepared by the Study Team)

4) Reptiles and amphibians

The results of the reptile and amphibian survey are shown in Table 7.5-11. The reptiles of 4 families and 6 species, and the amphibians of 1 family and 1 species were found. There were no threatened species in IUCN Red List.

Table 7.5-11 Results of Reptile and Amphibian Survey

No.	Family Name	Scientific Name	Common Name	Time		Transect					IUCN
				Day	Night	1	2	3	4	5	
1	Colubridae	*Ptyas mucosa*	Indo-chinese Rat Snake		19:30	1					NL
2	Elapidae	*Naja kaouthia*	Monocellate Cobra		21:15			1			LC
3		*Bungarus fasciatus*	Yellow-banded Krait		20:27				1		NL
4	Homalopsidae	*Cerebrus rhychops*	Dog-faced Water Snake	11:20					1		NL
5	Natricidae	*Amphiesma stolatum*	Buff-striped Keelback	8:44						3	NL
6		*Xenochrophis piscator*	ChequeredKeelback	11:26						1	NL
7	Ranidae	*Fejervarya limnocharis*	Paddy Frog		20:12	5					LC
8		*Fejervarya cf. limnocharis*	Paddy Frog		20:45		6				LC

(Prepared by the Study Team)

Note: Numbers in the table show the numbers of individuals recorded

5) Fishes

The results of the fish survey in the Yangon River are shown in Table 7.5-12. The fishes of 9 families and 10 species were found. There were no threatened species in IUCN Red List.

The results of the fish survey in the creek are shown in Table 7.5-13. The fishes of 3 families and 3 species, and the prawns of one family and one species were found. They were less than 10cm and numbers of catches per one cast net ranged between 0-1.

Table 7.5-12 Results of Fish Survey (Yangon River)

No.	Family	Scientific name	Common Name	English name	S1	S2	S3	S4	S5	IUCN
1	Ariidae	*Arius burmanicus*	Nga yaung	Sea catfish	O	O	O			NL
2	Bagaridae	*Mystus gulio*	Nga yway/Nga zin	Long whiskers catfish	O	O	O	O	O	LC
3	Batrachoididae	*Allenbatrachus grunniens*	Nga oak pha	Toad fish			O			NL
4	Cynoglossidae	*Cynoglossus bilineatus*	Nga khway shar	Fourlined tonguesole	O	O	O		O	NL
5		*Cynoglossus lingua*	Nga khway shar	Long tongue sole		O		O	O	NL
6	Engraulidae	*Setipinna wheeleri*	Nga pyar	Burma hairfin anchovy	O	O	O	O		NL
7	Mugilidae	*Rhinomugil corsula*	Kabalu/Nga zin	Corsula					O	LC
8	Polynemidae	*Polynemus paradiseus*	Nga pon na	Paradise threadfin	O	O	O	O	O	NL
9	Schilbidae	*Silonia silondia*	Nga myin	Silond catfish	O	O	O		O	LC
10	Sciaenidae	*Otolithoides pama*	Nga poke thin	Pama croaker	O	O	O	O	O	NL

(Prepared by the Study Team)

Table 7.5-13 Results of Fish Survey (Creek)

No.	Family	Scientific name	Common Name	English name	Upper	Middle	Lower	IUCN
1	Ariidae	*Arius burmanicus*	Nga yaung	Sea catfish	1	1	1	NL
2	Bagaridae	*Mystus gulio*	Nga yway/Nga zin	Long whiskers catfish	1	1	1	LC
3	Schilbidae	*Silonia silondia*	Nga myin	Silond catfish	0	1	1	LC
4	Palaemonoidae	*Palaemon sp.*	Not known	Prawn	1	0	1	NL

(Prepared by the Study Team)

Note: Numbers in the table show the numbers of individuals recorded per three throw of cast net

6) Tidal-flat organisms

The results of the tidal-flat organisms are shown in Table 7.5-14. The tidal-flat organisms of 4 families and 6 species were found in this survey. There were no threatened species in IUCN Red List.

Table 7.5-14 Results of Tidal-Flat Organisms

No.	Family	Scientific name	Common name	English name	IUCN
1	Gobiidae	*Boleophthalmus boddarti*	Nga phyan	Boddart's goggle-eyed goby	NL
2		*Periophthalmus cantonensis*	Nga phyan	New Guinea mudskipper	NL
3	Osypodidae	*Uca crassipes*	Phonegyi ganan	Fiddler crab	NL
4	Gelasimidae	*Macrophthalmus sp.*	Shunt ganan	Mud crab	NL
5		*Sesarma intermedia*	Shunt ganan	Fiddler crab	NL
6	Littorinidae	Unidentified	Hkyu	Aquatic snail (gastropod)	NL

(Prepared by the Study Team)

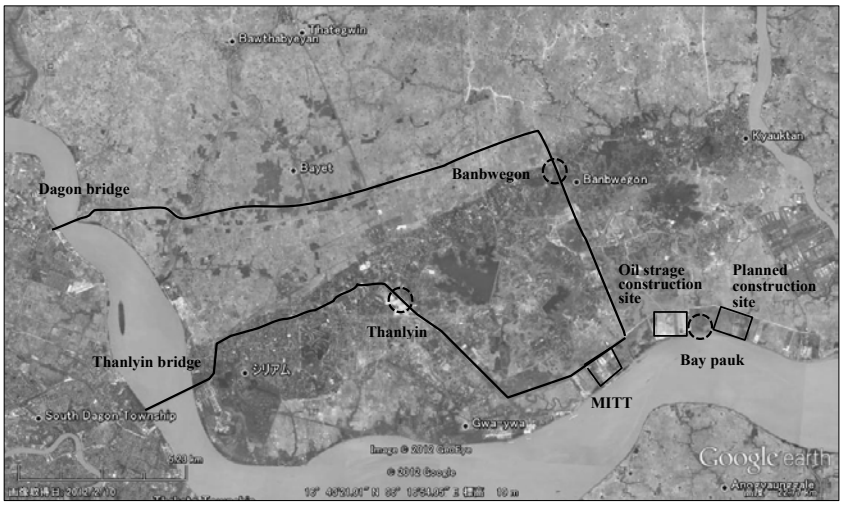
(3) Discussion

There were no threatened species by IUCN Red List. The large parts of the study area were rice paddies or former rice paddies, and wild plants were only found along the creek and around the river edge. The tidal flat appeared during the neap tide along the river edge. Mangroves and bushy trees inhabited together along the creek. Not many numbers of fishes could be living in the creek, with catches ranged 0-1 per one cast net from the results of fishes survey.

7.5.4. Interview survey

(1) Methodology

To understand the impact to air quality, noise and vibration and so on derived from operation of Yangon Port in Thilawa, the interview survey was conducted around and along the access roads on 20th September 2012. Three survey sites were selected, Bay Pauk area adjacent to the project sites, Thanlyin area along the Thanlyin bridge route, and Banbwegon area along the Dagon bridge route, as show in Figure 7.5-4.



Source: Google

Figure 7.5-4 Location of Interview Survey Sites

The following questionnaires were distributed to ten people at each site.

<Bay Pauk>

1. Compared to before construction of Yangon Port in Thilawa Area (before 1998)

1-1 River water quality	a better - b unchanged - c worse - d uncertain
1-2 Air quality	a better - b unchanged - c worse - d uncertain
1-3 Noise and vibration	a better - b unchanged - c worse - d uncertain
1-4 Traffic volume	a decreased - b unchanged - c increased - d uncertain
1-5 Fish catches	a increased – b unchanged - c decreased - d uncertain
1-6 Ecosystems	a better - b unchanged - c worse - d uncertain

2. Regarding to oil storage facility construction work (under construction)

1-1 River water quality	a better - b unchanged - c worse - d uncertain
1-2 Air quality	a better - b unchanged - c worse - d uncertain
1-3 Noise and vibration	a better - b unchanged - c worse - d uncertain
1-4 Traffic volume	a decreased - b unchanged - c increased - d uncertain
1-5 Fish catches	a increased – b unchanged - c decreased - d uncertain

1-6 Ecosystems a better - b unchanged - c worse - d uncertain

<Thanlyin and Banbwegon>

1. Compared to before construction of Yangon Port in Thilawa Area (before 1998) and before construction work of oil storage facility

1-1 Air quality a better - b unchanged - c worse - d uncertain

1-2 Noise and vibration a better - b unchanged - c worse - d uncertain

1-3 Traffic volume a decreased - b unchanged - c increased - d uncertain

(2) Results

Ten men and 3 women ranging in age from 25 to 51 were surveyed in Bay Pauk area. The results are shown in Table 7.5-15 and Table 7.5-16. Each answer was the same because the 13 people were surveyed at the same time and answered after discussion among with them. The answers of all "unchanged" for the water quality, air quality, noise and vibration and ecosystems, all "increased" for the traffic volume, and all "decreased" for the fish catches were collected to questionnaire No.1 and No.2. The reasons for decreasing of fish catches was not because of the construction of the port but because small boats had been restricted to downstream of the Yangon River some years ago.

Table 7.5-15 Results of question No.1 (Bay Pauk Area)

	a	b	c	d
Water quality	0	13	0	0
Air quality	0	13	0	0
Noise and vibration	0	13	0	0
Traffic volume	0	0	13	0
Fish catches	0	0	13	0
Ecosystems	0	13	0	0

(Prepared by the Study Team)

Table 7.5-16 Results of Question No.2 (Bay Pauk Area)

	a	b	c	d
Water quality	0	13	0	0
Air quality	0	13	0	0
Noise and vibration	0	13	0	0
Traffic volume	0	0	13	0
Fish catches	0	0	13	0
Ecosystems	0	13	0	0

(Prepared by the Study Team)

Seven men and 3 women (total of 10 people) ranging in age from 37 to 49 were surveyed in

Thanlyin area. The results are shown in Table 7.5-17. All answered “unchanged” for the air quality and noise and vibration, and all answered “increased” for the traffic volume.

Table 7.5-17 Results of Question (Thanlyin Area)

	a	b	c	d
Air quality	0	10	0	0
Noise and vibration	0	10	0	0
Traffic volume	0	0	10	0

(Prepared by the Study Team)

Six men and 4 women ranging in age from 21 to 52 were surveyed in Banbwegon area. The results are shown in Table 7.5-18.

Table 7.5-18 Results of Question (Banbwegon Area)

	a	b	c	d
Air quality	0	10	0	0
Noise and vibration	0	4	6	0
Traffic volume	0	0	10	0

(Prepared by the Study Team)

(3) Discussion

Environmental impact from operation of Yangon Port in Thilawa Area and construction work of oil facility seems to be small in Bay Pauk area. Impact of air quality and noise and vibration seems to be small in Thanlyin area, where unloaded trucks are passing through. On the other hand, more than half of respondents answered that there was an increase in Noise in Banbwegon area, where loaded trucks are passing through. In addition to increasing cargo transport from Yangon Port in Thilawa, increases in the number of routes and school buses could be major factors.

Appendix

RESETTLEMENT ACTION PLAN (DRAFT)

STUDY REPORT

THE PORT DEVLOPMENT PROJECT

OF THILAWA (PHASE I)

FEBRUARY 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

The Overseas Coastal Area Development Institute of Japan

NIPPON KOEI CO., LTD

Index

Attachement

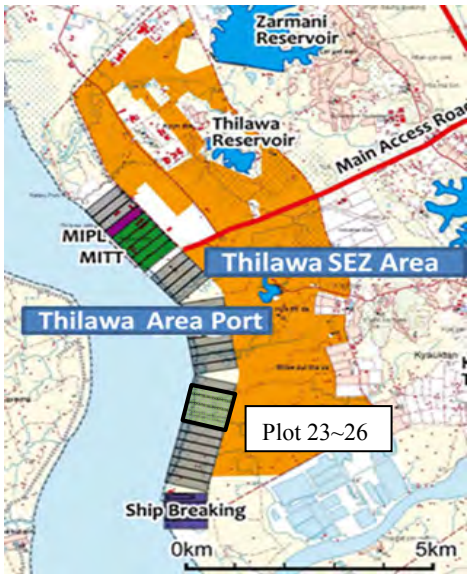
ABBREVIATION

ADB	Asian Development Bank
CFMB	Central Farmland Management Body
DHSHD	Department of Human Settlement and Housing Development,
EIA	Environmental Impact Assessment
JICA	Japan International Cooperation Agency
KT	Kyauktan Township
MOC	Ministry of Construction
MOECAF	Ministry of Environmental Conservation and Forestry
MOM	Minutes of Meeting
MPA	Myanma Port Authority
PAP	Project Affected Person
RAP	Resettlement Action Plan
SEZ	Special Economic Zone
SIA	Social Impact Assessment
SLRD	Settlement and Land Record Department
UNDP	United Nations Development Programme
WB	World Bank
YRG	Yangon Region Government

1. Introduction

1.1. Project Outline

Yangon port in Thilawa area (Thilawa area port) is located 16km downstream from Yangon main port. The port is expected to function as the gateway port supporting the rapid economic development of Myanmar, considering the proximity to the largest city as well as the development of SEZ (Special Economic Zone) in the hinterland. Thilawa area port is in total 7.4km in length and 750m in width divided to 37 plots (Plot 1 to 37). MPA and JICA have studied Plot 23 to 26 to prepare the development plan. The plan includes the urgent works as the first phase implementation package targeting the end of year 2015 called '**Thilawa Area Port Urgent Development Plan**', followed by '**Thilawa Area Port Development Plan**' covering the second and the third phases targeting the year 2025. Urgent development plan (Phase I) , which is subject to ODA Loan and the objective of this Resettlement Action Plan (RAP), is proposed in Plot 25 and along the river-side of Plot 26 as shown in Figure 1-1.

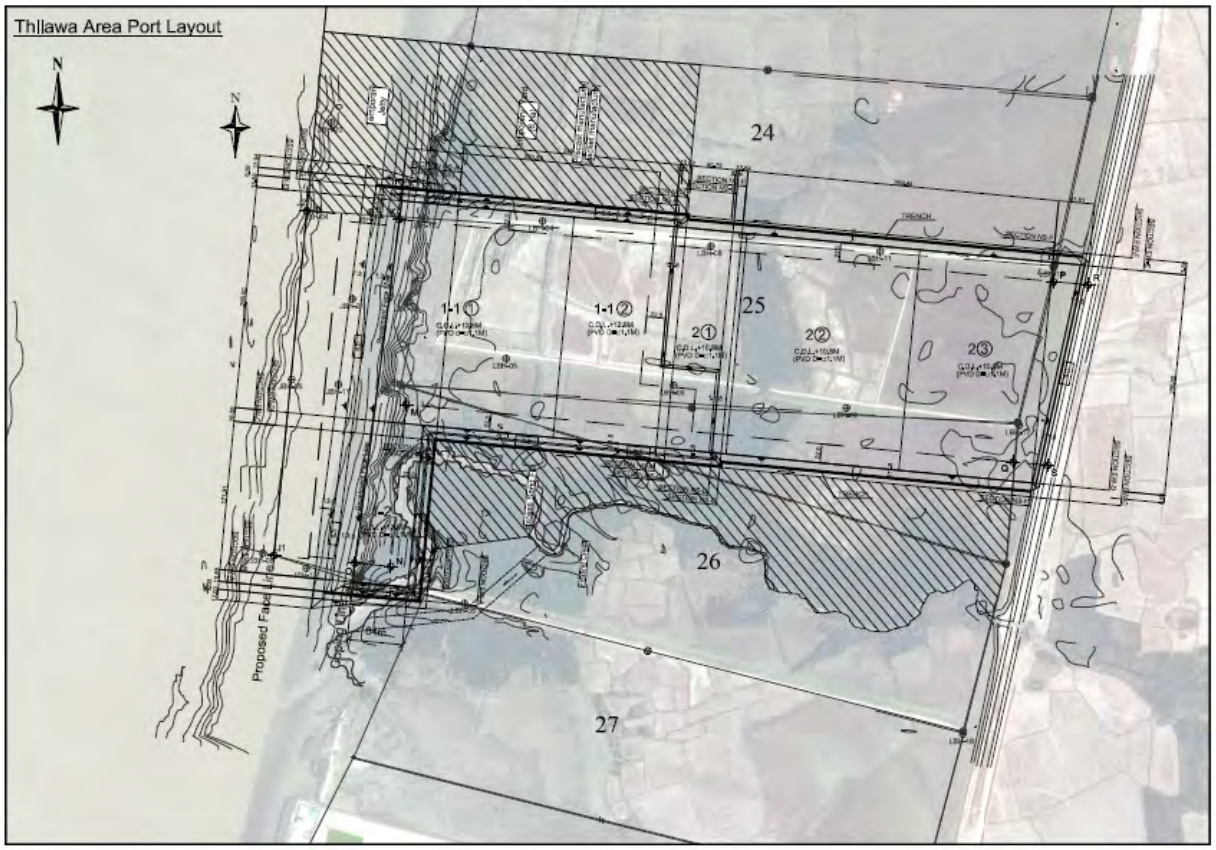


Source: Google, JICA Study Team

Figure 1-1 Location of Urgent Development Plan (Phase I)

1.2. Project Component/Affected Area

Taking into consideration the temporary work zones and soil improvement work, the whole area of Plot 25, parts of Plot 24 and Plot 26 will comprise the project area as shown in Figure 1-2. The land in the urgent development plan (Phase I) is officially owned by MPA. There is no residential area but there are some paddy fields in the project site. Therefore, the paddy fields in Plot 24-26 shown in Figure 1-2 represent the project affected area and this Resettlement Action Plan (RAP) including Due Diligence Report examines land acquisition for these paddy fields.



Source: Google, JICA Study Team

Figure 1-2 Project Affected Area

2. Legal and Policy Framework

2.1. Relevant Legislation for RAP in Myanmar

Laws or Guidelines for approval procedure of Environmental Impact Assessment/Social Impact Assessment (EIA/SIA) have not been established as of January 2014 in Myanmar. Ministry of Environmental Conservation and Forestry (MOECAF) is planning to establish a Myanmar Project Appraisal Procedure including the approval procedure of EIA/SIA, however it is not yet determined whether this will also include procedure for land acquisition/resettlement. According to an interview survey to MOECAF, the procedure is being established according to ADB (Asian Development Bank) standards.

Law and Rule for right to use farmland were enacted in 2012 and are currently applied as the Farmland Law (The Pyidaungsu Hluttaw Law No. 11/2012) and Farmland Rules (Notification No. 62/2012). Farmland Law states in Clause 26, "Notwithstanding any provision contained in any other existing law, Central Farmland Management Body (CFMB, organized by the Union Government) must be coordinated with acted for suitable compensation and indemnity in case of repossession of farmland either in the interest of the State or in the interest of the public. Confiscated farms are to be compensated without any lose. If farm is upgraded with building, it is required to compensate for such building", and states in Article 27, "whosoever shall not be entitled for getting compensation, if the right for farming or farmland was revoked by CFMB in accordance with this law".

2.2. Relevant Myanmar Legislation for Past Resettlement/Land Acquisition

MPA officially acquired land for Plot 1~37 for the purpose of Thilawa Area development in 1995 ~ 1996 through Department of Human Settlement and Housing Development, MOC (DHSHD). This land acquisition was conducted before the Farmland Law was applied. The land acquisition for the project site conducted by MPA in 1995 and compensation to the farmers made by DHSHD in 1996 were carried out according to the following laws/acts.

- 1953 Land Nationalization Act (The State Law and Order Restoration Council Law No.8/94.1994)
- 1963 Disposal of Tenancies Law (The State Peace and Development Council Law No. 8/2006)
- 1963 Agriculturist's Rights Protection Law (The State Law and Order Restoration Council Law No.8/92.1992)

1953 Land Nationalization Act states in Item 42 of Chapter 18, "Except where agricultural lands are liable to be resumed possession by the State for default or conditions prescribed under any other law for the time being in force, compensation in respect of agricultural land resumed

possession by the State shall be paid in accordance with the provisions of this section and the Schedule II".

