## 4. Geophysical Prospecting

Electric sounding at 103 exploration spots were carried out from March 1997 to April 1997. The method is Wenner alignment. The maximum electrode interval is 160 m for all the spots. The location of the spots is shown in Figure 4.1 "Location Map of Electric Sounding Spots and Geological Profiles Showing Deepest Resistivity".

The data is given in Data Book. The results of analyses are drawn in the 11 profiles shown in Attachment-1. The core drilling results are also added into the profiles.

The resistivity boundary is shown in the 11 profiles by the long broken line. The resistivity boundaries are much lower than that of the geological boundaries that were known by the core drilling. Therefore, the geological boundaries were finally decided based on the drill logs through the course of interpretation for analysis results. The main causes of the discrepancy of the resistivity boundaries are inferred as follows.

1) The resistivity boundary not always reflects geological boundaries, because the geological boundaries in this area are unconformity. It is prospected that the upper portions of each geological unit such as Alluvium, Pleistocene, Pliocene formations and Bed rock is developed weathering, deteriorating and crack distributing by unconformity. Therefore, the resistivity boundary might be appeared below the geological unconformity boundary until reaching sound conditions.
2) The resitivity value by the analysis show an apparent value. It means that resistivity value is very much affected by the surrounding resistivity values in the shallower or neighboring zones.
3) Limit of analysis for similar resistivity layers and/or analysis error. An interpretation of core drilling data may be more reliable. The detail is described in Chapter 5.