Schedule II:

Description of Land	Extent of Compensation
1. (A) Agricultural land defined as State land under the Upper Burma Land and Revenue Regulation, 1889, and situated in areas where the aforesaid Regulation is applicable. 1. (B) Agricultural land defined as State land situated in states	(1) Compensation equal to the land revenue

According to the laws/acts applicable when land acquisition was conducted by changing registration of the right to use farmland from farmers to MPA, MPA was required to make compensation equal to the land revenue to the entitled farmers. The land revenue is equal to investments on land which shall be compensated according to JICA policy.

2.3. JICA Policy

The key principle of JICA policies on involuntary resettlement and land acquisition is summarized below.

1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
2. 2. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
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.
4. Compensation must be based on the full replacement cost* as much as possible.
5. Compensation and other kinds of assistance must be provided prior to displacement.
6. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
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. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
8. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
9. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.
10. Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.
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.
12. Eligibility of Benefits include, the PAPs who have formal legal rights to land (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.
13. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are

land-based.

14. Provide support for the transition period (between displacement and livelihood restoration.
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.
16. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

*Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

3. Project Policies

3.1. Reconciliation of Myanmar Legislation and JICA Policy

Based on the relevant Myanmar legislation stated above, the policies and practices of the government are not completely consistent with JICA policy and WB Safe Guard Policy. Therefore, provisions and principles adopted in this RAP will supersede the provisions of the relevant legislation currently in force (in Myanmar) wherever a gap exists.

3.2. Project Policy Setting

MPA officially acquired land for Plot 1~37 for the purpose of Thilawa Area development in 1995 ~ 1996 through DHSHD, MOC, however some farmers are using the project site for paddy fields. Hence, this RAP firstly focuses on the appropriateness of the past compensation (Due Diligence) and secondly studies a current Resettlement Action Plan (RAP).

4. Due Diligence

4.1. Purpose of Past Land Acquisition

The purpose of past land acquisition was Thilawa area development projects in Plot 1 to 37 planned by MPA. MPA carried out the registration change for land use in Plot 1 to 37 by making compensation to farmers who had a right for farming.

4.2. Fact Findings for Past Land Acquisition

4.2.1. Relevant Legislation and Compensation

The relevant legislation is stated in Chapter 2.2 Relevant Myanmar Legislation for Past Resettlement/Land Acquisition.

The procedure of past land acquisition and actual compensation are as follows.

- In 1995, MPA paid 8.01million kyat to DHSHD, MOC for the purpose of getting land of 1507acres (603ha) in Plot 1 to 37 for Thilawa Area development.
- In 1996, DHSHD, MOC paid compensation to eligible persons in Plot1 to 37 who have a certificate to use farmland. 20,000 kyat/acre (50,000 kyat/ha) was paid for registration change.
- In 1997 and 2000, Thanlyin Township and Kyauktan Township nationalized the land of 4.25acre (1.7ha) and 1503.33acre (601ha) in Plot 1 to 37 respectively, applying for it with Yangon Division State Peace and Development Council. Plot 1~37 is officially registered as national notation called “LaNa-(Kyauk Tan) 2000”. **(Attachment-1)**

4.2.2. Land Use and Assets

According to interview surveys to the farmers and the Settlement and Land Record Department (SLRD), Kyauk Tan Township (KT) branch, there were only paddy fields or no houses and buildings on Plot 24-26.

4.2.3. Productivity of the farmland

JICA Study Team conducted interview surveys to the farmers and SLRD, KT and desk survey to study productivity of the farmland of 1996. Results of the survey are as follows;

Crop Yield

According to the interview to SLRD,KT, crop yield in 1996 was 40 tin/acre = 943 kg/acre (1)

* 1 tin = 52 lb = 23.587 kg

Rice Price

According to the interview to SLRD,KT, rice price in 1996 was 400 kyat/tin = 16.96 kyat/kg (2)
According to the interview to the farmers, rice price at present is 120 kyat/kg. Average wholesale price of rice (Emata) was 14,900kyat/50kg in 2010 and 1,164 kyat/50kg in 1995, and rice price in 1995 is 0.078 times the price in 2010. Hence, estimated rice price from the farmers is 120kyat/kg x 0.078 = 9.36 kyat/kg (3)

Productivity

The productivities of the paddy field in 1996 are calculated as follows.

Interview to SLRD: (1)943kg/acre x (2)16.96kyat/kg = 15,993 kyat/ acre (4)
Interview to the farmers (estimation): (1) 943kg/acre x (3)9.36kyat/kg = 8,826 kyat/ acre (5)

4.2.4. Replacement Cost of Paddy Field

The government of Myanmar owns all farmland with a few exceptions and farmland or rights for farming were not allowed to be sold/bought between farmers in 1996, however, some trading was allegedly conducted illegally. According to the interview survey to DHSHD, MOC, trading price of the paddy field around the project site was 8,000 kyat/ acre. The farmers interviewed confirmed that the trading price of the paddy field in 1996 was less than 10,000 kyat/acre..

4.3. Appropriateness of the Past Land Acquisition

Land Nationalization Act (1953) stipulates in item 42 of chapter 18, "Compensation equal to the land revenue", while JICA Policy states "Compensation must be based on the full replacement cost as much as possible".

Compensation price in 1996 (20,000 kyat/acre) was almost equal to 1.25 or 2.3 times the productivity of the farmland (8,826 kyat/acre or 15,993 kyat/acre). It was also almost double the land price in 1996 (8,000 – 10,000 kyat/acre).

Hence the compensation in 1996 was carried out appropriately in accordance with Land Nationalization Act (1953) and also follows JICA Policy.

The farmers who received compensation in 1996 have continued to use the lands illegally because the project has not started in the project site. Taxes also have been paid by the farmers however tax payments don't mean an evidence for land ownership. Actually the tax payment slips state they are "crooked farm land" and "This does not serve as an evidence for land ownership" (See Attachment-2 Land Use Certificate and Tax Payment Records of 3 farmers). The tax rates are only below 100 kyats and collected for statistical purposes according to the interview survey to the SLRD, KT.

5. Resettlement Action Plan (Additional Assistance)

5.1. Policy of Additional Assistance

Past compensation was appropriately done in 1996 as clarified in the Due Diligence Study. Therefore, additional assistance for the PAPs will exclude compensation for land. The policy of additional assistance is set following the gap analysis between current Myanmar legislation and JICA Policy. Principle of the assistance policy is summarized below.

Table 5-1 Comparison between Myanmar Legislation and JICA Policy and Assistance Policy

No.	Items	Myanmar Legislation	JICA Policy	Assistance Policy
1	Productive Land (Paddy Field)	Value calculated based on the current market price of the farmland of that area, in confiscating farms in the long term interests of nation for the non-profitable construction activities and national security (Farmland Rules, 2012, Art.67)	Compensation must be based on the full replacement cost* as much as possible. *The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.	No compensation is considered because compensation of land was done in 1996.
2	Investments on Productive Land (Crops, Houses and Other Structures)	Three times the value calculated based on the average production of the grain and other crops currently sowed and current market price of that area (Farmland Rules, 2012, Art.67)	Compensation must be based on the full replacement cost* as much as possible. *The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.	Appropriate compensation will be examined based on socio-economic survey.
3	Loss of Income/Livelihood due to Loss of Productive Land	There is no stipulation in the Farmland law and rules but it might be included in the compensation for crop and structure. (Farmland Rules, 2012, Art.67)	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	Appropriate compensation/support will be examined based on socio-economic survey.

			opportunities and production levels to pre-project levels.	
4	Others	N/A	-Consultation -Appropriate participation of affected people -Grievance redress mechanism -Cut-off date -Support for transaction period -Consideration to vulnerable people etc.	JICA Policy applied -Consultation -Cut-off Date -Grievance redress mechanism etc.

5.2. Socio Economic Survey

5.2.1. Introduction

Both MPA and JICA Study Team have carried out interview surveys to DHSHD, MOC, to the Administration Office of Kyauktan Township and to farmers in Plot 23 to 26 by field reconnaissance from August to December 2012. The results of the interviews on Population, Property/Land, and Livelihood are as follows. These results contain the project site Plot 23~26, however the objective of compensation for land acquisition/resettlement for this project is investments on land of Plot 25 (Urgent Development Plan (Phase I)) as stated before.

5.2.2. Population, Property and Land

Census survey was conducted on 19th October 2012 by the JICA Study Team and result is shown in Table 5-2. There are only paddy fields of 13.6 acres and there are no residents or other properties in Plot 25.

Table 5-2 Result of Census Survey

Plot No.		23	24	25	25-26 Delta	26
Households	**nos.**	**11**	**0**	**0**	**0**	**0**
Residents	**Persons**	**42**	**0**	**0**	**0**	**0**
Fisherman		11	0	0	0	0
Farmer		0	0	0	0	0
Company Employee		0	0	0	0	0
General Worker		0	0	0	0	0
Others		31	0	0	0	0
Paddy Field	**acre**	**14.9**	**13.6**	**13.6**	**8.7**	**6.5**
Used by a Resident in Plot21		0.0	0.0	0.0	0.0	1.5
Used by Others		14.9	13.6	13.6	8.7	5.0
Housing Land	**m2**	**275**	**0**	**0**	**0**	**0**
Used by Residents in Plot23		275	0	0	0	0
Used by Others		0	0	0	0	0
Building	**nos.**	**11**	**0**	**0**	**0**	**0**
Residential Building / Storage (Single Story, Wood)		11	0	0	0	0
Others		0	0	0	0	0
Livestock	**nos.**	**0**	**0**	**0**	**0**	**0**

(prepared by the Study Team)

5.2.3. Socio Economic Conditions of Project Affected Persons (PAPs)

(1) Project Affected Persons (PAPs)

There are 3 paddy field users in Plot 25, which is the project affected area in the urgent development plan, and they use 1.2 acres, 3.7 acres and 8.7 acres (in total 13.6 acres) of the land as shown in Table 5-3 and Figure 5-1. They live outside of the project area. They also use 8.4 acres, 14.9 acres and 19.8 acres outside of the project site respectively. Land not affected by the project is located on the land side of the main route running north-south on the east side of the project affected area and inside SEZ area which is planned to be developed by 2030.

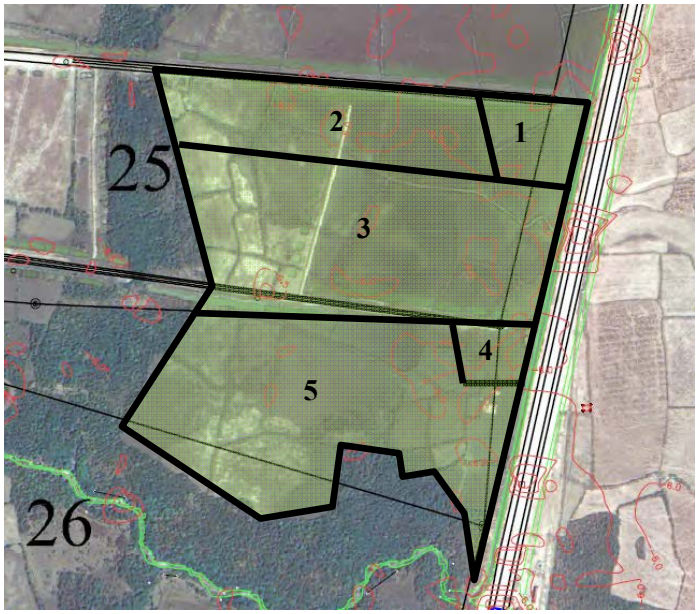
The PAPs are the house hold and the number of their family is 6, 7 and 10 respectively.

The PAPs don't have other income sources except for farming according to the interview survey to PAPs. The impact on their livelihood is calculated as 13%, 20% and 30%. They work from May (when the rainy season starts) to December (when rice is harvested) or a total of 8 months per year.

Table 5-3 Current User of Paddy Field in Plot 25

No.	Name of PAPs	Affected Land (acre)	Not Affected Land (acre)	Total (acre)
1	Ye Lwin	**1.2 (13%)**	8.4	9.6
2	Bae Thu	**3.7 (20%)**	14.9	18.6
3	Gaw Bar Lu	**8.7 (31%)**	19.8	28.5
Total		**13.6 (24%)**	43.1	56.7

(prepared by the Study Team)



Source: Goolgle, JICA Study Team

Figure 5-1 Current User of Paddy Field in Plot 25

(2) Productivity of the Farmland

JICA Study Team conducted interview surveys to the farmers and SLRD, KT to study productivity of the farmland. Rice cropping is carried out only one time a year from May to December and the only water source is rain water. Results of the survey are as follows;

Crop Yield

According to the Interview to SLRD,KT, crop yield is 50 tin/acre = 1,179 kg/acre (1)

* 1 tin = 52 lb = 23.587 kg

Rice Price

According to the interview to the farmers, rice price is 120 kyat/kg (2)

According to the interview to SLRD, KT, rice price 3,500kyat/tin = 148 kyat/kg (3)

Productivity

The productivity of the paddy field is calculated as below.

(1) 1,179kg/acre x (3) 148 kyat/kg = 174,492 kyat/acre (4)

(3) Income of PAPs

Incomes of PAPs are estimated below based on the productivity of the farmland.

According to UNDP (2011), the poverty line in Myanmar 2010 is 376,151 kyat as yearly expense so PAPs are not considered to be poor.

Table 5-4 Estimated Incomes of PAPs

PAPs	Farmland (acre)	Productivity (kyat/acre)	Income (kyat/year)
Ye Lwin	9.6	174,492	1,675,123
Ba Thu	18.6	174,492	3,245,551
Gaw Bar Lu	28.5	174,492	4,973,022

(prepared by the Study Team)

5.3. Measures of Additional Assistance

5.3.1. Investments on Productive Land

Investments on the farmlands are only paddies. The farmland rules (2012) stipulates that the compensation for the crop is “Three times of the value calculated based on the average production of the grain and other crops currently sowed and current market price of that area”, while JICA Guidelines stipulate “Compensation must be based on the full replacement cost as much as possible.”.

Although the compensation for the land was appropriately completed in 1996, incomes of PAPs will be reduced by 13% to 31% by this project (Table 5-3). Considering income restoration of PAPs, three times the value based on farmland rules (2012) is applied. The estimated assistance amount for investments on productive land is summarized in Table 5-5.

Table 5-5 Estimated Assistance Amount for Investments on Productive Land

Farmer	Affected Land (acre)	Productivity (kyat/acre)	Amount of Assistance (kyat/year)	Amount of Assistance (kyat/3year)	Amount of Assistance (USD/3year)
Ye Lwin	1.2	174,492	209,390	628,171	641
Ba Thu	3.7	174,492	645,620	1,936,861	1,976
Gaw Bar Lu	8.7	174,492	1,518,080	4,554,241	4,647

Note: 1USD=980kyat
(prepared by the Study Team)

5.3.2. Loss of Income/Livelihood

As mentioned above, PAPs are using other farmlands outside of the project affected land and the affected area is 13%, 20% and 31% respectively (See Table 5-3). Three times the productivity of the affected land will be paid to PAPs. Therefore they can continue to cultivate rice on their remaining farmland without large impact on their livelihood. In case PAPs wish change their occupation, however, some income restoration measures shall be provided such as job training and/or employment opportunities. Major parts of their remaining farmlands are located in the proposed SEZ project site, so they may also have some income restoration supports from the SEZ project before commencement of the SEZ project. Hence, it is considered that PAPs can maintain their living standard with the cash assistance and income restoration measures of the project or SEZ project.

5.3.3. Entitlement Matrix

The project entitlements developed and presented in the entitlement matrix below correspond to the impacts identified.

Table 5-6 Entitlement Matrix for Additional Assistance in the Project Site

Item No.	Type of Loss	Entitled Persons	Entitlement	Implementation Issues	Responsible Organization
1	Investments on Productive Land	Those who have been cultivating rice in the project site	Cash assistance for three (3) times annual yield amount at the current market price	a. Survey for investments on land b. Survey for market price c. Determination of entitled persons d. Consultation with entitled persons e. Payment for cash assistance f. Monitoring g. Grievance Adjustment	MPA
2	Loss of	Those who have	Provision of	a. Determination of	MPA

	Income/Livelihood due to loss of Productive Land	been cultivating rice in the project site	Employment Opportunity and Job Training	entitled persons b. Consultation with entitled persons c. Provision of assistance f. Monitoring g. Grievance Adjustment	

(prepared by the Study Team)

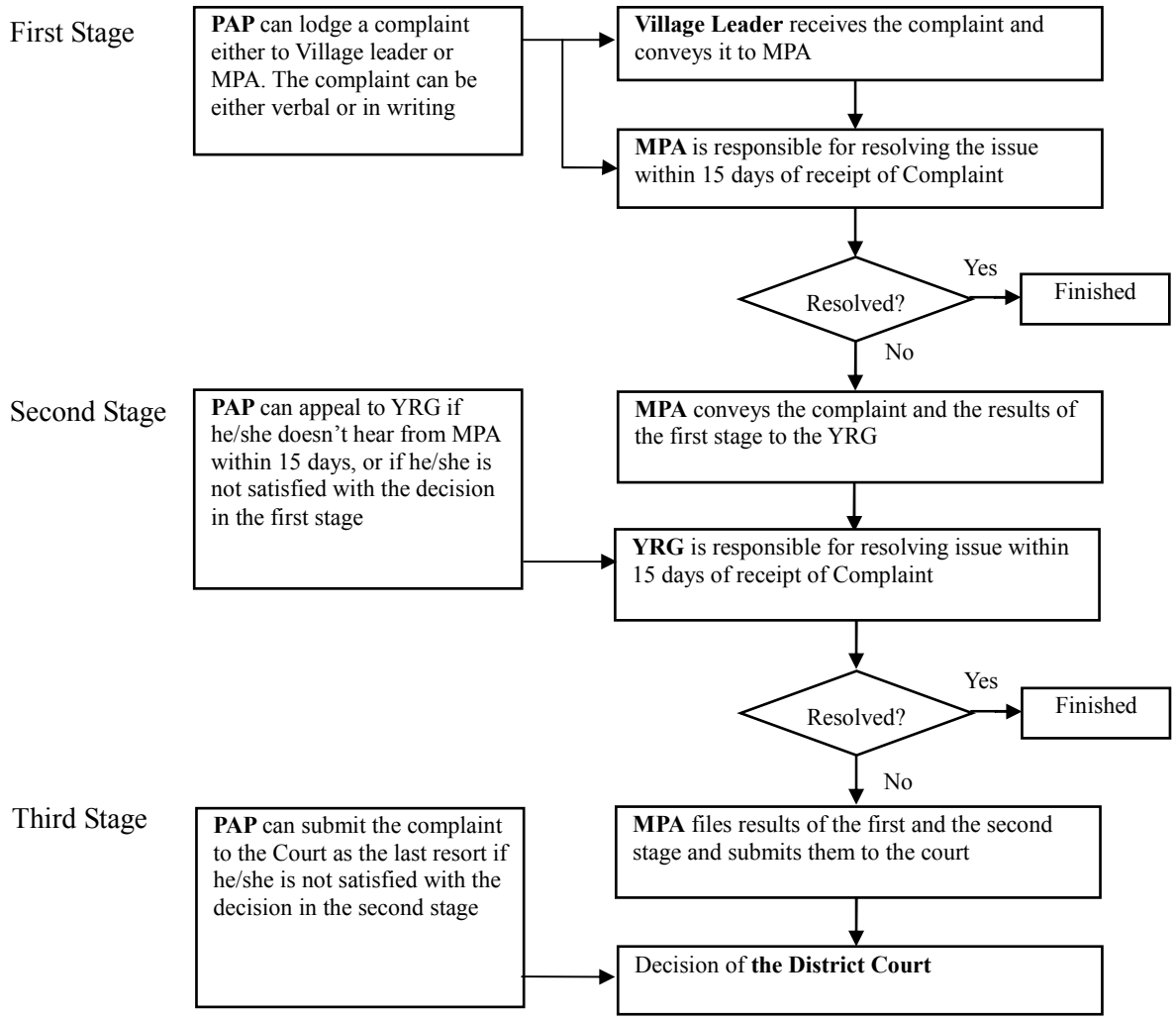
5.4. Consultation and Disclosure

MPA hosted a consultation meeting on 15 February 2013 with the support of the JICA Study Team to explain the project outline, due diligence and policy/plan for land acquisition (surrender of land). In the meeting, MPA also declared the cut-off date. The minutes of meeting are summarized in Attachment-3 MOM for Consultation Meeting.

5.5. Implementation and Grievance Redress Mechanism

MPA has overall responsibility for the implementation of the additional assistance as the executing agency of the project. Village chief and Administration office of Kyauktan Township (KT) shall assist MPA in communicating and consulting with PAPs.

Grievance redress mechanism is not required under the current law in Myanmar, however shall be established specially for this project to ensure that complaints related by PAPs are appropriately dealt with. Grievance process shall be easily accessible for the residents and either verbal or writing grievance can be applied. Three stages are prepared to discuss the complaints, such as MPA, YRG, and Court procedure shown in Figure 5-2. MPA will be liable for all administrative and legal fees that arise through the resolution process.



(prepared by the Study Team)

Figure 5-2 Process of Grievance Redress

5.6. Monitoring

Monitoring shall be implemented at the time of RAP implementation; monitoring plan is shown in Table 6-2. The monitoring form is shown in Attachment-4.

Table 5-7 Monitoring Plan for Resettlement Action Plan

Items	Monitoring Items	Monitoring Points	Frequency (Duration during Operation)	Responsible Organization
【Before Construction 】				
Public Consultation	Contents of Consultation meeting	Project Site	At least 1 time during RAP Updating	MPA
Cash Assistance for investments on productive land	Progress of Cash Assistance Payment	--	Quarterly until compensation is completed	MPA
Income Restoration Measure	Provision of Job Training	--	Quarterly before port operation	MPA
	Provision of Job Opportunity	--	Quarterly before port operation	MPA
【Operation Phase】				
Income Restoration Measure	Provision of Job Training	--	If required	MPA
	Provision of Job Opportunity	--	If required	MPA
Grievance Redress Mechanism	Confirmation of grievance redress	--	One Time/Year	MPA

(prepared by the Study Team)

5.7. Updating of RAP

Other PAPs are identified in the project site (Plot 25 and parts of Plot 24 and 26), MPA has decided to the updating work including consultation by themselves

5.8. Implementation Schedule

Expected time schedule of implementation of RAP is presented in Table 5-8.

Table 5-8 Tentative Implementation Schedule

Activities	2014												2015											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Project Schedule																								
Prequalification																								
Bidding																								
Civil Works																								
RAP Implementation																								
RAP Updating by MPA																								
Approval of RAP by JICA				▲																				
Implementation of Cash Assistance																								
Implementation of Income Restration Measure																								
Grievance Redress					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	→
Monitoring					–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	→

(prepared by the Study Team)

Attachment-1 Compensation Records for Past Land Acquisition

နောက်ဆက်တွဲ (က)

ရန်ကုန်တိုင်း အေးချမ်းသာယာရေးနှင့် ဖွံ့ဖြိုးရေးကောင်စီ
၂၀၀၀ ပြည့်နှစ်၊ ၄ ပြီ [illegible] လ၊ ၉ ရက်
လယ်ယာမြေကို သတ်မှတ်သည့် နည်းလမ်းအတိုင်း အသုံးပြုခွင့် အမိန့်စာ
အမှတ်စဉ်အမှတ် ၂ / လန (ကျောက်တန်း) ၂၀၀၀

ရန်ကုန်တိုင်း အေးချမ်းသာယာရေးနှင့် ဖွံ့ဖြိုးရေးကောင်စီသည် ပြည်ထောင်စု မြန်မာနိုင်ငံတော် အစိုးရအဖွဲ့ရုံး၏ ၂၂-၁၁-၉၀ ရက်စွဲပါ စာအမှတ် [illegible] ဖြင့် [illegible] လုပ်ပိုင်ခွင့်ကို အသုံးပြုလျက် အောက်ပါဇယားတွင် ဖော်ပြထားသော လယ်ယာမြေကို နောက်ကျောပါ စည်းကမ်းချက်များနှင့်အညီ [illegible] လယ်ယာမြေနိုင်ငံပိုင်ပြုလုပ်ရေး အက်ဥပဒေပုဒ်မ [illegible] အရ [illegible]

လုပ်ငန်းဆောင်ရွက်ရန် မြေအဖြစ် အသုံးချရန် ဦးဆောင်ညွှန်ကြားရေးမှူး

မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင် အား ခွင့်ပြုလိုက်သည် –

မြို့နယ်	ရပ်ကွက်/ ကျေးရွာ	ကွင်း		ဦးပိုင်	ဧရိယာ		နယ်နိမိတ်
		အမှတ်	အမည်	အမှတ်	ဧက	ဒသမ	
ကျောက်တန်း	သီလဝါကျေးရွာ	၆၅၁	သီလဝါတောင်	–	၁၂၂	၈၅	သက်သေခံမြေပုံအတိုင်း
	"	၆၅၃ဘီ	ဂရိကွင်း	–	၂၅၆	၁၀	
	"	၆၅၃စီ	ဂရိကွင်း	–	၁၁၀	၃၅	"
	"	၆၅၈	သီလဝါမြောက်	–	၁၄	၂၅	
	ဖလမ်းကျေးရွာ	၆၀၉အေ	ဖလမ်းကွင်း	–	၈၇	၂၁	
	"	၆၁၀	ဖလမ်းတောင်	–	၁၇၅	၈၈	
	ကရဝိကျေးရွာ	၆၀၇	ဂရိကွင်း	–	၅၉၂	၀၂	
	"	၆၁၁	ဘုရားငုတ်တို	–	၁၄၄	၆၂	
			စုစုပေါင်း		၁၅၀၃	၃၃	

စာအမှတ် ၂၈၃ / ၃ – ၃ / တယက
ရက်စွဲ၊ ၂၀၀၀ပြည့်နှစ်၊ ၄ ပြီ လ၊ ၉ ရက်။

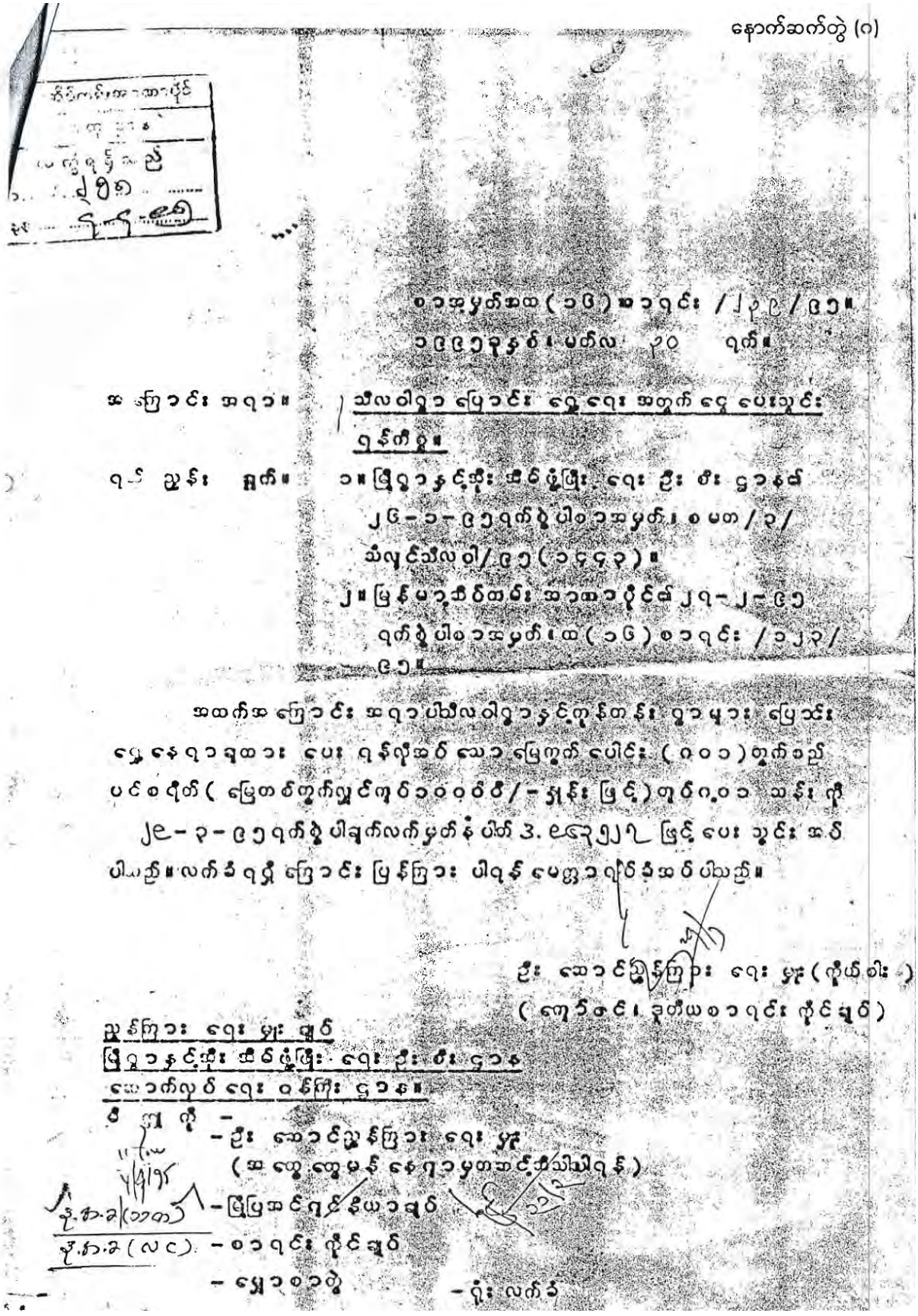
ဥက္ကဋ္ဌ (ကိုယ်စား)

မြန့်ဝေခြင်း –
မြို့နယ်အေးချမ်းသာယာရေးနှင့်ဖွံ့ဖြိုးရေးကောင်စီ ကျောက်တန်း မြို့နယ်
မြို့နယ်မြေစာရင်းဦးစီးဌာန ကျောက်တန်း မြို့နယ်
ရပ်ကွက်/ကျေးရွာ အုပ်စု အေးချမ်းသာယာရေးနှင့် ဖွံ့ဖြိုးရေးကောင်စီ
သီလဝါ / ဖလမ်း / ကရဝိ ရပ်ကွက်/ကျေးရွာ
[illegible] ဦးဆောင်ညွှန်ကြားရေးမှူး၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်

ခွင့်ပြုမိန့်ရသူက အမိန့်စာ၊ စည်းကမ်းချက်များကို လိုက်နာပါမည်ဟု ဝန်ခံကတိပြုလက်မှတ်ရေးထိုးပြီး ပြန့်ဝေရန်။

မိတ္တူ –
လယ်ယာစိုက်ပျိုးရေးနှင့်ဆည်မြောင်းဝန်ကြီးဌာန
ခရိုင်အေးချမ်းသာယာရေးနှင့်ဖွံ့ဖြိုးရေးကောင်စီ ရန်ကုန်တောင်ပိုင်းခရိုင်
တိုင်းမြေစာရင်းဦးစီးဌာန၊ ရန်ကုန်တိုင်း။

Source: MPA



Source: MPA

Attachment (A)

Yangon Division Peace and Development Council

6 April, 2000

Order to utilize the farm land as per prescribed method

File – 2/ La Na (Kyauk Tan) 2000

Yangon Division State Peace and Development Council, with the power entrusted by letter number 10/610-Sa/Ah Pha Ra of the Government of the Union of Myanmar, has granted Managing Director of Myanma Port Authority the right to use the described farm land, accordingly to the regulations mentioned on the back of this letter, for the purpose of Thilawa Port Construction by the Section 39 of the Act of Nationalization of Farm Land, 1953.

Township	Quarter/ Village	Plot		U Paing No.	Area		Demarcation
		No.	Name		Acre	Decimal	
Kyauk Tan	Thilawa Village	655	Thilawa Mountain	-	122	85	As par evidence map
	Thilawa Village	657 B	Garan Plot	-	256	10	
	Thilawa Village	657 C	Garan Plot	-	110	35	
	Thilawa Village	658	Thilawa North	-	14	25	
	Phalan Village	609 A	Phalan Plot	-	87	21	
	Phalan Village	610	Phalan Mountain	-	175	88	
	Karat Village	607	Garan Plot	-	592	02	
	Karat Village	611	Phaya Ngote To	-	144	67	
			Total		1503	33	

Letter No: 283/ 3 – 3 / Ta Ya Ka

Date : 6 April, 2000

Chairman

Distributed to:

Township Peace and Development Council, Kyauk Tan Township
Township Land Administration Department, Kyauk Tan Township
Quarter/ Village Track Peace and Development Council
Thilawa/ Phalan/ Karat Village

} To distribute after the signage of the granted person as agreement and compliance to the stated regulations.

Managing Director, Myanma Port Authority

CC:

Divisional Land Administration Office, Yangon Division, Southern Yangon District, District Peace and Development Council, Ministry of Agriculture and Irrigation

Attachment C

Letter No: Ah Hta (16) Account/ 239/ 95

30th March, 1995

Subject: : Payment for the Relocation of Thilawa Village

Reference: : (1) Letter No. SaMaTa/3/Thanlyin Thilawa/95 (1443) of Department of Human Settlement and Housing Development dated 26-1-95

(2) Letter No. Hta (16) account/ 123/95 of Myanma Port Authority dated 27-2-95

With regard to the abovementioned subject, Kyats 8.01 million which is the primary cost required for the relocation of 801 plots (Kyats 10,000 per plot) in Thilawa area is hereby submitted with Check No. 3.963527 dated 29.3.95. Response upon receipt of the document is hereby requested.

Managing Director (For)

(Kyaw Zin, Deputy Chief Audit)

Director General

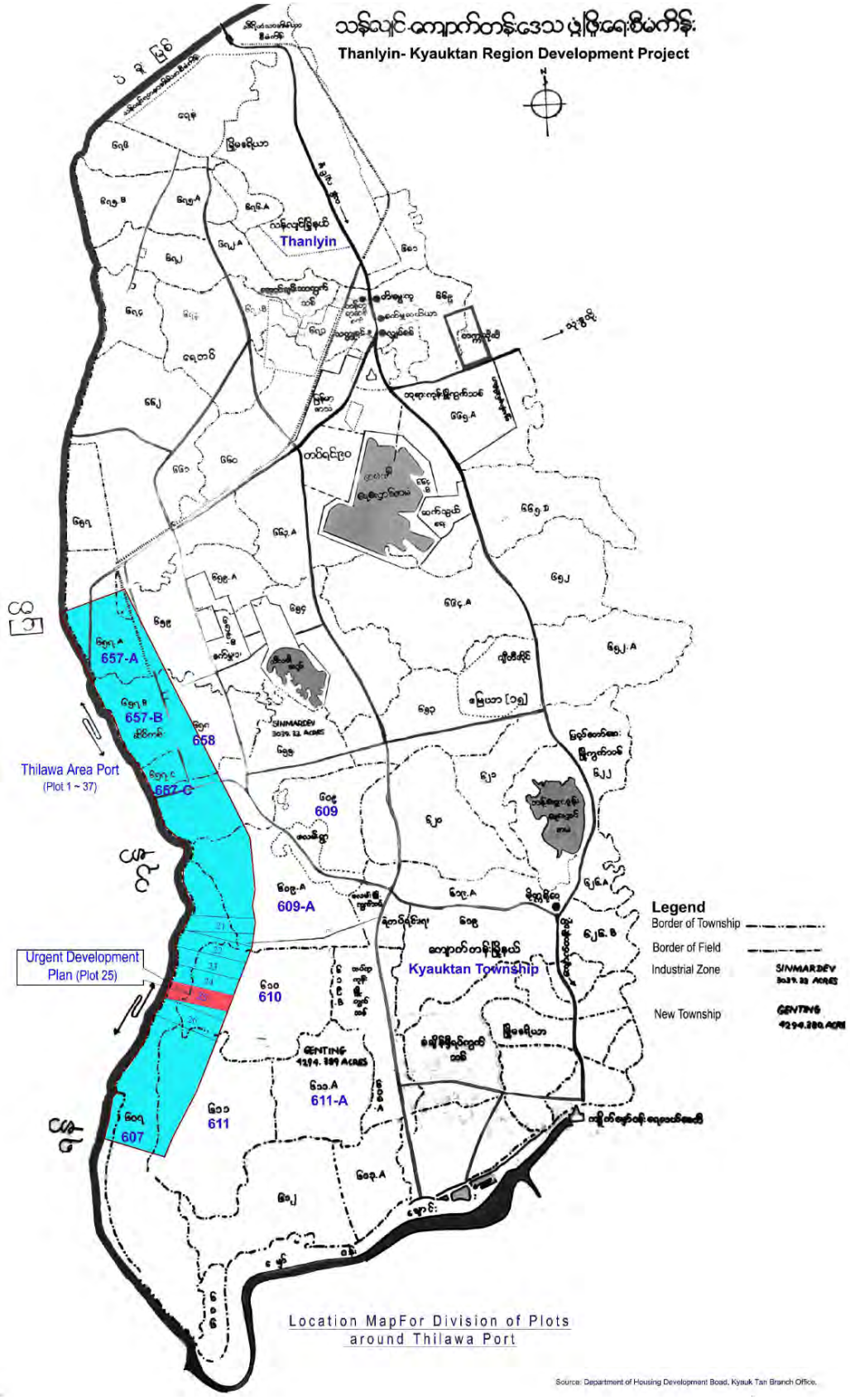
Department of Human Settlement and Housing Development

Ministry of Construction

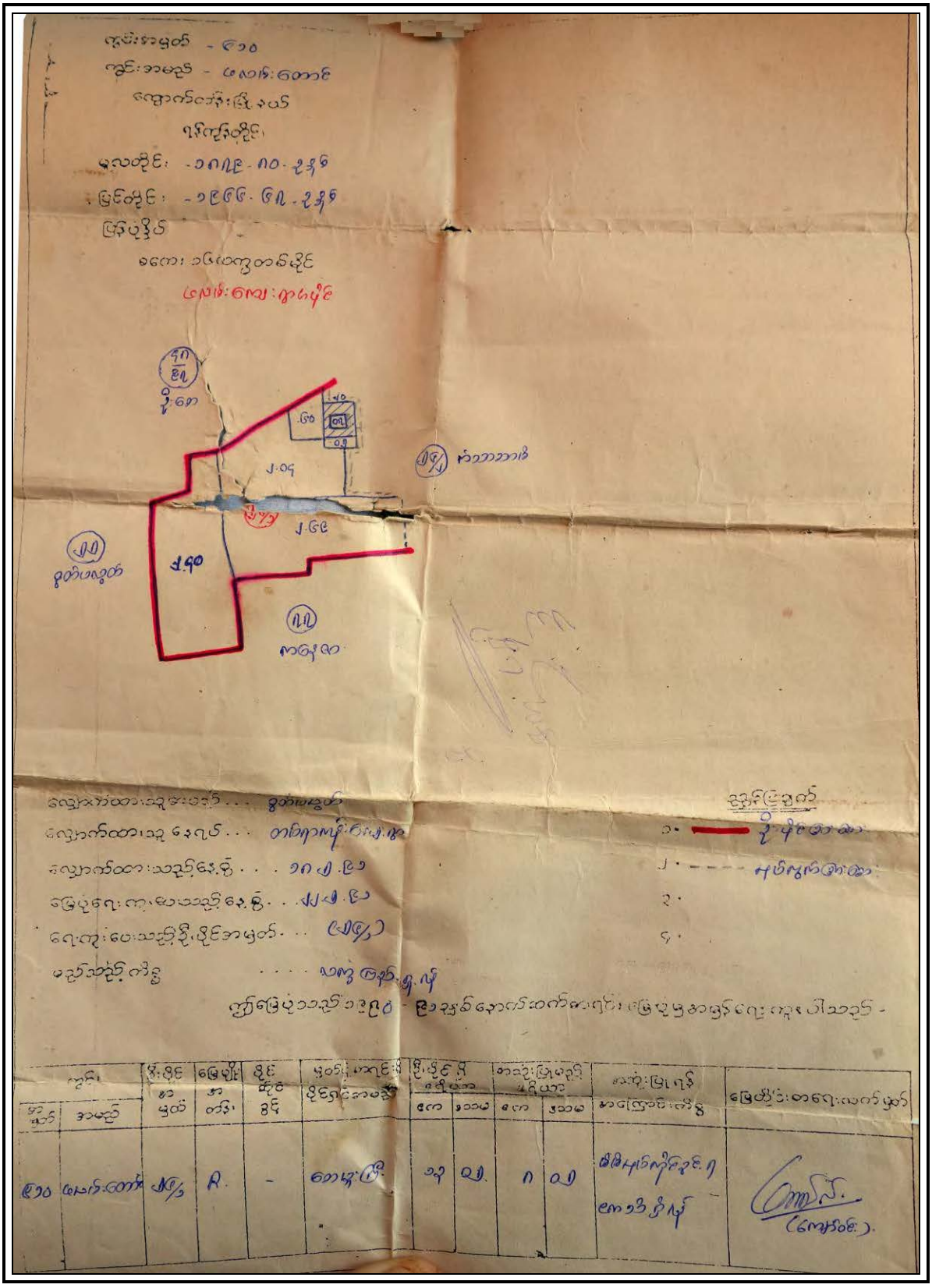
CC:

- Managing Director
  (C/O General Manager)
- Chief Engineer
- Chief Audit
- Inter-departmental Circular Letter - Office File

Attachment-2 Land Use Certificate and Tax Payment Records of 3 Farmers

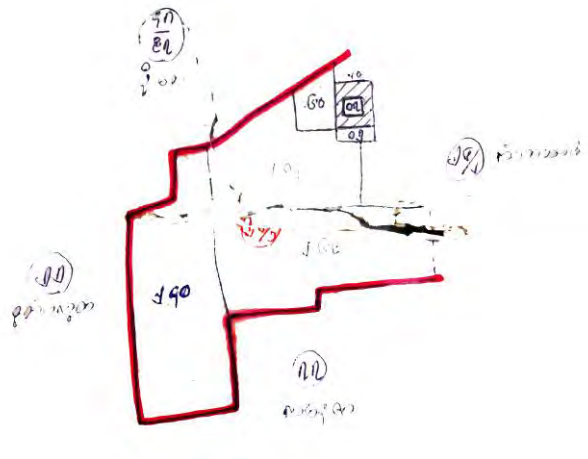


Source: Settlement and Land Record Department, Kyauktan Township



Land Use Certificate (For Cultivation)
Name : **2. Sout Plout Mani (Bae Thu)**
Plot: **610 (56/1) Phalan Taung**

Plot No-**610**
Name of Plot- **Phalan Taung**
Kyauktan Township
Yangon Division
Initial Survey Date: **Year 1879-1880**
Revised Date: **1966-1967**
Re-Printing-
Scale: **16in: 1 Mile**
Phalan Village

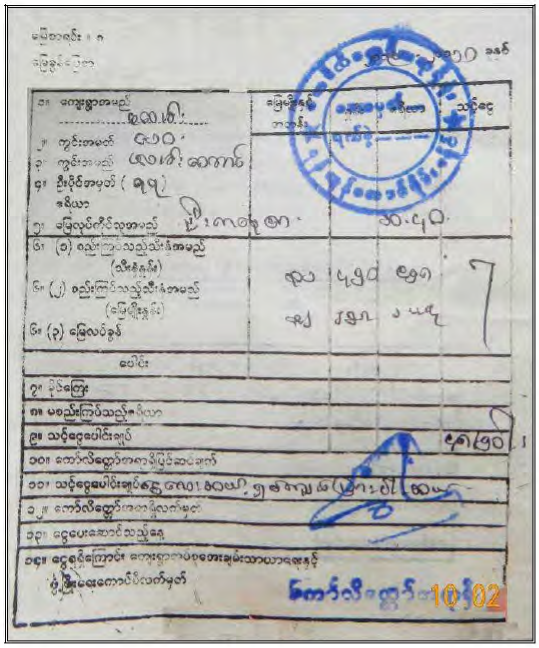


Legend
1._____ U Paing Border
2.- - - - - - - - - - - - - Plot Border

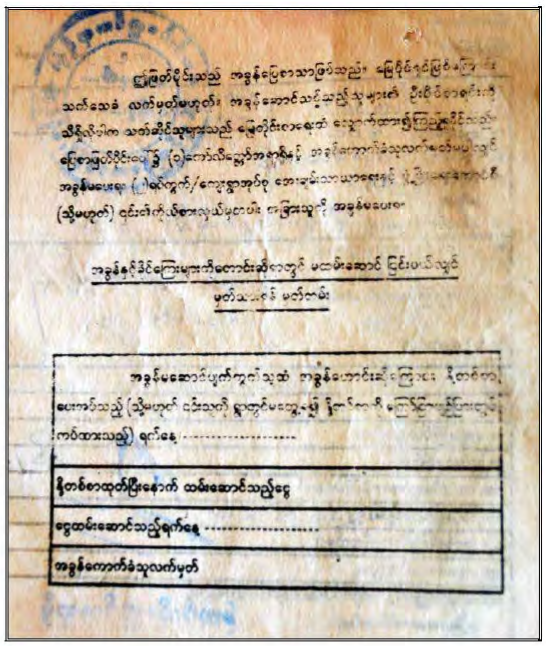
Name of Applicant: **Souk Palout Mani**
Address: **Tat Yar Gone Village**
Submission Date: **18.5.1991**
Date of Map Copy: **22.5.1991**
U Paing No: **56/1**
Description: **For reference**
This map is a true copy of 1990-91 Attachment.

Plot		U Paing No	Class of Land	Owner Ship	Name of the Person Registered	Total Area		Actual cultivation area		Description	Signature (Land Surveyor)
Plot No	Name					Acre	Decimal	Acre	Decimal		
610	Phalan Taung	56/1	R	-	Saw Mu Gyi	13	05	8	05	Enquiry of Land Area for Cultivation	Kyaw Win

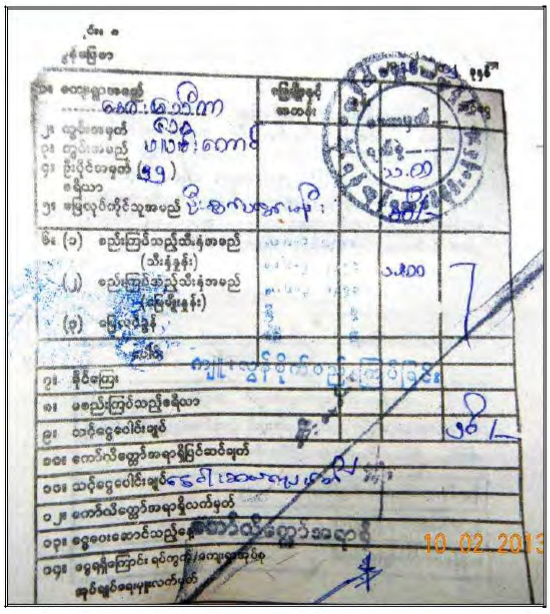
Land Use Certificate (For Cultivation)
Name : **2. Sout Plout Mani (Bae Thu)**
Plot: **610 (56/1) Phalan Taung**



Tax Payment Slip (1) (Front page)
Name: 1. U Kanay Zar (Ye Lwin)
Plot: 610, (Year 2009-2010)



Tax Payment Slip (1) (Back page)



Tax Payment Slip (2-1)
(2) Name: U Souk Palot Mani (Bae Thu)
Plot: 610 (55) , (Year 2011-2012)

Tax Payment Slip (2-2)
Name: U Souk Palot Mani (Bae Thu)
Plot: 610(56/2), (Year 2011-2012)

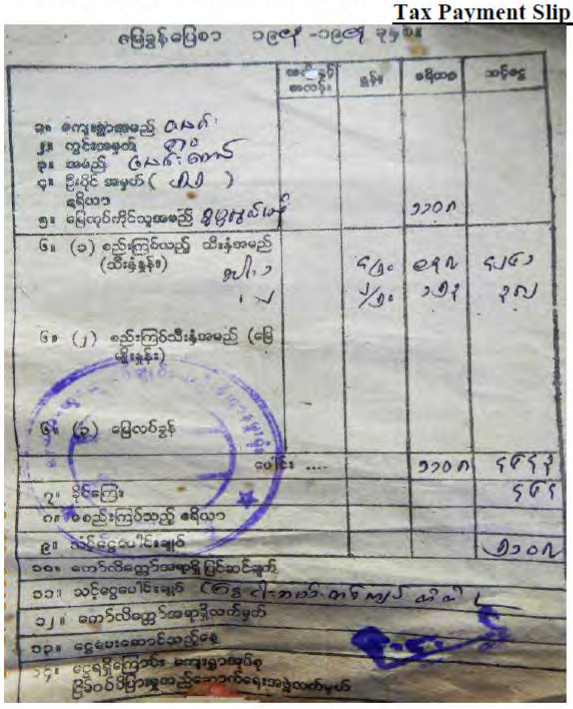
Tax Payment Slip for 3 Farmers (Latest)

Tax Payment Slip (3)

Name: 3. U Gaw Bar Lu

Plot: 610 (80) , (Year 2011-2012)

Tax Payment Slip for 3 Farmers (Latest)



Tax Payment Slip (4)

Name: 2. U Souk Palot Mani (Bae Thu)

Plot: 610 (55) , (Year 1993-1994)

Tax Payment Slip (Past Before 1996)

Land Registration Form C

Land Tax Receipt: **2009-2010**

	Category and Class	Rate	Area	Amount
1. Village: **Phalan** 2. Plot Number: **610** 3. Name: **Phalan Taung** **4.** UPaing/ No. **77** Area 5. Land Utilizer's Name**: U Kanay Zar** (Ye Lwin)			**10.40**	
6. (1) Levied Crop (Crop Rate) 6 (2) Levied Crop (Land Rate) 6 (3) Free Land Tax	**R-1** **R-2**	**4.50** **2.50**	**9.58**	
Total				**48.50**
7. Crop Tax				
8. Area which will not be levied				
9. Total Amount				
10. Amendment of Regional Officer's Office				
11. Total Amount:		**Kyats Forty Eight and Cent 50 Only**		
12. Signature of Regional Officer				
13. Date of Payment				
14. Village Head's Signature				

<u>Tax Payment Slip (1)</u> (Front page)
(1) Name: U Kanay Zar (Ye Lwin)
Plot: 610, (Year 2009-2010)

This receipt is only for tax purpose. This does not serve as an evidence for land ownership. If the list of tax payable individuals is wanted, the concerned individual can make request to Land Administrator Officer. Tax shall not be paid (1) if the receipt is signed by Collector or Tax Collector and (2) apart from Chief Administrator of Quarter 2 or his representative.

Record of the tax and Crop tax Evasion

Date of the issue of tax evasion notice (or the Date of the notice being pasted on Notice Board because the payer is not found in the village) ----------
Amount paid after notice
Date of payment ----------
Tax Collector's Signature

<u>Tax Payment Slip (1)</u> (Back page)

Land Registration Form C

Land Tax Receipt: **2011-2012**

	Category and Class	Rate	Area	Amount
1. Village: **Aye Mya Thida** **2.** Plot Number: **610** **3.** Name: **Phalan Taung** 4. U Paing/ No. (**55)** Area 5. Land Utilizer's Name: **U Souk Palot Mani** (Bae Thu)			**11.00**	
6. (1) Levied Crop (Crop Rate) 6 (2) Levied Crop (Land Rate) 6 (3) Free Land Tax			**11.00**	
Total				
7. Crop Tax		**Crooked Farm Land**		
8. Area which will not be levied				
9. Total Amount				**50.00**
10. Amendment of Regional Officer's Office				
11. Total Amount:		**Kyats Fifty Only**		
12. Signature of Regional Officer				
13. Date of Payment				
14. Village Head's Signature				

Tax Payment Slip (2-1)
Name: 1. U Souk Palot Mani (Bae Thu)
Plot: 610 (55) , (Year 2011-2012)

Tax Payment Slip for 3 Farmers (Latest)

Land Registration Form C

Land Tax Receipt: **2011-2012**

	Category and Class	Rate	Area	Amount
15. Village: **Phalan** 16. Plot Number: **610** 17. Name: **Phalan Taung** **18.** UPaing/ No. **(56/2)** Area 19. Land Utilizer's Name**: U Souk Palot Mani** (Bae Thu)			**6.05**	
20. (1) Levied Crop (Crop Rate) 6 (2) Levied Crop (Land Rate) 6 (3) Free Land Tax			**6.05**	
Total				**39.75**
21. Crop Tax		**Crooked Farm Land**		
22. Area which will not be levied				
23. Total Amount				
24. Amendment of Regional Officer's Office				
25. Total Amount:		**Kyats Thirty and Cent Seventy Five Only**		
26. Signature of Regional Officer				
27. Date of Payment				
28. Village Head's Signature				

Tax Payment Slip (2-2)
Name: 2. U Souk Palot Mani (Bae Thu)
Plot: 610(56/2), (Year 2011-2012)

Tax Payment Slip for 3 Farmers (Latest)

Land Registration Form C

Land Tax Receipt: **2011-2012**

	Category and Class	Rate	Area	Amount
1. Village: **Aye Mya Thida** 2. Plot Number: **610** 3. Name: **Phalan Taung** 4. U Paing / No. **(80)** Area 5. Land Utilizer's Name: **U Gaw Bar Lu**			**10.15**	
6. (1) Levied Crop (Crop Rate) 6 (2) Levied Crop (Land Rate) 6 (3) Free Land Tax				
Total				
7. Crop Tax		**Crooked Farm Land**		
8. Area which will not be levied				
9. Total Amount				**40.50**
10. Amendment of Regional Officer's Office				
11. Total Amount:		**Kyats Forty and Cent Fifty Only**		
12. Signature of Regional Officer				
13. Date of Payment				
14. Village Head's Signature				

Tax Payment Slip (3)
Name: 3. U Gaw Bar Lu
Plot: 610 (80) , (Year 2011-2012)

Tax Payment Slip for 3 Farmers (Latest)

Land Registration Form C

Land Tax Receipt: **1993-1994**

	Category and Class	Rate	Area	Amount
1. Village: **Phalan** 2. Plot Number: **610** 3. Name: **Phalan Taung** 4. UPaing/ No. (**55)** Area 5. Land Utilizer's Name: **U Souk Palot Man** (Bae Thu)			**11.00**	
6. (1) Levied Crop (Crop Rate) **R- 1** **R- 2** 6 (2) Levied Crop (Land Rate) 6 (3) Free Land Tax		**4/50** **2/50**	**9.47** **1.53**	**42.61** **3.82**
Total			**11.00**	**46.43**
7. Crop Tax				**4.64**
8. Area which will not be levied				
9. Total Amount				**51.07**
10. Amendment of Regional Officer's Office				
11. Total Amount:		**Kyats Fifty One Only**		
12. Signature of Regional Officer				
13. Date of Payment				
14. Village Head's Signature				

Tax Payment Slip (4)
Name: 2. U Souk Palot Mani (Bae Thu)
Plot: 610 (55) , (Year 1993-1994)
Tax Payment Slip (Past Before 1996)

Attachment-3 MOM for Stakeholder Meeting/Consultation

ပို့ဆောင်ရေးဝန်ကြီးဌာန၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်က ပိုင်ဆိုင်သော သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်ရှိ မြေပေါ်တွင် ကျူးကျော်၍ လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်း ဆောင်ရွက်လျက်ရှိသော လယ်သမားများနှင့် တွေ့ဆုံခဲ့မှုအခြေအနေ တင်ပြခြင်း

တွေ့ဆုံဆွေးနွေးမှု ပြုလုပ်သည့်နေ့၊ ၁၅-၂-၂၀၁၃ (သောကြာနေ့)

တွေ့ဆုံဆွေးနွေးမှုပြုလုပ်သည့်အချိန်၊ ၁၀း၃၀ နာရီ

တွေ့ဆုံဆွေးနွေးမှု ပြုလုပ်သည့်နေရာ၊ သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ်(၂၅) နေရာ

တွေ့ဆုံဆွေးနွေးပွဲသို့ တက်ရောက်သူများစာရင်း

(က) ဦးမြသန်း၊ မြို့ပြအင်ဂျင်နီယာချုပ်၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်

(ခ) ဦးတင့်လွင်၊ ဌာနခွဲအင်ဂျင်နီယာ၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်

(ဂ) ဦးဝင်းမျိုးဦး၊ လက်ထောက်တိုင်းတာရေးဌာနခွဲမှူး၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်

(ဃ) ဦးတင်ဝင်းဇော်၊ ပ-ရေတိုင်းကြပ်၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်

(c) Mr. SOMA Tekemasa, OCDI/Nippon Koei Co., Ltd (JICA Study Team)

(စ) ဦးစောမျိုးလွင်၊ Nippon Koei Co., Ltd (JICA Study Team)

(ဆ) ဦးဖိုးကျော်(ဦးဂေါ်ဘာလူးကိုယ်စား) ကျူးကျော် လယ်စိုက်တောင်သူ

(ဇ) ဦးရာဂျား(ဦးရဲလွင်ကိုယ်စား) ကျူးကျော် လယ်စိုက်တောင်သူ

(စျ) ဦးဒန်းဘူး(ဦးဘဲသူးကိုယ်စား) ကျူးကျော် လယ်စိုက်တောင်သူ

၁။ ၁၅-၂-၂၀၁၃ ရက်နေ့၊ နံနက် ၁၀း၃၀ အချိန်တွင် ပို့ဆောင်ရေးဝန်ကြီးဌာန၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်ကပိုင်ဆိုင်သော သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်ရှိ မြေပေါ်တွင် ကျူးကျော်၍ လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်း ဆောင်ရွက်လျက်ရှိသော ဦးဂေါ်ဘာလူး၊ ဦးရဲလွင်နှင့် ဦးဘဲသူးတို့အား သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နေရာတွင် သွားရောက်တွေ့ဆုံခဲ့ရာ ၎င်းတို့မှာ ပေလကပ်(ဟိန္နျဘုရားပွဲ) သို့ သွားရောက်နေသဖြင့် ၎င်းတို့ကိုယ်တိုင်လာရောက်ခြင်းမရှိဘဲ ဦးဂေါ်ဘာလူးကိုယ်စား ၎င်း၏တူဖြစ်သူဦးဖိုးကျော်၊ ဦးရဲလွင်ကိုယ်စား ၎င်း၏အစ်ကိုဖြစ်သူဦးရာဂျားနှင့် ရပ်ကွက်/ကျေးရွာ ခေါင်းဆောင်ဟောင်း ဦးဒန်းဘူးတို့နှင့် တွေ့ဆုံခဲ့ပါသည်။