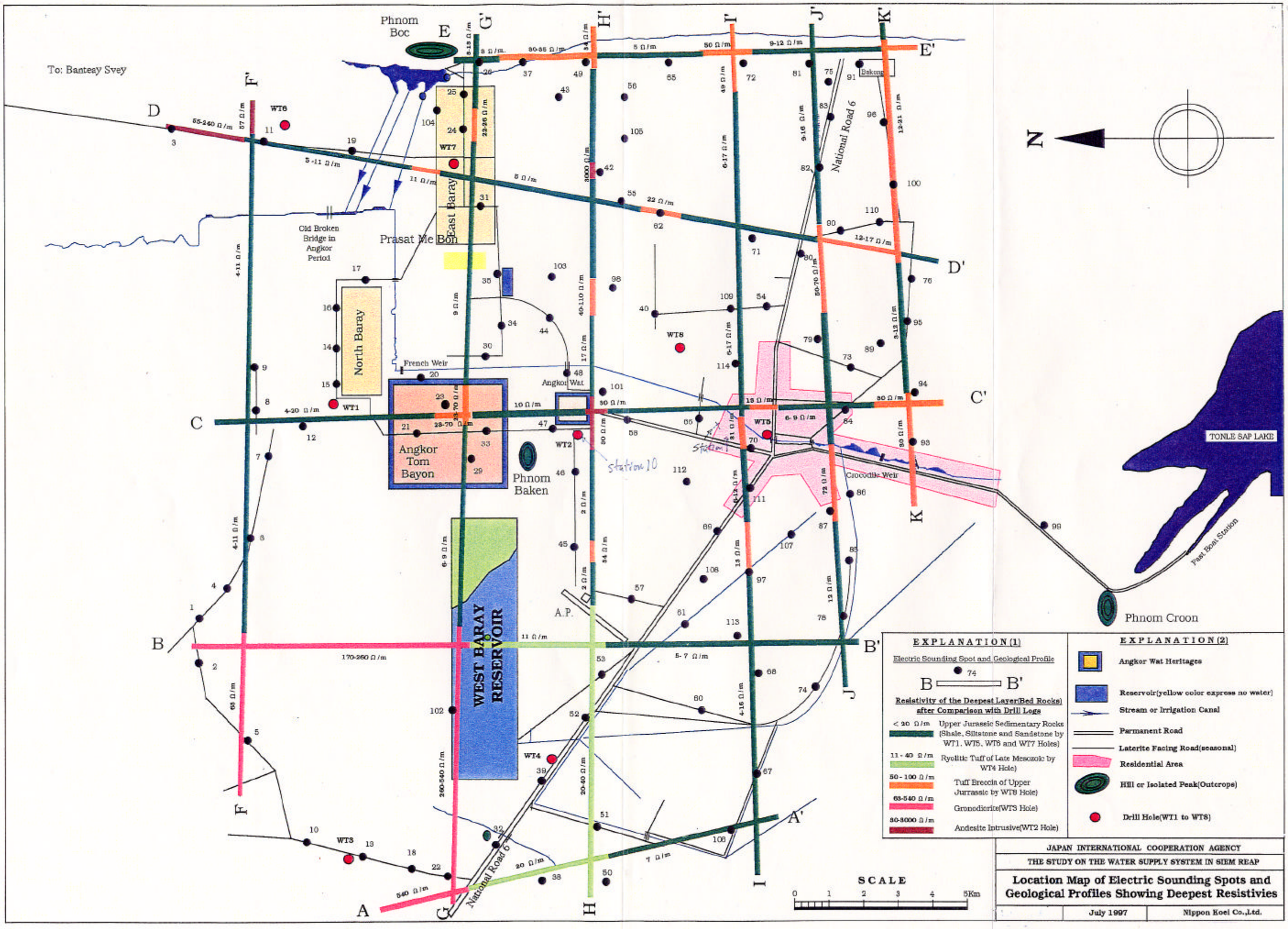


**Figure 4.1 Location Map of Electric Sounding**

## 5. Core Drilling for Geotechnical Investigations

Core drilling at 8 places was carried out as shown in Figure 4.1. Data of drill logs are shown in Attachment-1 for the WT1 to WT8 with the Standard Penetration Test (SPT or N value), electric logging and location of soil sampling point for test.

Geological profile of 10 places in total is arranged by referring the results of core drilling and the electric sounding. As a result, the 4 main geological units were clarified.

1) Alluvium Deposits

The layer is widely developed with the characteristic that coarse to medium sand is in the northeast area, and medium to fine sand is in the south area. Resistivity value reflects the above grain size condition with 50-3,000 ohm/m for the northeast area, and 50-1,100 ohm/m for the south area. Electric logging result of WT1 to WT8 is correlative with the electric sounding. A natural gamma logging of WT1 to WT8 shows that 4-25 cps in the north area and 4-20 cps in the south area. The thickness of the layer is 10-20 m. It becomes thin to the northward in general.

N value of the layer varies place by place. However, the value observed at WT1, WT2 , WT3 and WT8 holes is rather high and widely ranging from 4 to 50. On the other hand, N value of WT4, WT5 and WT7 demonstrates rather smaller values of 2 to 22. It is inferred that the in southwestward, it might become more homogeneous deposits than the northeastward.

Figure 3.1 shows that the layer develops shallower in the north to eastward and deeper in the westward. The deepest parts can be traced near the West Baray. It is a buried valley trending from north to south direction, where the old river course of Siem Reap is located.

2) Pleistocene Deposits

The layer underlying the Alluvial deposits is coarse to medium sand (stone) with boulders in the north ward, and medium to fine sand (stone) with boulders in the south ward. Resistivities were examined by both methods of the electric sounding and logging, also reflect such contrast of the grain size distribution in the layer. Coarse to medium sand (stone) has resistivities ranging from 74 to 1,900 ohm/m. Medium to fine sand (stone) develops in the southward has resistivities of 20 to 400 ohm/m. Natural gamma measurement is 6-20 cps throughout this layer. But no distinguishable contrast is found.

N values of this layer ranges from 16 to 50 and/or more than 50 throughout the layer in all holes. Minimum value is 16 or 18 at WT4, WT7 and so on. Distribution of such small values demonstrates that the layer is composed of various materials from clay to coarse sand. Comparing with the value in alluvial deposits, this layer has 10 to 20 higher values of 10 to 20 than that.

Figure 3.2 shows the bottom of this layer. The map shows that the bottom of this layer is a distinguished hydrogeological boundary judged by pumping test in the wells.

3) Pliocene Formation

The formation is composed of homogeneous and impermeable clay stone. The drilling core sample is mostly cylindric core. Resistivity ranges from 10 to 200 ohm/m by surface sounding, and from 5 to 20 ohm/m by logging. The core sample demonstrates that physical property, mechanical property and electric resistivity value might be uniform throughout this formation, except with the uppermost parts of weathering near boundary.

4) Bed Rock

The bed rock distribution is shown in Figure 3.3 by three dimension. The followings explain each bed rock conditions.

**Shale, sandstone and silt stone**

The rock is dark to reddish brown color. The rock is mostly very hard in fresh condition. However, the top parts near the upper boundary is decomposed or deteriorated to soil condition by weathering. The thickness of the weathered zone ranges from 8 m at WT1 and WT6 (shale), 5 m at WT5, and 3 m at WT7 (sandstone). Resistivity is mostly less than 10 ohm/m and 5 to 20 ohm/m by logging.

**Ryolitic tuff**

The rock is found out by WT4 in the depth from 71.7 to 80 m (hole bottom). Light gray to green color, heavily altered tuff. The surrounding area might be affected by gronodiorite intrusion. Resistivity ranges from 11 to 40 ohm/m, and 20-30 ohm/m by logging.

**Tuff breccia**

Rock appears in the hole WT8 from the depth of 88.5 to 95 m (hole bottom). The rock is greenish to purplish brown tuff breccia with coarse matrix. Resistivity is 12-120 ohm/m, and 5-10 ohm/m by logging. It is prospected that a few zones of tuff breccia develop as shown in Figure 3.3.

**Gronodiorite intrusive**

Based on the facts from core sample of WT3 in the depth of 58 to 80 m (hole bottom), and extremely high resistivities of 63-540 ohm/m in the vicinity of West Baray, the wide distribution of granodiorite is estimated.

**Andesite intrusive**

Andesite intrusives are found from the hole WT2 in the depth of 77 to 95 m (hole bottom), and several electric sounding results. Resistivities vary from 30-3,000 ohm/m place by place.

## 6. Soil Laboratory Test

1) Laboratory Test for the 8 Core drilling in 1997

The result is summarized in Table 6.1 to Table 6.2 "Soil Laboratory Test in 1998-1999".

The elastic deformation coefficient from the unconfined compression result was re-calculated by using the same pressure range of groundwater fluctuation. The estimated deformation coefficient is several to ten times larger value than that of the actual land reversible movements of 1.3 mm by the monitoring. The reason shall be explained as, i) the test was done under the unconfined condition, though the layer is confined, ii) the samples were released a confined stress by taking samples and loosen, and iii) the samples were disturbed in some degree, through the course of hydraulic pressing for sampling purpose.

The actual field records from the monitoring was used for the evaluation of land movement.