၂။ ထိုသို့တွေ့ဆုံစဉ် မိမိတို့က လယ်သမားများနှင့် သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်ရှိမြေမှာ ပို့ဆောင်ရေးဝန်ကြီးဌာန၊ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်က ယခင်လယ်စိုက်တောင်သူများအား လျော်ကြေးပေးဆောင်ထားပြီးဖြစ်၍ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်ကပိုင်ဆိုင်သောမြေဖြစ်ကြောင်း၊ အဆိုပါမြေနေရာသည် ဆိပ်ကမ်းဖွံ့ဖြိုးရေးလုပ်ငန်းများ ဆောင်ရွက်ရန် နိုင်ငံတော်က သတ်မှတ်ပေးထားသောမြေဖြစ်ကြောင်း၊ သို့ရာတွင်ဆိပ်ကမ်းဖွံ့ဖြိုးရေးလုပ်ငန်းများ မဆောင်ရွက်နိုင်သေးသည့်ကာလအတွင်း လယ်သမားများကျူးကျော်၍ လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်းများ ဆောင်ရွက်နေခြင်းသာဖြစ်ကြောင်း၊ ယခုအခါ မြေကွက်အမှတ် (၂၅) နှင့် (၂၆) တွင် ဂျပန်နိုင်ငံမှ ချေးငွေရယူ၍ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်က ဆိပ်ကမ်းတည်ဆောက်ရေးလုပ်ငန်းများကို မကြာမီ စတင်ဆောင်ရွက်တော့မည်ဖြစ်ကြောင်း၊ ထို့ကြောင့် ယခု လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်းများ ကျူးကျော်ဆောင်ရွက်လျက်ရှိသူများအနေဖြင့် လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်းများကို ဆက်လက်မဆောင်ရွက်ရန် ပြောကြားလိုကြောင်း၊ သို့ရာတွင် ယခုလယ်စိုက်သူများအနေဖြင့် နစ်နာမှုမရှိစေရေးအတွက် သီလဝါဆိပ်ကမ်းဒေသတွင် ဆိပ်ကမ်းတိုးချဲ့တည်ဆောက်ရေးလုပ်ငန်းများ ဆောင်ရွက်လျက်ရှိသော ကုမ္ပဏီများတွင်ဖြစ်စေ၊ မိမိတို့ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်ကဆောင်ရွက်မည့် ဆိပ်ကမ်းတည်ဆောက်ရေးလုပ်ငန်းများတွင်ဖြစ်စေ၊ အလုပ်အကိုင်အခွင့်အလမ်းများကို ဖန်တီးပေးသွားမည်ဖြစ်ကြောင်း၊ ထို့အပြင် အိမ်နေရာပြောင်းရွှေ့သည့်အခါ လိုအပ်သည့်အကူအညီများကို ပေးသွားမည်ဖြစ်ကြောင်း၊ ထို့ကြောင့် ယခုဆွေးနွေးပွဲသို့ လာရောက်သည့် လယ်သမားများအနေဖြင့် အလုပ်လုပ်ကိုင်ရန်ဆန္ဒရှိပါက ယခုချက်ချင်း အမည်နှင့် နိုင်ငံသားစိစစ်ရေးကဒ်ပြားနံပတ်များကို ပေးစေလိုကြောင်း၊ မိမိတို့အနေဖြင့် အလုပ်အကိုင်ရရှိရေးကို ချက်ချင်းဆက်သွယ်ဆောင်ရွက် ပေးသွားမည်ဖြစ်ကြောင်း၊ လယ်သမားများ လိုအပ်သည့်အကူအညီများရှိပါက မိမိတို့ထံ ဆက်သွယ်၍ အကူအညီတောင်းခံနိုင်ပါကြောင်း၊ လယ်သမားများအနေဖြင့်လည်း ယခုကဲ့သို့ မိမိတို့အဖွဲ့က ရှင်းလင်းပြောကြားခဲ့သည့်အတိုင်း သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်ရှိ မြေပေါ်တွင် ဆိပ်ကမ်းတည်ဆောက်ရေးလုပ်ငန်းများ စတင်ဆောင်ရွက်ရန် ရှိခြင်းအပေါ် ဆန္ဒသဘောထားများကို သိလိုကြောင်း မေးမြန်းခဲ့ပါသည်။

၃။ ထိုကဲ့သို့ ပြောကြားခဲ့ခြင်းအပေါ် ရပ်ကွက်/ကျေးရွာခေါင်းဆောင်ဟောင်း ဦးဒန်းဘူးက သီလဝါဆိပ်ကမ်းဒေသ၊ မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်ရှိ မြေပေါ်တွင် လယ်ယာစိုက်ပျိုးခြင်းလုပ်ငန်းများ ဆောင်ရွက်လျက်ရှိသော လယ်သမားများမှာ ပေလကပ် (ဟိန္နူဘုရားပွဲ) သို့ သွားရောက်နေသဖြင့် ၎င်းတို့ကိုစောင့်နေရ၍ အချိန်အနည်းငယ်နောက်ကျခဲ့ရကြောင်း၊ ထိုကဲ့သို့ နောက်ကျခဲ့ခြင်းအတွက် ခွင့်လွှတ်ပါရန်တောင်းပန်ပါကြောင်း၊ သီလဝါဆိပ်ကမ်းဒေသ၊

မြေကွက်အမှတ် (၂၅) နှင့် (၂၅-၂၆) ကြား ကွက်လပ်မြေပေါ်ရှိ လယ်ယာမြေအတွက် လျော်ကြေးငွေ ရရှိပြီးဖြစ်ပါကြောင်း၊ သို့ရာတွင် အချိန်ကာလကြာညောင်းသွားပြီးဖြစ်ပါကြောင်း၊ လျော်ကြေးရရှိမှု သည် လွန်ခဲ့သော (၁၅) နှစ်ခန့်ကဖြစ်ပြီး တစ်ဧကလျှင် ငွေကျပ် ၂၀၀၀၀ နှုန်းဖြစ်ကြောင်း မြန်မာ့ ဆိပ်ကမ်းအာဏာပိုင်အနေဖြင့် ၎င်းမြေပေါ်တွင် ဆိပ်ကမ်းဖွံ့ဖြိုးရေးလုပ်ငန်းများ ဆောင်ရွက်မည် ဆိုပါက မိမိတို့အနေဖြင့် ကန့်ကွက်ရန်မရှိပါကြောင်း၊ သီလဝါအထူးစီးပွားရေးဇုန်အတွင်း ကျရောက် လျက်ရှိသည့် မြေနေရာများအတွက် အထက်အဖွဲ့အစည်းများသို့ အသနားခံတင်ပြထားပြီးဖြစ်သဖြင့် အထက်အဖွဲ့အစည်းများ၏ ဆုံးဖြတ်ချက်ကို စောင့်စားလျက်ရှိပါကြောင်း၊ မိမိတို့အတွက် အလုပ် အကိုင်အခွင့်အလမ်းများရရှိမည်ဆိုပါက အလုပ်လုပ်ကိုင်လိုကြောင်း၊ မိမိတို့အနေဖြင့် အခြားသော သဘောဆန္ဒများကို ပြောကြားရန် မရှိတော့ပါကြောင်း ပြန်လည်ပြောကြားခဲ့ပါသည်။

၄။ သီလဝါမြေကွက်အမှတ် (၂၅) နှင့် (၂၆) တွင် ဆိပ်ကမ်းဖွံ့ဖြိုးရေးလုပ်ငန်းများ မကြာမီ ဆောင်ရွက်တော့မည်ဖြစ်သဖြင့် ၎င်းနေရာအား ခြံစည်းရိုးကာရံခြင်း၊ သဲမှုတ်တင်ခြင်းလုပ်ငန်းများ ဆောင်ရွက်မည်ဖြစ်ရာ ဆိပ်ကမ်းဖွံ့ဖြိုးရေးလုပ်ငန်းများ ဆောင်ရွက်ခြင်းအတွက် သိရှိကြောင်းနှင့် မိမိတို့ ဝင်ရောက်လုပ်ကိုင်လျက်ရှိသော လယ်စိုက်ခြင်းလုပ်ငန်း လုပ်ကိုင်ရန်မရှိကြောင်း ပူးတွဲပါ စာပေါ်တွင် လက်မှတ်ရေးထိုးပေးရေးကိစ္စအား မိမိတို့မှ ဆွေးနွေးခဲ့ရာ ဦးဒန်ဘူးနှင့် တက်ရောက် လာသူများမှ မိမိတို့သည် လယ်မြေကိစ္စအသနားခံစာတင်ပြထားသဖြင့် လက်မှတ်ရေးထိုးပေးနိုင်ခြင်း မရှိပါကြောင်း ပြန်လည်တင်ပြခဲ့ပါသည်။

၅။ တွေ့ဆုံဆွေးနွေးပွဲကို ၁၁း၃၀ နာရီအချိန်တွင် ရုတ်သိမ်းခဲ့ပါသည်။

(မြသန်း)
မြို့ပြအင်ဂျင်နီယာချုပ်

(တင့်လွင်)
ဌာနခွဲအင်ဂျင်နီယာ

(ဝင်းမျိုးဦး) 18/2/2013
လ/ထ တိုင်းတာရေးဌာနခွဲမှူး

(စောမျိုးလွင်)
Nippon Koei Co., Ltd (JICA Study Team)

Thilawa Folder UTL (18-2-2013) Venus CE - 2

Report of the Meeting with Farmers who are unlawfully using the area between Plot 25 and 25-26 which is owned by Myanma Port Authority of Ministry of Transport

Date of Meeting	:	15-2-2003 (Friday)
Time of Meeting	:	10:30 AM
Place of Meeting	:	Plot (25), Thilawa Port Area

Meeting Attendance List

(a) U Mya Than, Chief Engineer, Myanma Port Authority
(b) U Tint Lwin, Divisional Engineer, Myanmar Port Authority
(c) U Myo Win Oo, Assistant Survey Division Officer, Myanmar Port Authority
(d) U Tin Win Zaw, Grade one Hydrographic Surveyor, Myanmar Port Authority.
(e) Mr. SOMA Tekemasa, OCDI/Nippon Koei Co., Ltd (JICA Study Team)
(f) U Saw Myo Lwin, Nippon Koei Co., Ltd (JICA Study Team)
(g) U Phoe Kyaw (on behalf of U Gaw Bar Luu) Squatter Farmer
(h) U Raja (on behalf of U Ye Lwin) Squatter Farmer
(i) U Dan Bu (on behalf of U Bae Thu)Squatter Farmer

1. At 10:30 am on 15th Feb 2013, The team went and met with U Gaw Bar Lu, U Ye Lwin and U Bae Thu (who are squatting farmers on plot no 25 and between plot 25-26 at Thilawa port area owned by Myanmar Port Authority, Ministry of Transport) but they were going to (Hindu Temple Festival). So, we met with their representative persons U Poe Kyaw (on behalf of U Gaw Bar Luu, his niece), U Ye Lwin (on behalf of U Raja, his elder brother) and former village head U Dan Bu.

2. Meeting discussion with farmers are as follow;
   - The empty land between plot 25-26 and 25 is owned by Myanmar Port Authority and compensation to farmers is already made.
   - Those lands were planned for Port Development works by the State but the works have not been started that the farmers came back to farm on the land again.
   - Now, Myanmar Port Authority will use Plot 25 and 26 for Port Development with the loan from Japan and the construction works will soon be started.
   - Therefore, the farmers are now notified to stop farming on the area from now on.
   - However, Myanmar Port Authority will arrange the works opportunity for the farmers at Port Construction Works of Myanmar Port Authority or other companies which will conduct Port extension works in Thilawa Port Area.
   - Therefore, if the farmers present here today wish to have job, they are requested to provide their names and National Registration Card numbers right away.
   - We will notify them as soon as there is job opportunity for them.

- If there is any request, the farmers can contact us.
- The comment from farmers upon the construction on Plot 25 and 26 is also requested.

3. With regard to the above-mentioned explanation, U Dan Bu replied;
   - The farmers who are cultivating on block no. (25) and between (25-26) are going to the Hindu Temple Festival and we apologized for having to wait for them. The compensation for the area is already received but it has been a long time. Compensation charges was made last (15) years ago and the rate was 20000kyats for one acre and we have no objection against Port Development works on these lands. We also submitted appeal letter to superior association and waiting for their decision and if we got the work opportunity for us we want to do and we don't have anything else to say.

4. We discussed about the signing the attachment which acknowledges that , soon, arrangement on Thilawa Block no. (25) and between (25-26) and fencing the project area and sand filling will be carried out and cultivation work on that land will be stopped but they refused to sign the paper because they have submitted the appeal letter and waiting for the response.

5. The meeting finished at 11:30am.

(Mya Than)	(Tint Lwin)	(Win Myo Lwin)
Chief Civil Engineer	Divisional Engineer	Assistant Suveryor

(Saw Myo Lwin)

Nippon Koei Co., Ltd (JICA Study Team)

Date: ( ) February. 2013.

To.

Managing Director

Myanmar Port Authority

Ministry of Transport.

Subject: No cultivation on the land that owned by Port Authority.

1. I,_____. Registration Number/ National Identified Card Number _____ has been using farm land ( ) acre of Plot ( ) which is owned by Myanmar Port Authority, Ministry of Transport for cultivation.

2. I hereby report that there will be no cultivation on the mentioned area from -2-2013 since I have acknowledged that MPA will use the Plot ( ) which is owned by MPA, Ministry of Transport for the Port Construction.

Signature:

Name:

NRIC Number:

Witnesses

Signature:	Signature:
Name:	Name:
NRIC Number:	NRIC Number:

Photos for Consultation Meeting on 15 February 2013

	
Consultation Meeting (1)	Consultation Meeting (2)
	
Consultation Meeting (3) (Witnessed by JICA Study Team)	Consultation Meeting (4) (PAPs)
	
Consultation Meeting (5)	Plot 25 (No Investment on Land as of 15 February 2013)

Attachment-4 Monitoring Form

Public Consultation

No.	Date	Place	Contents of Consultation /Main Comments and Answers
1			
2			

Land Acquisition (Surrender of Land) Implementation

Land Acquisition Activities	Planned Total	Unit	Progress in Q'ty			Progress in %		Expected Date of Completion
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter	
Progress of Cash Assistance		**HHs**						
Plot24		**HHs**						
Plot25		**HHs**						
Between Plot25 - 26								
Plot26		**HHs**						
Progress of Land Acquisition		**Ha**						
Plot24		**Ha**						
Plot25		**Ha**						
Between Plot25 - 26		**Ha**						
Plot26		**Ha**						
Progress of Restoration Measures								
Job Training		**No. of PAPs**						
Job Opportunity		**No. of PAPs**						

HHs: Households

Grievance Redress

No.	Date	Contents of Grievance and Resolution
1		
2		

Monitoring Form (Construction Phase)

The latest results of the below monitoring items shall be submitted to JICA for **monthly basis except weekly basis of water quality** for the construction period.

－Air Quality

Item	Monitoring Result during Report Period
Countermeasures for dust prevention	

－Water Quality

Item	Monitoring Result during Report Period
1. Water quality monitoring during riverbank dredging, disposal of dredged soil to river, and dredging for the collection of landfill material a. turbidity survey (temperature, turbidity in SS, pH, and salinity) **Weakly Survey** b. countermeasures for turbid water at disposal of dredged soil to river c. other countermeasure for turbidity	
2. a. Turbidity survey of surplus water from land filling (temperature, turbidity in SS, pH, salinity, and visual check on oil content) **Weakly Survey** b. Countermeasures for securing drainage at construction (discharge channel, etc.)	
3. Condition of waste water on washing concrete works, etc.	
4. Maintenance of construction equipment and a condition of prevention measures for oil spill	
5. Condition and maintenance of temporary toilets and septic tanks	
6. Condition and treatment of drainage for construction	

－Waste

Item	Monitoring Result during Report Period
Types, amount, disposal methods of wastes	

－**Noise and Vibration**

Item	Monitoring Result during Report Period
Maintenance conditions of vehicles	
Situation of transport route setting, consideration to the residents and road users (strict abidance of speed limit and avoidance of unnecessary revving/idling, etc.)	

－**Sediment**

Item	Monitoring Result during Report Period
Sediment monitoring **before/intermediate/after dumping** (Specific gravity, Water content, Grain size, TOC, Arsenic, Cadmium, Chromium, Lead, Copper, Nickel, Zinc, DDT)	

－**Fishery Activity**

Item	Monitoring Result during Report Period
Consideration for fishery activities	

－**Infectious diseases such as HIV/AIDS**

Item	Monitoring Result during Report Period
Achievement of education for construction workers on prevention against infectious diseases	

－**Work Environment**

Item	Monitoring Result during Report Period
Achievement of safety management plan to comply with safety standards for project site (e.g., safety training, periodical safety patrol, or safety meeting, etc.)	

－**Accidents**

Item	Monitoring Result during Report Period
Achievement of traffic safety management plan to comply with on-land and marine traffic	

regulation/rules for project (e.g., providing fence, sign board, or off-limits area of outsiders, and arrangement of guardsman or security boat, etc.)	

Monitoring Form (Operation Phase)

The latest results of the below monitoring items shall be submitted to JICA for **periodically as noted** for the first 3 years after operation starts

－Water Quality（Treated drainage water） **To be submitted for Quarterly Basis**

Item (Unit)	Measured value	Country's Standard*[1]	Referred Int'l Standard*[2]	Target Value	Measurement Point*[3]	Remark
Temperature(^{O}C)		40	N/A	N/A		
Salinity		N/A	N/A	N/A		
pH		5~9	6~9	To be Set		
BOD (mg/L)		20~60	30	To be Set		
COD (mg/L)		N/A	125	To be Set		
Oil Contents (mg/L)		5	10	To be Set		
SS (mg/L)		30	50	To be Set		
Coliform Bacteria (MPN/100mL)		N/A	400	To be Set		

*1: Water and Air Pollution Control Plan (Ministry of Industry (1) Standing Order No.3, 21 August 1995)

*2: Environmental, Health, and Safety (EHS) Guidelines, International Finance Corporation

*3: At the outfall of drainage (2 points or more) and in front of the wharf (2 points or more, 2 layers)

－Water Quality (facility) **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Maintenance condition for septic tank and oil separator, etc.	

－Waste **To be submitted for Quarterly Basis**

Item	Monitoring Result during Report Period
Types, amount, disposal methods of wastes	

－Noise and Vibration **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Maintenance conditions of vehicles	
Situation of consideration to the residents and road users (strict abidance of speed limit and avoidance of unnecessary revving/idling, etc.)	

－Water Use **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Method of water supply and water consumption	

－Infectious diseases such as HIV/AIDS **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Achievement of education for port workers on prevention against infectious diseases	

－Work Environment **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Achievement of safety management plan to comply with safety standards for project site (e.g., safety training, periodical safety patrol, or safety meeting, etc.)	

－Accidents **To be submitted for Yearly Basis**

Item	Monitoring Result during Report Period
Achievement of traffic safety management plan to comply with on-land and marine traffic regulation/rules for project (e.g., providing fence, sign board, or off-limits area of outsiders, and arrangement of guardsman or security boat, etc.)	

Monitoring Form (Land Acquisition)

Public Consultation

No.	Date	Place	Contents of Consultation /Main Comments and Answers
1			
2			

Land Acquisition (Surrender of Land) Implementation

Land Acquisition Activities	Planned Total	Unit	Progress in Q'ty			Progress in %		Expected Date of Completion
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter	
Progress of Cash Assistance		**HHs**						
Plot24		**HHs**						
Plot25		**HHs**						
Between Plot25 - 26								
Plot26		**HHs**						
Progress of Land Acquisition		**Ha**						
Plot24		**Ha**						
Plot25		**Ha**						
Between Plot25 - 26		**Ha**						
Plot26		**Ha**						
Progress of Restoration Measures								
Job Training		**No. of PAPs**						
Job Opportunity		**No. of PAPs**						

HHs: Households

Grievance Redress

No.	Date	Contents of Grievance and Resolution
1		
2		

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	(a)Environmental and Social consideration study has been conducted by JICA's preparatory study however EIA reports have not been prepared because it is not currently required in official process. (b)Draft of guidelines for project appraisal procedure (including EIA) is now under preparation in Myanmar, so that EIA has not been currently approved by Myanmar government. (c)Conditions are not confirmed due to under preparation of project appraisal procedure by Myanmar government. (d)Other required environmental permits are not confirmed due to the same reason above.
	(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) N (b) N	(a)Stakeholder meetings and negotiation with PAPs was held in Feb., Jul, Aug 2013. (b) By holding a stakeholder meeting, comments from them is planned to be reflected to the project design.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a)Alternative plans have been comprehensively examined from survey results including environmental/social considerations, future demands, technical issues, costs.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted from ships, vehicles and project equipments comply with the country's emission standards? Are any mitigating measures taken?	(a) N/A	(a) There are no emission and environmental standards. The impact to air quality is very limited but some mitigation measures will be taken to minimize the effect.
	(2) Water Quality	(a) Do effluents from the project facilities comply with the country's effluent and environmental standards? (b) Do effluents from the ships and other project equipments comply with the country's effluent and environmental standards? (c) Does the project prepare any measures to prevent leakages of oils and toxicants? (d) Does the project cause any alterations in coastal lines and disappearance/appearance of surface water to change water temperature or quality by decrease of water exchange or changes in flow regimes? (e) Does the project prepare any measures to prevent polluting surface, sea or underground water by the penetration from reclaimed lands?	(a) N/A (b) N/A (c) Y (d) Y (e) Y	(a)There are no effluent and environmental standards. Waste water shall be treated in the project facilities to minimize the effect. (b)There are no effluent and environmental standards. But all ships are required to comply with regulations and standards stipulated in the MARPOL convention. (c)There are no major sources of oil and toxicant leakages. Treatment of bilge water and toxicant by the oil separator, and monitoring of the waste water will be implemented. (d)The current speed and water exchange rate may reduce inside of the jetty, which may cause little deterioration of the water quality but restraining of the river bank erosion. (e)Both project site and plланed land fill materials are not polluted.
	(3) Wastes	(a) Are wastes generated from the ships and other project facilities properly treated and disposed of in accordance with the country's regulations? (b) Is offshore dumping of dredged soil properly disposed in accordance with the country's regulations? (c) Does the project prepare any measures to avoid dumping or discharge toxicants?	(a) Y (b) Y (c) Y	(a)There are no country's regulations applied in Thilawa Area but all wastes generated from the ships and other facilities shall be properly treated and disposed same as the other existed facilityes. (b)There are no country's regulations for dredged soil dumping. The appropriate monitorings and counter measures shall be conducted during the dredging and dumping works to minimize spreading of the contaminated sediment. (c)All wastes generated from the ships and other facilities shall be properly treated and disposed.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N/A	(a) There are no noise and vibration standards. The impact to noise and vibration is limited but some countermeasures(truck maintenance, education for driver etc.) to reduce noise will be implemented.
	(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)There will be no extraction of a large volume of groundwater.
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a)There will be no major odor sources.
	(7) Sediment	(a) Are adequate measures taken to prevent contamination of sediments by discharges or dumping of hazardous materials from the ships and related facilities?	(a) Y	(a)Treatment of bilge water and toxicant by the oil separator and monitoring of the waste water will be implemented.
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)There are no protected area in the vicinity of the project site.
	(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 organisms? Are adequate measures taken to reduce negative impacts on aquatic organisms? (e) Is there a possibility that the project will adversely affect vegetation or wildlife of coastal zones? If any negative impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	(a) Y (b) N (c) N (d) Y (e) N	(a)There are tidal flats on the river edge and small patches of mangroves along the creek. (b)There are no protected habitats of endangered species based on the IUCN Red List in the vicinity of the project sites. (c)The creek will be maintained in the urgent development plan(Phase1). (d)Waste water treatment will be implemented to reduce the impact to the organisms. (e)There are no endangered vegetation or wildlife in the vicinity of the project site because the major portion of the project site is paddy field.
	(3) Hydrology	(a) Do the project facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	(a) Y	(a)The current speed and water exchange rate may reduce inside of the jetty, which may cause little deterioration of the water quality but restraining of the river bank erosion.
	(4) Topography and Geology	(a) Does the project require any large scale changes of topographic/geographic features or cause disappearance of the natural seashore?	(a) N	(a)No large scale changes are required due to jetty structure. The river bank erosion will be restrained by reducing the current speed inside of the jetty.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement/ Land Acquisition	(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) N/A (g) Y (h) Y (i) Y (j) Y	(a)There are no residents in the urgent development plan (Phase I). Measures for loss of income/livelihood due to loss of productive land are required. (b)Stake holders meetings(SHM) were held in Feb., Jul., Aug. 2013, and adequate explanation on compensation and restoration measures for livelihood were given in the meeting . (c)Abbreviate land acquisition/resettlement action plan (RAP) is prepared. (d)The compensations(additional assistance) will be done prior to commencement of construction work. (e)Compensation(additional assistance) policy is prepared in Abbreviate RAP. (f)There is no minority or indigenous people in the project site. (g)Agreement will be made prior to commencement of construction work. (h)Organizational framework will be established. Capacity and budget for the compensation(additional assistance) are also secured. (i)Monitoring plan is developed. (j)The grievance redress mechanism will be established.
	(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 changes in water uses (including fisheries and recreational uses) in the surrounding areas due to project will adversely affect the livelihoods of inhabitants? (c) Is there a possibility that port and harbor facilities will adversely affect the existing water traffic and road traffic in the surrounding areas? (d) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are considerations given to public health, if necessary?	(a) N (b) N (c) Y (d) Y	(a)Positive impacts on living conditions due to new employment and infrastructure are expected. No negative impacts are expected. (b)Fishery adtivity are carrying out in the Yangon river including around project site but the impact on the fishery is limmited because water area which required by the project is limmitted and no fishing activity is conducted on the project site. (c)There is a possibility of increase of accidents associated with increase of traffic volume during construction and port operation. Some mitigation measures such as adherence of regulation/rules and education for labors/drivers will be implemented. (d)The infection rates of HIV etc. show a decreasing tendency, however they are still higher than other countries and they are at a risk to be brought due to the increase of labors. The mitigation measures for the spread of infection will be implemented by educating the infection diseases to labors.

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)There is no cultural heritage in and around project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N/A	(a)There is no special landscape in and around project site which requires consideration.
	(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)There is no minority or indigenous people around project site. (b) Same as above
	(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/A (b) Y (c) Y (d) Y	(a)Because there is currently no law/regulation in Myanmar related to work environment and work safety, it is necessary to make rules to be applied in the Project. (b)Tangible safety considerations will be in place for individuals involved in the Project according to the standards to be applied in the Project. (c)Intangible measures will be planned and will be implemented for individuals involved in the Project, such as making rules for safety and educating labors. (d)Appropriate measures are taken such as periodical education to security guards involved in the Project.

Attachment 16

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?	(a) Y (b) Y (c) Y	(a)Some measures for air and water pollution, noise, wastes, sediment etc. will be applied. (b)The impact for natural environment by the construction activities is limited but some measures for "water pollution" will be taken to reduce the impact for ecosystems. (c)There are negative impacts on "resettlement/land acquisition", "infectious diseases", "work environment" and "accidents". Mitigation measures for them will be taken.
	(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)Monitoring program is planned and will be implemented. (b)The items, methods and frequencies of the monitoring program are stipulated in the Monitoring program. The items and frequencies of the monitoring are as follows. <During Construction> Air pollution(Monthly),Water pollution(Weekly,Monthly),Wastes(Monthly), Noise(Monthly),Sediments(Three times), Ecosystem(Monthly), Hydorology(Monthly), Resettlement(Quarterly), Local Economy(Monthly,Quarterly), Land Use(Monthly), Infectious diseases (Monthly), Work Environmen(Monthly), Accidents(Monthly) <During Operation> Water pollution(Quarterly, Yearly), Wastes(Quarterly), Noise(Yearly), Sediments(Quarterly, Yearly), Ecosystem(Quarterly, Yearly), Land Use(Quarterly, Yearly), Water usage(Yearly), Infectious diseases (Yearly), Work Environmen(Yearly), Accidents(Yearly) (c)The monitoring framework will be established before construction starts. (d)There is no regulation to submit the monitoring results to the regulatory authorities in Myanmar, however, monitoring forms are established to submit to JICA.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Note on Using Environmental Checklist	(a) Where necessary, impacts on groundwater hydrology (groundwater level drawdown and salinization) that may be caused by alteration of topography, such as land reclamation and canal excavation should be considered, and impacts, such as land subsidence that may be caused by groundwater uses should be considered. If significant impacts are anticipated, adequate mitigation measures should be taken. (b) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (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 (b) N	(a)There will be no impact on groundwater hydrology and land subsidence. (b)During Construction: Trans boundary and global issues will not be occurred because the effect of construction work may be limited in/around the project site and temporary. During Operation: Increase of water and road traffic might slightly increase green house gases in/around the project site, which will not lead any significant trans boundary or global issues.

Water Quality Survey Results

Site		S1	S2	S3	S4	S5	Laboratory
Date		14-8-2012	14-8-2012[*1]	13-8-2012	13-8-2012[*1]	15-8-2012	-
Hour		7:30	8:00	6:50	7:30	9:00	-
Depth(m)	-	6	13	3	24	8	On site
Water temp. ℃	Surface.	24.0	24.2	22.8	24.0	24.5	On site
	Bottom	24.0	24.4	22.8	25.6	24.4	
Salinity	Surface.	0	0	0	0	0	On site
	Bottom	0	0	0	0	0	
pH	Surface.	7.6	7.8	7.8	6.1	7.5	On site
	Bottom	7.5	7.7	6.5	7.8	7.6	
SS (mg/L)	Surface.	310	325	260	290	282	Iso-Tech[*3]
	Bottom	300	330	288	308	320	
Turbidity (NTU)	Surface.	250	268	240	270	265	Iso-Tech
	Bottom	245	316	250	300	288	
DO (mg/L)	Surface.	6.0	8.0	7.0	6.0	6.0	On site
	Bottom	8.0	7.6	5.5	7.5	9.0	
BOD (mg/L)	Surface.	288	160	192	128	240	Iso-Tech
	Bottom	192	288	160	240	288	
Coliform bacteria MPN/100mL	Surface.	>16	>16	>16	>16	>16	NHL[*4]
	Bottom	>16	21	>16	17	>16	
Oil content (mg/L)	Surface.	ND[*2]	ND	ND	ND	ND	MSTRD[*5]
	Bottom	ND	ND	ND	ND	ND	
T-N (mg/L)	Surface.	0.55	0.61	0.55	0.55	0.54	IDEA[*6]
	Bottom	0.77	0.75	0.51	0.86	0.59	
T-P (mg/L)	Surface.	0.185	0.170	0.173	0.184	0.189	IDEA
	Bottom	0.303	0.298	0.204	0.323	0.271	

*1: Water samples at bottom layer were collected on 30th August at S2 and S4

*2: ND; Not detectable

*3: ISO Tech Laboratory

*4: Ministry of Health Department of Health National Health Laboratory

*5: Myanma Scientific and Technological Research Department

*6: IDEA Consultants, Inc.

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0041

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station (I) surface

Location: Thilawa Port Expansion

Date and Time of collection: 14.8.2012

Date and Time of arrival at Laboratory: 14.8.2012

Date and Time of Commencing examination: 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	250	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	288	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	310	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

(Waste) A - 0042

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station (I) bottom

Location: Thilawa Port Expansion

Date and Time of collection: 14.8.2012

Date and Time of arrival at Laboratory: 14.8.2012

Date and Time of Commencing examination: 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	245	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	192	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	300	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
~~B.E (Civil) 1980, M.MES~~
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

(Waste) A - 0043

WASTEWATER QUALITY TEST RESULTS FORM

Client BANCA

Address

Nature of Water Station (II) surface

Location Thilawa Port Expansion

Date and Time of collection 14.8.2012

Date and Time of arrival at Laboratory 14.8.2012

Date and Time of Commencing examination 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	268	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	160	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	325	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0053

WASTEWATER QUALITY TEST RESULTS FORM

Client BANCA

Address

Nature of Water Station II (Bottom)

Location Thilawa Port Expansion

Date and Time of collection 30.8.2012

Date and Time of arrival at Laboratory 30.8.2012

Date and Time of Commencing examination 4.9.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	316	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	288	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	330	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
~~B.E (Civil) 1980, M.MES~~
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

(Waste) A - 0044

WASTEWATER QUALITY TEST RESULTS FORM

Client BANCA

Address

Nature of Water Station (III) surface

Location Thilawa Port Expansion

Date and Time of collection 13.8.2012

Date and Time of arrival at Laboratory 14.8.2012

Date and Time of Commencing examination 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	240	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	192	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	260	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

(a division of WEG Limited)

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

(Waste) A - 0045

WASTEWATER QUALITY TEST RESULTS FORM

Client BANCA

Address

Nature of Water Station (III) bottom

Location Thilawa Port Expansion

Date and Time of collection 13.8.2012

Date and Time of arrival at Laboratory 14.8.2012

Date and Time of Commencing examination 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	250	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	160	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	288	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0046

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station (IV) surface

Location: Thilawa Port Expansion

Date and Time of collection: 13.8.2012

Date and Time of arrival at Laboratory: 14.8.2012

Date and Time of Commencing examination: 19.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	270	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	128	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	290	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature:

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0054

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station IV (Bottom)

Location: Thilawa Port Expansion

Date and Time of collection: 30.8.2012

Date and Time of arrival at Laboratory: 30.8.2012

Date and Time of Commencing examination: 4.9.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	300	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	240	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	308	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
~~B.E (Civil) 1980, M.MES~~
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0047

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station (V) surface

Location: Thilawa Port Expansion

Date and Time of collection: 15.8.2012

Date and Time of arrival at Laboratory: 16.8.2012

Date and Time of Commencing examination: 21.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	265	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	240	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	282	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

(a division of WEG Limited)

ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd)
Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

No.18, Lanthit Road,
Nanthargone Quarter,
Insein Township, Yangon.
Fax: 01-644506, Ph: 01-640955,
09-73225175, 09-73242162
E-mail: isotechlaboratory@gmail.com

ISO-TECH LABORATORY

(Waste) A - 0048

WASTEWATER QUALITY TEST RESULTS FORM

Client: BANCA

Address:

Nature of Water: Station (V) bottom

Location: Thilawa Port Expansion

Date and Time of collection: 15.8.2012

Date and Time of arrival at Laboratory: 16.8.2012

Date and Time of Commencing examination: 21.8.2012

Results of Water Analysis

Parameters	Influent Results	Effluent Results
Nitrate (mg/l)	Nil	
Turbidity	288	
Chemical Oxygen Demand (COD) (mg/l)		
Biochemical Oxygen Demand (BOD)(5 days at 20°C)(mg/l)	288	
Dissolve Oxygen (DO) (mg/l)		
Total Solids (mg/l)		
Suspended Solids (mg/l)	320	
Dissolved Solids (mg/l)		
Phosphate (mg/l)	Nil	
Ammonia Nitrogen (NH_3)(mg/l)		
Ammonium Nitrogen (NH_4) (mg/l)		

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Win Myint
B.E (Civil) 1980, M.MES
Technical Officer
ISO TECH Laboratory

(a division of WEG Limited)

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 204 Date of report : 17.8.12

Sender: BANCA

Address: Thilawar, Station 1 surface

Voucher No: 024746

Source (Description) : River water

Date and Time of collection : 7:30 AM, 14/8/12

Date and Time of receipt : ……., 14/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 204 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 205 Date of report : 17.8.12

Sender: BANCA

Address: Thilawar, Station 1 bottom

Voucher No: 024746

Source (Description) : River water

Date and Time of collection : 7:30 AM, 14/8/12

Date and Time of receipt : ……., 14/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 205 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 206 Date of report : 17.8.12

Sender: BANCA

Address: Thilawar, Station 2 surface

Voucher No: 024746

Source (Description) : River water

Date and Time of collection : 8:00 AM, 14/8/12

Date and Time of receipt : ……., 14/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 206 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 201 Date of report : 16.8.12

Sender: BANCA

Address: Thilawar, Station 3 surface

Voucher No: 024745

Source (Description) : River water

Date and Time of collection : 7:50 AM, 13/8/12

Date and Time of receipt : 11:00 AM, 13/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 201 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 202 Date of report : 16.8.12

Sender: BANCA

Address: Thilawar, Station 3 bottom water

Voucher No: 024745

Source (Description) : River water

Date and Time of collection : 7:50 AM, 13/8/12

Date and Time of receipt : 11:00 AM, 13/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 202 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 203 Date of report : 16.8.12

Sender: BANCA

Address: Thilawar, Station 4 surface

Voucher No: 024745

Source (Description) : River water

Date and Time of collection : 8:10 AM, 13/8/12

Date and Time of receipt : 11:00 AM, 13/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 203 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 207 Date of report : 20.8.12

Sender: BANCA

Address: Thilawar, Station 5 surface

Voucher No: 024746

Source (Description) : River water

Date and Time of collection : 9:00 AM, 15/8/12

Date and Time of receipt : 11:30 AM, 15/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 207 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF HEALTH
DEPARTMENT OF HEALTH
NATIONAL HEALTH LABORATORY
35, HMAW KUN DAIK STREET, YANGON
BACTERIOLOGY SECTION

WATER BACTERIOLOGY REPORT

Laboratory No: Wa (P)- 208 Date of report : 20.8.12

Sender: BANCA

Address: Thilawar, Station 5 bottom

Voucher No: 024746

Source (Description) : River water

Date and Time of collection : 9:00 AM, 15/8/12

Date and Time of receipt : 11:30 AM, 15/8/12

Result of Analysis:

Total coliforms in MPN/ 100ml	>16
Escherichia coli	Isolated

(MPN= Most Probable Number)

Report: Water sample of Wa (P)- 208 is **bacteriologically unsatisfactory.**

Lab Officer/ Microbiologist:

Head/ Consultant Microbiologist
Bacteriology Section

Dr. Khin Myat Nwe
Deputy Director (Public Health)
National Health Laboratory

0154

MINISTRY OF INDUSTRY

CENTRAL RESEARCH AND DEVELOPMENT CENTRE
Yangon-Insein Road, West-Gyogone, Insein Township, Yangon, Myanmar
Telephone 522632, 522635, 640383

Central Research and Development Centre
No.....
Date.....
CRDC

CERTIFICATE

RESULT

Reference : BANCA
Sample : Water

Sr: No.	Item	Station(2).bottom 10:15 , 30/8	Station(4).bottom 10:50 , 30/8
1.	Most Probable Number (M.P.N)	21	17
	E.Coli	4	6
	Remark	Unsatisfactory	Unsatisfactory

Remarks Results Valid for Tested Sample Only

Method/ Equipment used

Tested by: ( )
Win Pa Pa Han

Checked by: ( )
Daw Hta Hta Gyi
B.Sc (Zoology), D.F.T.,
M.Dev.S

( )
KHIN MA MA KYI
BE(Chemical)DFT,MS(Food)(Malaysia),DMA,DCSc
Deputy Director
Central Research and Development Centre

Our Reference C.R.D.C, 1-Sa Ma (R&D)(7)2012/YG/Da-Sa (234)
Date 6-9-2012

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ၆၇

RESULT

Sample No.		292/12-13	293/12-13	294/12-13	295/12-13
Job No.		J-540	J-541	J-542	J-543
Sample Mark		S-T (1)(S-F)	S-T (1)(B-T)	S-T (2)(S-F)	S-T (3)(B-T)
Sample Date		14.8.2012	14.8.2012	14.8.2012	13.8.2012
Oil and Grease	(ppm)	Nil	Nil	Nil	Nil

Not a certificate of conformance
စံမှီနှံစံညွှန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Methods of Analysing Water for Municipal and Industrial Use (SOLVAY)

Tested by: Daw Khin Khin Gyi

Checked by: Dr. Khin Aye Tue

Daw Khin Htay

Technical Director: U Win Khaing Moe

Our Reference: ၃၀၇

Date 17.9.12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ၆၇

RESULT

Sample No.		296/12-13	297/12-13	298/12-13	299/12-13
Job No.		J-544	J-545	J-546	J-547
Sample Mark		S-T (3)(S-F)	S-T (4)(S-F)	S-T (5)(S-F)	S-T (5)(B-T)
Sample Date		13.8.2012	13.8.2012	15.8.2012	15.8.2012
Oil and Grease	(ppm)	Nil	Nil	Nil	Nil

Not a certificate of conformance
စမ်းသပ်ခဲ့သည်နှင့်ကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Methods of Analysing Water for Municipal and Industrial Use (SOLVAY)

Tested by: Daw Khin Khin Gyi

Daw Khin Htay

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 207

Date 17.9.12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ၆၇

RESULT

Sample No.		309/12-13	310/12-13
Job No.		J-558	J-559
Sample Mark		S-T (2)(B-T)	S-T (4)(B-T)
Sample Date		30.8.2012	30.8.2012
Oil and Grease	(ppm)	Nil	Nil

Not a certificate of conformance
စံမှီနှံစံညွှန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Methods of Analysing Water for Municipal and Industrial Use (SOLVAY)

Tested by: Daw Khin Khin Gyi

Daw Khin Htay

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: ၁၀၄

Date 17.9.12

No. 12-1116-1

7 November 2012

To : Hydrocon Services, (Myanmar) Ltd.

CERTIFICATE OF MEASUREMENT

In accordance with the official Methods for measurement of water quality authorized by Japanese Industrial Standard Committee, IDEA Consultants, Inc., a Concentration Measurement Certificate Office of Japan, hereby reports and certifies the measurement results as follows.