# Table 6.1 Summary of Physical Properties (1/2)

| Borehole No | Sample No | Depth(m) from | Depth(m) to | Water Content (%) | Unit Weight (ton/m3) | Liquid Limlt (%) | Plasticity Index (%) | Specific Gravity Gs | Grain Size Analysis(%) Gravel | Coa. | Med. | Sand Fine | Silt | Clay | Undrained Strength(ton/m2) UC | Modulus 50% Cγ (ton/m2) | Colour | USCS | Soil Desciption |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WT-3 | DB-1 | 18.30 | 18.80 | 11.5 | 2.2 | 34.8 | 27.5 | 2.57 | 0 | 0 | 7 | 36 | 57 | | 21.7 | 987 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-3 | DB-2 | 24.00 | 24.50 | 16.0 | 2.1 | 45.6 | 30.8 | 2.52 | 1 | 1 | 2 | 11 | 85 | | 13.0 | 549 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-3 | DB-3 | 27.20 | 27.50 | 12.2 | 2.2 | 35.9 | 22.1 | 2.63 | 0 | 0 | 16 | 47 | 36 | | 6.7 | 1464 | Pale yellowish Brown | CL | Clayey SAND |
| WT-3 | DB-4 | 29.00 | 29.50 | 11.4 | 2.3 | 38.2 | 25.0 | 2.59 | 0 | 0 | 10 | 30 | 60 | | 21.1 | 6012 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-3 | DB-5 | 33.00 | 33.45 | 14.0 | 2.2 | 31.0 | 18.5 | 2.59 | 1 | 0 | 11 | 42 | 47 | | 11.7 | 472 | Pale yellowish Brown | SC | Clayey SAND |
| WT-3 | DB-6 | 36.10 | 36.60 | 15.1 | 2.2 | 40.0 | 27.2 | 2.54 | 0 | 0 | 2 | 30 | 67 | | 19.8 | 1083 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-1 | 9.40 | 9.60 | 16.5 | 2.1 | 40.6 | 21.2 | 2.63 | 3 | 1 | 10 | 29 | 57 | | 6.2 | 579 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-2 | 18.40 | 18.80 | 12.0 | 2.2 | 31.1 | 18.1 | 2.56 | 1 | 0 | 9 | 40 | 51 | | 9.0 | 1389 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-3 | 29.20 | 29.50 | 15.0 | 2.2 | 36.9 | 22.4 | 2.61 | 0 | 0 | 6 | 16 | 77 | | 6.8 | 786 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-4 | 32.50 | 32.95 | 11.4 | 2.3 | 29.4 | 17.3 | 2.54 | 0 | 0 | 7 | 33 | 60 | | 17.8 | 6346 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-5 | 36.75 | 37.00 | 14.9 | 2.1 | 49.3 | 35.0 | 2.59 | 0 | 0 | 2 | 17 | 80 | | 47.4 | 7498 | Grayish Brown | CL | Sandy CLAY |
| WT-4 | DB-6 | 54.60 | 55.00 | 10.9 | 2.2 | 31.2 | 17.8 | 2.62 | 1 | 4 | 4 | 26 | 65 | | 8.6 | 1809 | Yellowish Gray | CL | Sandy CLAY |
| WT-4 | DB-7 | 57.10 | 57.45 | 15.6 | 2.2 | 38.3 | 19.3 | 2.55 | 0 | 0 | 2 | 22 | 75 | | 6.5 | 1284 | Very light Gray | SC | Clayey SAND |
| WT-6 | DB-1 | 7.20 | 7.50 | 11.2 | 2.3 | 24.9 | 11.3 | 2.65 | 0 | 0 | 17 | 42 | 41 | | 3.9 | 297 | Pale yellowish Brown | SC | Clayey SAND |
| WT-6 | DB-2 | 16.20 | 16.60 | 10.9 | 2.3 | 24.2 | 14.5 | 2.58 | 1 | 0 | 19 | 38 | 42 | | 8.9 | 728 | Pale yellowish Brown | SC | Clayey SAND |
| WT-6 | DB-3 | 42.60 | 42.90 | 7.0 | 2.1 | 33.7 | 20.6 | 2.55 | 1 | 0 | 10 | 35 | 55 | | 39.6 | 9253 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-6 | DB-4 | 56.50 | 56.88 | 26.7 | 2.0 | 58.0 | 27.6 | 2.66 | 0 | 0 | 1 | 1 | 98 | | 8.1 | 902 | Grayish Brown | CH | Sandy CLAY |
| WT-7 | DB-1 | 13.60 | 14.00 | 12.1 | 2.3 | 27.3 | 16.5 | 2.56 | 0 | 0 | 18 | 43 | 38 | | 7.0 | 744 | Very light Gray | SC | Clayey SAND |
| WT-7 | DB-2 | 19.00 | 19.60 | 12.8 | 2.3 | 27.8 | 17.0 | 2.56 | 1 | 0 | 12 | 42 | 45 | | 13.2 | 305 | Very light Gray | SC | Clayey SAND |
| WT-7 | DB-3 | 23.00 | 23.40 | 14.0 | 2.2 | 33.3 | 18.8 | 2.62 | 0 | 0 | 11 | 48 | 41 | | 10.8 | 346 | Very light Gray | SC | Clayey SAND |
| WT-7 | DB-4 | 27.15 | 27.50 | 11.1 | 2.2 | 29.7 | 19.9 | 2.58 | 0 | 0 | 10 | 40 | 50 | | 11.3 | 2911 | Very light Gray | SC | Clayey SAND |
| WT-7 | DB-5 | 35.50 | 35.80 | 13.1 | 2.2 | 40.9 | 27.5 | 2.63 | 1 | 1 | 9 | 26 | 63 | | 21.2 | 438 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-7 | DB-6 | 46.20 | 46.75 | 11.5 | 2.3 | 35.5 | 22.2 | 2.60 | 0 | 0 | 9 | 35 | 56 | | 38.6 | 668 | Pale yellowish Brown | CL | Sandy CLAY |
| WT-7 | DB-7 | 48.25 | 48.50 | 10.8 | 2.3 | 33.7 | 20.8 | 2.60 | 1 | 0 | 9 | 32 | 59 | | 45.2 | 890 | Pale yellowish Brown | CL | Sandy CLAY |