1. Title	Sediment and water quality analysis	
2. Sample Description		
2.1 Sample Type	Water	
2.2 Sampling Location	Yangon River, Myanmar	
2.3 Sampling Date	28 September 2012	
3. Methods of Measurement	Total nitrogen : JIS K 0102-2008 45.4 Total phosphorus : JIS K 0102-2008 46.3.1	
4. Objectives	Total nitrogen	Total phosphorus
5. Unit	(mg/L)	(mg/L)
St.I (S)	0.55	0.185
St.I (NB) (6 m)	0.77	0.303
St II (S)	0.61	0.170
St. II(NB) (13 m)	0.75	0.298
St. III (S)	0.55	0.173
St. III (NB) (3 m)	0.51	0.204
St. IV (S)	0.55	0.184
St. IV (NB) (24 m)	0.86	0.323
St. V (S)	0.54	0.189
St. V (NB) (8 m)	0.59	0.271

IDEA Consultants, Inc.
3-15-1 Komazawa, Setagaya-ku, Tokyo 154-8585, Japan
Tel : +81-3-4544-7609

Sediment Quality Survey Results

Site		S1	S2	S3	S4	S5	Lab.
Date		14-8-2012	14-8-2012	13-8-2012	13-8-2012	15-8-2012	
Hour		7:30	8:00	6:50	7:30	9:00	-
Depth	m	6	13	3	24	8	On site
Physical properties							
Specific gravity	-	2.69	2.67	2.69	2.67	2.70	ITC[*2]
Water content	%	56.42	69.44	61.20	61.73	51.14	ITC
Heavy metals							
Arsenic	mg/kg	ND[*1]	ND	ND	ND	ND	MSTRD[*3]
Cadmium	mg/kg	0.3	0.4	0.42	0.5	0.35	PAL[*4]
Chromium	mg/kg	31.1	19.9	24.42	20.82	22.57	PAL
Lead	mg/kg	ND	ND	ND	ND	ND	MSTRD
Mercury	mg/kg	ND	ND	ND	ND	ND	UAE[*5]
Copper	mg/kg	40	10	100	100	100	MSTRD
Nickel	mg/kg	99.22	96	118.97	112	113.17	PAL
Silver	mg/kg	ND	ND	ND	ND	ND	UAE
Zinc	mg/kg	10	100	10	20	10	MSTRD
Organic Pollutants							
Total organic carbon	mg/g	16.0	8.1	9.4	8.9	4.9	MAS
PCBs	µg/kg	ND	ND	ND	ND	ND	UAE
DDT	µg/kg	ND	5.4	7.6	12.7	14.0	PAL
Dieldrin	µg/kg	ND	6.4	9.9	ND	ND	PAL
Endrin	µg/kg	ND	0.0032	ND	ND	ND	IDEA[*6]
Total petroleum hydrocarbon	mg/kg	77.6	13.8	45.8	31.4	100	UAE
TBT	µg/kg	ND	ND	ND	ND	ND	IDEA

*1: ND; Not detectable

*2: Construction Material Test Laboratory, Irrigation Technology Center, Bago, Irrigation Department

*3: Myanma Scientific and Technological Research Department

*4: Ministry of Agriculture and Irrigation Department of Agriculture Plant Protection Division Pesticide Analytical Laboratory

*5: United Analyst and Engineering Consultant Co., Ltd.

*6: IDEA Consultants, Inc.

CONSTRUCTION MATERIAL TEST LABORATORY
(SOIL)

IRRIGATION TECHNOLOGY CENTER, BAGO
IRRIGATION DEPARTMENT

SUMMARY SOIL TEST RESULTS

. Thilawa Port Expansion

Date ... 2

PLE NO.	GRAIN SIZE DISTRIBUTION				ATTERBERG'S LIMIT			SPECIFIC GRAVITY	NATURAL MOISTURE CONTENT	STANDARD COMPACTION		DIRECT SHEAR		
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)		Wn (%)	OMC (%)	MDD lb/ft^3	Cohesion (Kg/cm^2) (C)	Angle of internal fraction ϕ	
	37.00	61.00	2.00	0.00				2.69	56.42					Si
	21.50	76.50	2.00	0.00				2.67	69.44					Sil
)	33.50	65.50	1.00	0.00				2.69	61.20					Sil
)	36.50	61.50	2.00	0.00				2.67	61.73					Sil
	56.00	43.00	1.00	0.00				2.70	51.14					Sil

/ill not be liable for the inadequacy of an design that is done based on the result of the Soil Test of ITC.

Submitted By:

Checked By:

[Naw Zar Kh
Soil Officer (I
Water & Soil Mechanics
Irrigation Technology Ce

ONSTRUCTION MATERIAL TEST LABORATORY

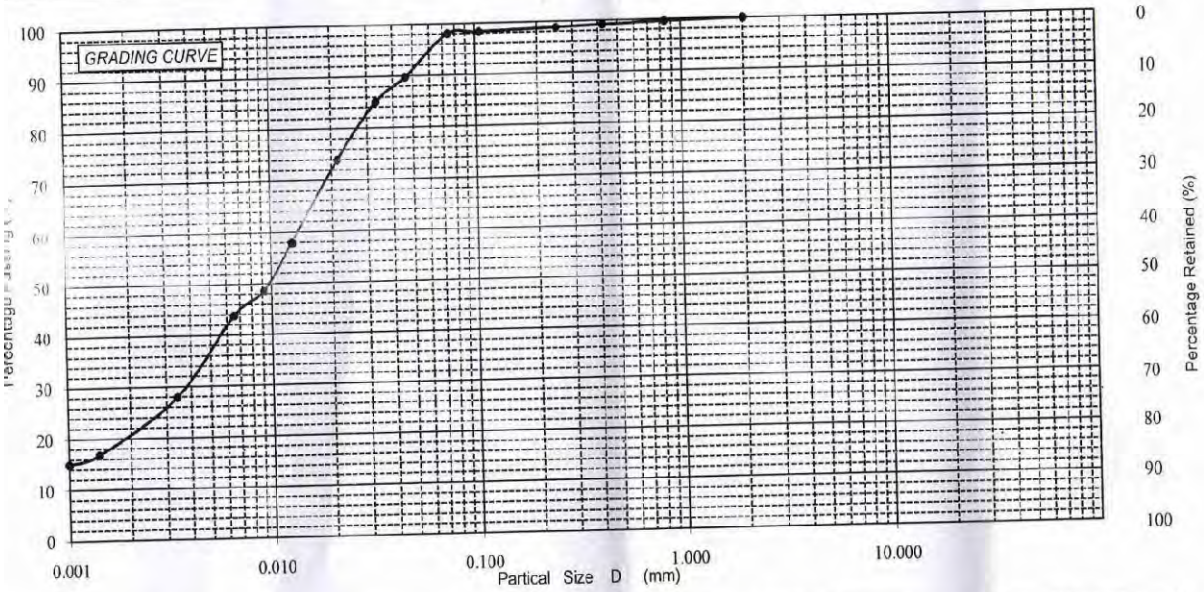
(SOIL)

IRRIGATION TECHNOLOGY CENTER, BAGO
IRRIGATION DEPARTMENT

PARTICAL SIZE ANALYSIS TEST

PROJECT: Thilawa Port Expansion — Date ... 28.8.2012

TEST NO: Station - I — LOCATION :



olloids	Clay	Silt	Fine Sand	Coarsed Sand	Fine Gravel	Gravel	Cobble
	0.001mm	0.005mm	0.074mm	0.42mm	2.00mm	4.75mm	75.0mm

Remarks:

Clay = 37.00% Silt = 61.00% Sand = 2.00 %

TESTED BY :	D.S.S
CHECKED BY:	Than Than Oo, S.O (Lab:)

ON MATERIAL TEST LABORATORY

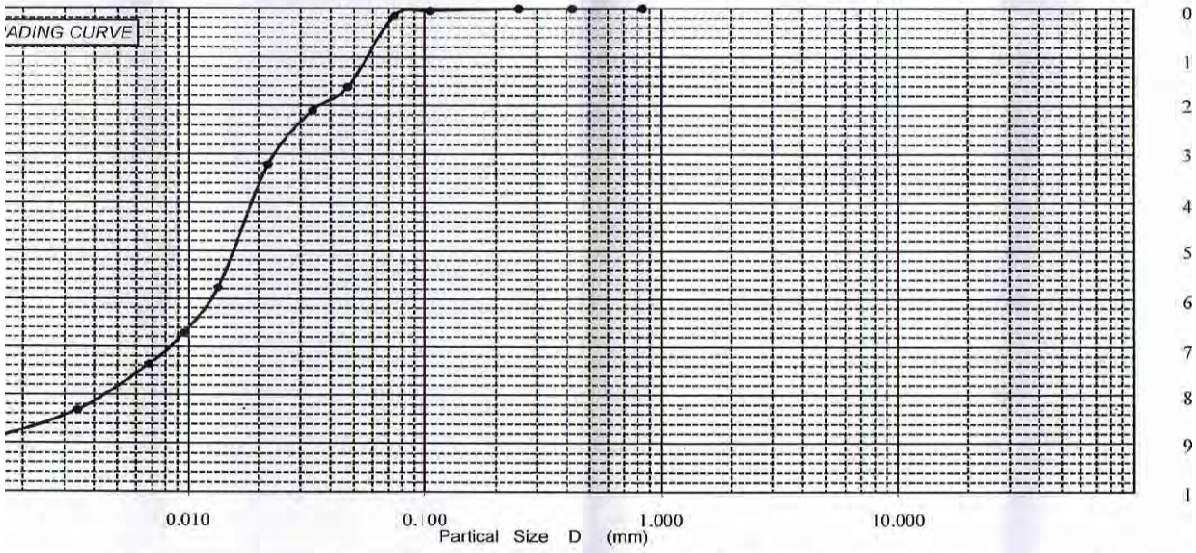
(SOIL)

N TECHNOLOGY CENTER, BAGO
RIGATION DEPARTMENT

PARTICAL SIZE ANALYSIS TEST

PROJECT: Thilawa Port Expansion — Date ... 28.8.2012

TEST NO: Station - II — LOCATION :



Clay	Silt	Fine Sand	Coarsed Sand	Fine Gravel	Gravel	C
0.005mm	0.074mm	0.42mm	2.00mm	4.76mm	75.0mm	

= 21.50% Silt = 76.50 % Sand = 2.00 %

TESTED BY :	D.S.S
CHECKED BY:	Than Than Oo, S.O (Lab:)

CONSTRUCTION MATERIAL TEST LABORATORY

(SOIL)

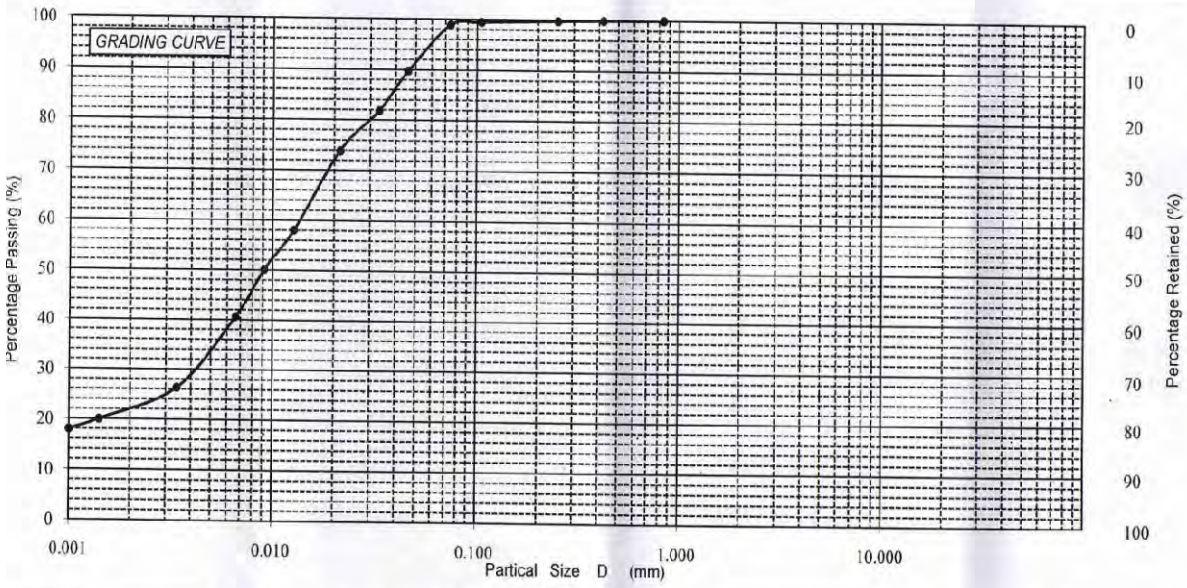
ITC

IRRIGATION TECHNOLOGY CENTER, BAGO
IRRIGATION DEPARTMENT

PARTICAL SIZE ANALYSIS TEST

PROJECT: Thilawa Port Expansion — Date ... 28.8.2012

TEST NO: Station - III — LOCATION :



Clay	Silt	Fine Sand	Coarsed Sand	Fine Gravel	Gravel	Cobble
0.001mm	0.005mm	0.074mm	0.42mm	2.00mm	4.76mm	75.0mm

emarks:

Clay = 33.50% Silt = 65.50 % Sand = 1.00 %

TESTED BY :	D.S.S
CHECKED BY:	Than Than Oo, S.O (Lab:)

ICTION MATERIAL TEST LABORATORY

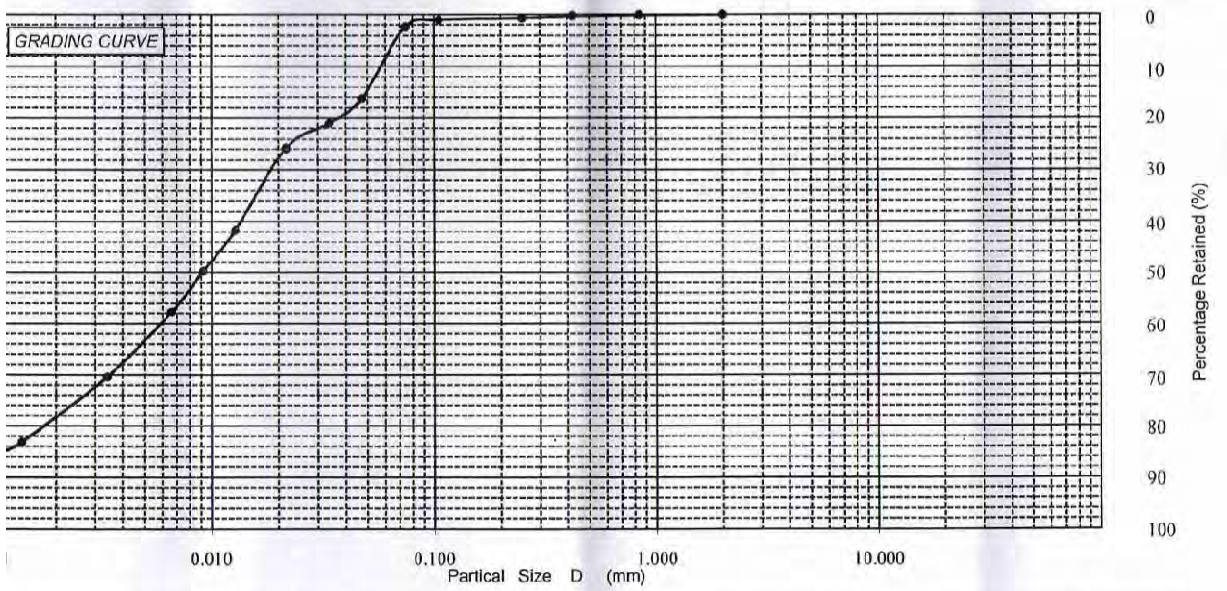
(SOIL)

TION TECHNOLOGY CENTER, BAGO
IRRIGATION DEPARTMENT

PARTICAL SIZE ANALYSIS TEST

PROJECT: Thilawa Port Expansion — Date ... 28.8.2012

TEST NO: Station - IV — LOCATION :



Clay	Silt	Fine Sand	Coarsed Sand	Fine Gravel	Gravel	Cobble
n 0.005mm	0.074mm	0.42mm	2.00mm	4.76mm	75.0mm	

lay = 36.50% Silt = 61.50 % Sand = 2.00 %

TESTED BY :	D.S.S
CHECKED BY:	Than Than Oo, S.O (Lab:)

TION MATERIAL TEST LABORATORY

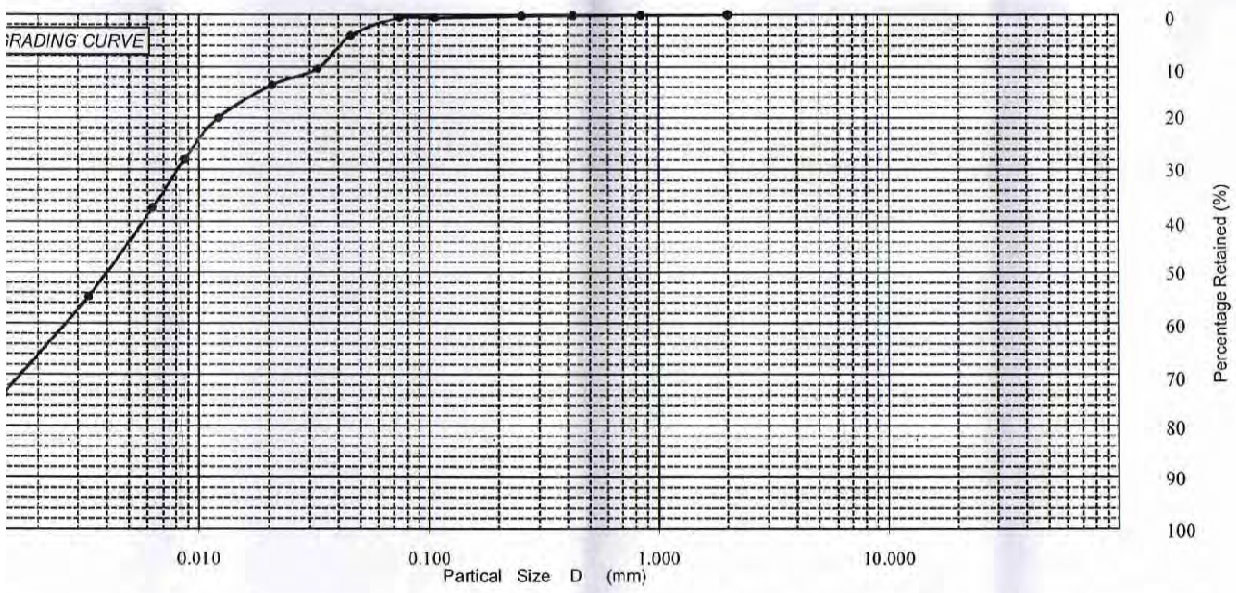
(SOIL)

ON TECHNOLOGY CENTER, BAGO
RRIGATION DEPARTMENT

PARTICAL SIZE ANALYSIS TEST

PROJECT: Thilawa Port Expansion — Date ... 28.8.2012

TEST NO: Station - V — LOCATION :



Clay	Silt	Fine Sand	Coarsed Sand	Fine Gravel	Gravel	Cobble
0.005mm	0.074mm	0.42mm	2.00mm	4.76mm	75.0mm	

= 56.00% Silt = 43.00 % Sand = 1.00 %

TESTED BY :	D.S.S
CHECKED BY:	Than Than Oo, S.O (Lab:)

6

DEPT. OF AGRICULTURE

SOIL ANALYTICAL DATA SHEET.

(FORM NO.1)

SHEET NO. 1

PROJECT BANCA

LAB NO. S BA

REFERENCES

DATE

Horizon	Depth in inches	Moisture (%)	pH 1:2.5 H_2O	pH 1:2.5 KCL	EC mmhos/cm	Texture sand %	Texture silt %	Texture clay %	Texture total %	Organic Carbon (%)	Humus (%)	Total N_2 (%)		Exchangeable Cat meq / 100 gm ++ Ca	++ Mg	+ K	+ Na
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1										1.60	2.77						
2										0.81	1.40						
3										0.94	1.62						
4										0.89	1.55						
5										0.49	0.85						

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ဂြ

RESULT

Sample No.		285/12-13
Job No.		J-531
Sample Marked.		ST-1
Copper as Cu	(%)	0.004
Zinc as Zn	(%)	0.001
Arsenic as As	(%)	N.D
Lead as Pb	(%)	N.D

N.D=Not Detected

Not a certificate of conformance
စမ်းသပ်ခဲ့သည်နှုန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Arthur I Vogel, A.O.A.C

Tested by: Daw Khin Nilar Chit

Daw Aye Aye Zin

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 196
Date 10. 9.12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: မြေ

RESULT

Sample No.		286/12-13
Job No.		J-532
Sample Marked.		ST-2
Copper as Cu	(%)	0.001
Zinc as Zn	(%)	0.01
Arsenic as As	(%)	N.D
Lead as Pb	(%)	N.D

N.D=Not Detected

Not a certificate of conformance
စံချိန်စံညွှန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Arthur I Vogel, A.O.A.C

Tested by: Daw Khin Nilar Chit

Daw Aye Aye Zin

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 196

Date 10·9·12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ေက်ာ

RESULT

Sample No.		287/12-13
Job No.		J-533
Sample Marked.		ST-3
Copper as Cu	(%)	0.01
Zinc as Zn	(%)	0.001
Arsenic as As	(%)	N.D
Lead as Pb	(%)	N.D

N.D=Not Detected

Not a certificate of conformance
စမ်းသပ်ခဲ့သည်နှင်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Arthur I Vogel, A.O.A.C

Tested by: Daw Khin Nilar Chit

Daw Aye Aye Zin

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 196
Date 10.9.12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: ေၾကြ

RESULT

Sample No.		288/12-13
Job No.		J-534
Sample Marked.		ST-4
Copper as Cu	(%)	0.01
Zinc as Zn	(%)	0.002
Arsenic as As	(%)	N.D
Lead as Pb	(%)	N.D

N.D=Not Detected

Not a certificate of conformance
စံမှီနိုစံညွှန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Arthur I Vogel, A.O.A.C

Tested by: Daw Khin Nilar Chit

Daw Aye Aye Zin

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 196
Date 10.9.12

Analysis Report

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MYANMA SCIENTIFIC AND TECHNOLOGICAL RESEARCH DEPARTMENT
No.(6)Kaba Aye Pagoda Road. Yankin P.O., Yangon

Reference: Biodiversity And Nature Conservation Association (BANCA)

Sample: မြေ

RESULT

Sample No.		289/12-13
Job No.		J-535
Sample Marked.		ST-5
Copper as Cu	(%)	0.01
Zinc as Zn	(%)	0.001
Arsenic as As	(%)	N.D
Lead as Pb	(%)	N.D

N.D=Not Detected

Not a certificate of conformance
စံချိန်စံညွှန်းကိုက်ညီကြောင်းထောက်ခံချက်မဟုတ်ပါ

Method/ Equipment used: Arthur I Vogel, A.O.A.C

Tested by: Daw Khin Nilar Chit

Daw Aye Aye Zin

Checked by: Dr. Khin Aye Tue

Technical Director: U Win Khaing Moe

Our Reference: 196
Date 10.9.12

The Government of the Replubic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agriculture
Plant Protection Division
Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm **Tel : 640344, 644214, 644213,**
Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 17/ 2012

Description of consignments / lot	: Soil Sample (1)
Name of owner and address	:U Tin Oo,BANCA,Thilawa Port Expansion
Original of sample	: The Floor of Yangon River
Designation of Sample	: Soil Sample(1)
Laboratory registration No	: HM- 17/ 2012
The sample was taken by	: U Tin Oo,BANCA ,Thilawa Port Expansion
Date of sampling	: 13.8.2012
Place of Sampling	: The Floor of Yangon River
Date of analysis	:31.8.2012
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal contents in the sample commodity (based on the samples submitted by U Tin Oo,BANCA, The Floor of Yangon River) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Clean Up Target Level (ppm)**
Cadmium(Cd)	0.3	0.8
Chromium(Cr)	31.1	100
Nickel (Ni)	99.22	35

NB: The results are valid only for the quantities the sample represented.
Date: 12.9.2012
ppm:parts per million

14/9/2012

.....
(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

.....
(Deputy Director)
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

The Government of the Replubic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agriculture
Plant Protection Division
Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm **Tel : 640344, 644214, 644213,**
Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 18/ 2012

Description of consignments / lot	: Soil Sample (2)
Name of owner and address	:U Tin Oo,BANCA,Thilawa Port Expansion
Original of sample	: The Floor of Yangon River
Designation of Sample	: Soil Sample (2)
Laboratory registration No	: HM- 18/ 2012
The sample was taken by	: U Tin Oo,BANCA, Thilawa Port Expansion
Date of sampling	: 13.8.2012
Place of Sampling	: The Floor of Yangon River
Date of analysis	:31.8.2012
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal contents in the sample commodity (based on the samples submitted by U Tin Oo,BANCA, The Floor of Yangon River) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Clean Up Target Level (ppm)**
Cadmium(Cd)	0.4	0.8
Chromium(Cr)	19.9	100
Nickel (Ni)	96	35

NB: The results are valid only for the quantities the sample represented.

Date: 12.9.2012

ppm:parts per million

14/9/2012

.....
(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

.....
(Deputy Director)
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

The Government of the Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agriculture
Plant Protection Division
Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm **Tel : 640344, 644214, 644213,**
Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 19/ 2012

Description of consignments / lot	: Soil Sample (3)
Name of owner and address	:U Tin Oo,BANCA,Thilawa Port Expansion
Original of sample	: The Floor of Yangon River
Designation of Sample	: Soil Sample (3)
Laboratory registration No	: HM- 19/ 2012
The sample was taken by	: U Tin Oo,BANCA, Thilawa Port Expansion
Date of sampling	: 13.8.2012
Place of Sampling	: The Floor of Yangon River
Date of analysis	:31.8.2012
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal contents in the sample commodity (based on the samples submitted by U Tin Oo,BANCA, Thilawa Port Expansion) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Clean Up Target Level (ppm)**
Cadmium(Cd)	0.42	0.8
Chromium(Cr)	24.42	100
Nickel (Ni)	118.97	35

NB: The results are valid only for the quantities the sample represented.
Date: 12.9.2012
ppm:parts per million

.....
(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

.....
(Deputy Director)
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

The Government of the Replubic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agriculture
Plant Protection Division
Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm **Tel : 640344, 644214, 644213,**
Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 20/ 2012

Description of consignments / lot	: Soil Sample (4)
Name of owner and address	:U Tin Oo,BANCA,Thilawa Port Expansion
Original of sample	: The Floor of Yangon River
Designation of Sample	: Soil Sample (4)
Laboratory registration No	: HM- 20/ 2012
The sample was taken by	: U Tin Oo,BANCA, Thilawa Port Expansion
Date of sampling	: 13.8.2012
Place of Sampling	: The Floor of Yangon River
Date of analysis	:31.8.2012
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal contents in the sample commodity (based on the samples submitted by U Tin Oo,BANCA, Thilawa Port Expansion) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Clean Up Target Level (ppm)**
Cadmium(Cd)	0.5	0.8
Chromium(Cr)	20.82	100
Nickel (Ni)	112	35

NB: The results are valid only for the quantities the sample represented.

Date: 12.9.2012

ppm:parts per million

17/9/2012

.....
(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

.....
(Deputy Director)
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

The Government of the Replubic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agriculture
Plant Protection Division
Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm **Tel : 640344, 644214, 644213,**
Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS
HM – 21/ 2012

Description of consignments / lot	: Soil Sample (5)
Name of owner and address	:U Tin Oo,BANCA,Thilawa Port Expansion
Original of sample	: The Floor of Yangon River
Designation of Sample	: Soil Sample (5)
Laboratory registration No	: HM- 21/ 2012
The sample was taken by	: U Tin Oo,BANCA, Thilawa Port Expansion
Date of sampling	: 13.8.2012
Place of Sampling	: The Floor of Yangon River
Date of analysis	:31.8.2012
Remarks on the condition of the sample	: Sample is packed in Plastic Bag

RESULTS:

Herewith it is certified that the heavy metal contents in the sample commodity (based on the samples submitted by U Tin Oo,BANCA, Thilawa Port Expansion) are as follow ;

Heavy Metal Contaminants	**Laboratory Finding (ppm)**	**Clean Up Target Level (ppm)**
Cadmium(Cd)	0.35	0.8
Chromium(Cr)	22.57	100
Nickel (Ni)	113.17	35

NB: The results are valid only for the quantities the sample represented.

Date: 12.9.2012

ppm:parts per million

17/9/2012

.....
(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

.....
(Deputy Director)
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

ANALYSIS REPORT

CUSTOMER NAME : FOREST PARK MACHINERY (THAILAND) CO., LTD.
ADDRESS : 325/5 SOI SUKHUMVIT 63 (EKKAMAI 19), SUKHUMVIT ROAD, KLONGTAN NUA, WATTANA, BANGKOK 10110. TEL. 0 2381 7407, 0 2381 7710 FAX 0 2381 7408
SAMPLING SOURCE : YANGON, MYANMAR
SAMPLE TYPE : SOIL
SAMPLING DATE : -
SAMPLING TIME : -
SAMPLING METHOD : -
SAMPLING BY : CUSTOMER
ANALYZED BY : MISS NADNAPA KAMOLBOON

RECEIVED DATE : SEPTEMBER 13, 2012
ANALYTICAL DATE : SEPTEMBER 13-OCTOBER 4, 2012
ANALYSIS NO. : LAP395-LAP399/2012
WORK NO : LAB3376-3/2012
REPORT NO. : L14927/2012

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT					DETECTION LIMIT
			STATION 1 LAP395/2012	STATION 2 LAP396/2012	STATION 3 LAP397/2012	STATION 4 LAP398/2012	STATION 5 LAP399/2012	
MERCURY (Hg)	mg/kg (dry weight)	ACID DIGESTION AND COLD VAPOUR AAS METHOD (U.S. EPA 2007:7471 B)	ND	ND	ND	ND	ND	0.100
SILVER (Ag)	mg/kg (dry weight)	ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (U.S. EPA 1996:3050 B AND U.S. EPA 2007:6010 C)	ND	ND	ND	ND	ND	0.500
PCBs	mg/kg (dry weight)	GAS CHROMATOGRAPHIC (ECD) METHOD (U.S. EPA 2007:3550 C AND 8082 A	ND	ND	ND	ND	ND	0.1
TOTAL PETROLEUM HYDROCARBONS	mg/kg (dry weight)	SOXHLET EXTRACTION METHOD (SM 2005:5520 E AND 5520 F)	77.6	13.8	45.8	31.4	100	10
SAMPLE CONDITION			GRAY SOIL	BROWN SOIL	BROWN SOIL	GRAY SOIL	GRAY SOIL	

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21st EDITION, 2005.
ND : NON-DETECTABLE.

Manida Yamyai

(MISS MANIDA YAMYAI)
TECHNICAL MANAGEMENT
OCTOBER 5, 2012

Piyapat S.

(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR
OCTOBER 5, 2012

သီလဝါစက်မှုဇုံအနီးရန်ကုန်မြစ်ကြမ်းပြင်ရှိသဲနုန်းမြေနမူနာများတွင် ပိုးသတ်ဆေးဓါတ်ကြွင်းစစ်ဆေးတွေ့ ရှိချက်

ဓါတ်ခွဲခန်း အမှတ်စဉ်	နမူနာ အမည်	ထွက်ရှိသည့် ဒေသ	ဓါတ်ခွဲစစ်ဆေးသည့် ပိုးသတ်ဆေး ဓါတ်ကြွင်းပမာဏ (PPb)				မှတ်ချက်
			Aldrin	Dieldrin	OP-DDT	PP-DDT	
၁၁၆	သဲနုန်းမြေ (ST 1)	ရန်ကုန်မြစ်ကြမ်းပြင် သီလဝါစက်မှုဇုံအနီး	ND	ND	ND	ND	
၁၁၇	သဲနုန်းမြေ (ST 2)	ရန်ကုန်မြစ်ကြမ်းပြင် သီလဝါစက်မှုဇုံအနီး	25.7490	6.4714	2.2723	3.160	
၁၁၈	သဲနုန်းမြေ (ST 3)	ရန်ကုန်မြစ်ကြမ်းပြင် သီလဝါစက်မှုဇုံအနီး	27.1519	9.9250	5.0185	2.6358	
၁၁၉	သဲနုန်းမြေ (ST 4)	ရန်ကုန်မြစ်ကြမ်းပြင် သီလဝါစက်မှုဇုံအနီး	16.5990	ND	7.2211	5.5721	
၁၂၀	သဲနုန်းမြေ (ST 5)	ရန်ကုန်မြစ်ကြမ်းပြင် သီလဝါစက်မှုဇုံအနီး	18.9988	ND	7.9783	6.0543	

ND = Not Detected (< Limit of Detection 1 PPb)
PPb = Parts Per billion

No. 12-1116-2

7 November 2012

To : Hydrocon Services, (Myanmar) Ltd.

CERTIFICATE OF MEASUREMENT

In accordance with the official Methods for measurement of sediment quality authorized by the Ministry of Environment of Japan, IDEA Consultants, Inc., a Concentration Measurement Certificate Office of Japan, hereby reports and certifies the results as follows.

1. Title	Sediment and water quality analysis	
2. Sample Description		
2.1 Sample Type	Sediment	
2.2 Sampling Location	Yangon River, Myanmar	
2.3 Sampling Date	28 September 2012	
3. Methods of Measurement	Tributyl tin : Endocrine-disrupting-chemicals investigation provisional manual X (Ministry of Environment,1998) Endrin : Manual for Monitoring Survey (Ministry of Environment of Japan)	
4. Objectives	Tributyl tin	Endrin
5. Unit	(μg/kg-dry)	(μg/kg-dry)
St. I	<0.1	<0.0011
St. II	<0.1	0.0032
St. III	<0.1	<0.0011
St. IV	<0.1	<0.0011
St. V	<0.1	<0.0011

IDEA Consultants, Inc.
3-15-1 Komazawa, Setagaya-ku, Tokyo 154-8585, Japan
Tel : +81-3-4544-7609

Photographs of Water and Sediment Quality Survey

Following photographs show sampling locations, sampling methods and equipment for water and sediment quality survey

	
Station 1	**Station 2**
	
Station 3	**Station 4**
	
Station 5	**Survey Boat**

Water Sampling (Surface)

Water Sampling (Bottom)

pH meter, Model pH6011, Taiwan

Salinometer, Sekisui SS 31A, Japan

Oxygen Test kit, Aqua D.O, Thailand

Photographs of Ecosystem Survey Location

Following photographs show ecosystem survey locations

Transect1

Transect2

Transect3

Transect4

Transect5

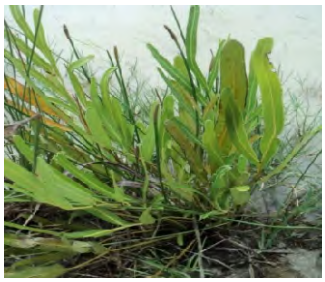
Creek

Photographs of Flora Survey

Following photographs show species which were found during the flora survey

		
Sonneratia caseolaris (L.)Engl	*Aegiceras coniculatum* (L.)Blanco	*Ceriops decandra* (Griff.)Ding Hou
		
Excoecaria agallocha L	*Phoenix paludosa* Roxb	*Crinum* sp.
		
Avicennia marina (Forsk)Vierh.	*Avicennia officinalis* L	*Cyperus exaltatus* Retz
		
Pontederia sp.	*Erythrina* sp.	*Hibiscus tiliaceus* L.
		
Eichhornia crassipes (Mart.)Solms	*Pluchea indica* (L.)Less.	*Clerodendrum inerme* Gaertn

 *Ipomoea* sp.	 *Alocasia macrorrhizos* G.Don	 *Cassytha filiformis* L.
 *Dioscorea sativa* L.	 *Melanthera biflora* (L.) Wild	 *Desmodium triflorum* (L.) DC
 *Fimbristylis ferruginea* Vahl	 *Nypa fruticans* Wurmb	 *Hoya burmanica* Rolfe
 *Cayratia trifolia* (L.) Domin	 *Sesbania paludosa* Roxb.	 *Heliotropium indicum* L.
 *Enhydra fluctuans* Lour.	 *Canavalia cathartica*	 *Luffa aegyptiaca* Mill.

		
Costus speciosus Sm.	*Dalbergia spinosa* Roxb.	*Acanthus ilicifolius* L.
		
Eclipta alba (L.)Hassk	*Mimosa pudica* L.	*Calotropis gigantea* (L.)Dryand.ex W.,T.Aiton
		
Acrostichum speciosum	*Ipomoea* sp.	*Alysicarpus vaginalis* (L.)DC.
		
Tadehagi triquetrum (L.)H.Ohashi	*Senna tora* (L.)Roxb.	*Geissaspis cristata* Wight & Arn.
		
Monochoria hastata Solms	*Melochia corchorifolia* L.	*Albizia lebbek* (L.) Benth.

		
Caesalpinia crista L	*Dolichandrone spathacea* (L. f.) K. Schum.	*Ficus religiosa* L.
		
Polygonum sp.	*Typha angustifolia* Chaub. & Bory	*Derris trifoliata* Lour.
		
Crinum asiaticum L.	*Urena lobata* L.	*Hewittia* sp.
		
Desmodium velutinum (Willd.)DC.	*Ruellia tuberosa* L.	*Sida acuta* Burm.f.
		
Eragrostis tremula Hochst. ex. Steud.	*Lindernia crustacean*	*Borreria distans* (H.B.K.)Cham.& Schlecht.

 *Echinochloa colona* Link.	 *Cynodon dactylon* Pers.	 *Musa* sp.
 *Jussiaea suffruticosa* L	 *Eleocharis dulcis* Trin	 *Schoenoplectus maritinus* L
 *Alternanthera sessilis* (L.)R.Br.	 *Momordica charantia* L	 *Cyperus malaccensis* Lam
 *Eleocharis* sp		

Photographs of Bird Survey

Following photographs show species which were found during the bird survey

	
Lesser Sand-plover and Chinese Pond-heron with breeding plumage	**Painted Stork**

Photographs of Mammal Survey

Following photographs show interview survey situation and species which were found during the mammal survey.

	
Interview Survey	**Interview Survey**
	
Interview Survey	***Bandicota indica***

Photographs of Reptiles and amphibians Survey

Following photographs show species which were found during the reptiles and amphibians survey.

Cerevbrus rhychops Dog-faced Water Snake

Amphiesma stolatum Buff-striped Keelback

Xenochrophis piscator

Chequered Keelback

Ptyas mucosa Indo-chinese Rat Snake

Najakauothia Monocellate Cobra

Bungarus fasciatus Yellow-banded Krait

	
Fejervarya limnocharis Paddy frog	*Fejervarya cf. limnocharis* Paddy frog

Photographs of Fish and Tidal-flat organisms Survey

Following photographs show survey situation and species which were found during the fish and tidal-flat organisms survey.

	
Beach Seine Net	Drift Net
	
Benthos Sampling	Cast Net

Polynemus paradiseus

Setipinna wheeleri

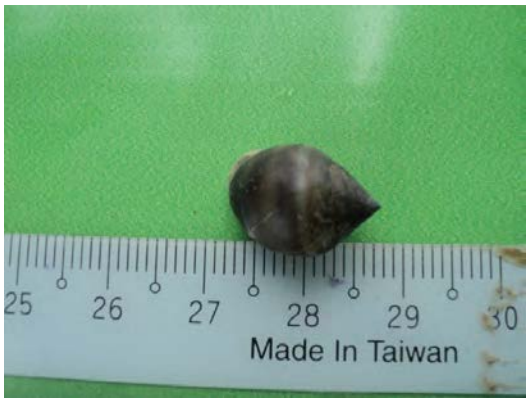
Otolithoides pama

Cynoglossus bilineatus

Cynoglossus lingua

Rhinomugil corsula

 *Silonia silondia*	 *Mystus gulio*
 *Arius burmanicus*	 *Allenbatrachus grunniens*
 *Palaemon* sp	 *Boleophthalmus boddarti* Boddart's goggle-eyed goby

 *Periophthalmus cantonensis* New Guinea mudskipper	 *Uca crassipes*, Fiddler crab
 *Macrophthalmus* sp.	 *Sesarma intermedia*,
 Aquatic snail (gastropod), unidentified	