# Table 6.1 Summary of Physical Properties (2/2)

| Borehole No | Sample No | Depth(m) from | Depth(m) to | Water Content (%) | Unit Weight (ton/m3) | Liquid Limit (%) | Plasticity Index (%) | Specific Gravity Gs | Grain Size Analysis(%) Gravel Coa. | Gravel Med. | Sand Fine | Silt | Clay | Undrained Strength(ton/m2) UC | Modulus 50% Cγ (ton/m2) | Colour | USCS | Soil Desciption |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WT-1 | DB-1 | 21.70 | 22.00 | 7.7 | 2.02 | NP | NP | 2.57 | 0 | 1 | 12 | 46 | 41 | + | + | Pale Yellowish Brown | SM | Silty Sand |
| WT-1 | DB-2 | 23.00 | 23.60 | 4.0 | 1.91 | NP | NP | 2.63 | 0 | 0 | 11 | 51 | 37 | 1.5 | 3.35 | Pale Yellowish Brown | SM | Silty Sand |
| WT-1 | DB-3 | 44.40 | 44.70 | 8.6 | - | - | - | 2.63 | 0 | 1 | 5 | 33 | 61 | - | - | Pale Yellowish Brown | C | Sandy Clay |
| WT-1 | DB-4 | 46.00 | 46.30 | 9.4 | 2.20 | 40.5 | 27.9 | 2.64 | 1 | 1 | 8 | 33 | 56 | 4.3 | 772 | Pale Yellowish Brown | CL | Sandy Clay |
| WT-1 | DB-5 | 49.50 | 50.00 | 7.7 | 2.28 | 39.6 | 29.0 | 2.63 | 0 | 0 | 7 | 34 | 59 | 4.9 | 1477 | Grayish Pink | CL | Sandy Clay |
| WT-1 | DB-6 | 54.30 | 54.70 | 8.9 | 2.21 | 33.4 | 24.5 | 2.62 | 0 | 0 | 5 | 45 | 50 | 6.7 | 387 | Pale Yellowish Brown | CL | Sandy Clay |
| WT-1 | DB-7 | 62.00 | 62.30 | 8.4 | 2.21 | 27.6 | 17.0 | 2.65 | 0 | 0 | 3 | 27 | 70 | 4.9 | 1187 | Grayish Brown | CL | Sandy Clay |
| WT-2 | DB-1 | 6.85 | 7.00 | 13.1 | 2.15 | 33.4 | 20.2 | 2.57 | 0 | 1 | 15 | 38 | 45 | + | + | Grayish Brown | SC | Clayey Sand |
| WT-2 | DB-2 | 15.85 | 16.00 | 1.2 | - | 21.8 | 13.0 | 2.55 | 0 | 0 | 16 | 51 | 32 | - | - | Pale yellowish Brown | SC | Clayey Sand |
| WT-2 | DB-3 | 25.50 | 25.85 | 8.9 | 2.13 | 26.7 | 15.1 | 2.65 | 0 | 0 | 13 | 42 | 45 | 1.0 | 896 | Very light Gray | SC | Clayey Sand |
| WT-2 | DB-4 | 36.70 | 37.00 | 8.5 | 2.15 | 28.0 | 16.7 | 2.51 | 0 | 0 | 12 | 43 | 45 | 3.3 | 317 | Very light Gray | SC | Clayey Sand |
| WT-2 | DB-5 | 41.70 | 41.90 | 6.5 | 2.18 | 27.8 | 17.5 | 2.69 | 0 | 0 | 8 | 32 | 60 | 4.9 | 994 | Pale Yellowish Brown | CL | Sandy Clay |
| WT-2 | DB-6 | 48.15 | 48.60 | 7.9 | 2.24 | 33.7 | 17.6 | 2.58 | 0 | 0 | 5 | 18 | 77 | 5.8 | 2045 | Pale Yellowish Brown | CL | Silty CLAY With Sand |
| WT-2 | DB-7 | 50.20 | 50.55 | 9.4 | 2.28 | 34.9 | 21.6 | 2.58 | 0 | 0 | 7 | 34 | 59 | 7.2 | 1218 | Grayish Brown | CL | Sandy CLAY |
| WT-2 | DB-8 | 53.10 | 53.40 | 13.3 | - | 42.2 | 23.3 | 2.65 | 49 | 10 | 7 | 9 | 25 | - | - | Grayish Brown | GC | Clayey Gravel With Sand |
| WT-2 | DB-9 | 63.10 | 63.55 | 11.8 | 2.04 | 40.5 | 21.6 | 2.54 | 0 | 0 | 1 | 11 | 88 | 4.8 | 457 | Yellowish Gray | CL | Silty CLAY |
| WT-2 | DB-10 | 70.70 | 70.90 | 7.9 | 2.18 | 29.1 | 15.1 | 2.58 | 0 | 0 | 24 | 47 | 28 | + | + | Pale Yellowish Brown | SC | Clayey SAND |
| WT-2 | DB-11 | 75.00 | 75.40 | 11.6 | 1.99 | 66.3 | 42.8 | 2.53 | 36 | 3 | 3 | 5 | 52 | 2.6 | 466 | Grayish Brown | CH | Silty CLAY |
| WT-5 | DB-1 | 14.00 | 14.50 | 9.6 | 2.19 | 35.9 | 23.6 | 2.59 | 0 | 2 | 11 | 35 | 51 | 3.1 | 447 | Pale Yellowish Brown | CL | Sandy CLAY |
| WT-5 | DB-2 | 35.60 | 35.80 | 11.7 | - | 35.9 | 22.0 | 2.62 | 0 | 0 | 14 | 41 | 46 | - | - | Grayish Brown | SC | Sandy CLAY |
| WT-5 | DB-3 | 46.70 | 47.00 | 6.4 | 2.22 | 38.5 | 27.6 | 2.64 | 0 | 0 | 2 | 38 | 60 | 7.6 | 1142 | Pale Yellowish Brown | CL | Sandy CLAY |
| WT-5 | DB-4 | 53.60 | 53.90 | 9.3 | 2.27 | 21.8 | 13.4 | 2.61 | 1 | 3 | 7 | 36 | 53 | + | + | Very light Gray | CL | Sandy CLAY |
| WT-5 | DB-5 | 58-50 | 59.00 | 8.0 | 2.28 | 36.4 | 25.8 | 2.61 | 0 | 0 | 5 | 29 | 67 | 7.0 | 1392 | Pale Yellowish Brown | CL | Sandy CLAY |
| WT-5 | DB-6 | 67.00 | 67.50 | 5.3 | - | 40.3 | 28.0 | 2.61 | 0 | 0 | 2 | 28 | 71 | - | - | Pale Yellowish Brown | CL | Sandy CLAY |
| WT-5 | DB-7 | 78.40 | 78.80 | 10.0 | 2.13 | 27.5 | 15.5 | 2.68 | 0 | 0 | 12 | 56 | 31 | + | + | Pale Brown | CL | Clayey SAND |
| WT-8 | DB-1 | 9.40 | 9.80 | 9.0 | 2.13 | 30.9 | 17.3 | 2.65 | 0 | 2 | 18 | 43 | 38 | + | + | Pale Yellowish Brown | SC | Clayey SAND |
| WT-8 | DB-2 | 18.40 | 18.70 | 9.6 | - | - | - | 2.62 | 0 | 1 | 12 | 48 | 39 | - | - | Pale Yellowish Brown | SM | Silty CLAY |
| WT-8 | DB-3 | 45.50 | 45.90 | 8.0 | 2.23 | 35.3 | 21.5 | 2.64 | 0 | 0 | 16 | 39 | 45 | 5.9 | 923 | Pale Yellowish Brown | SC | Clayey SAND |
| WT-8 | DB-4 | 53.05 | 53.35 | 8.4 | 2.19 | 40.0 | 25.0 | 2.62 | 0 | 0 | 3 | 23 | 73 | 5.8 | 1106 | Yellowish Gray | CL | Silty CLAY With Sand |
| WT-8 | DB-5 | 59.60 | 59.90 | 8.2 | - | 45.5 | 27.7 | 2.69 | 4 | 2 | 8 | 25 | 62 | - | - | Dark Yellowish Brown | CL | Sandy CLAY |
| WT-8 | DB-6 | 80.00 | 80.40 | 10.7 | 2.26 | 36.3 | 21.6 | 2.65 | 0 | 0 | 3 | 19 | 78 | 5.7 | 1060 | Pale Yellowish Brown | CL | Silty CLAY With Sand |
| WT-8 | DB-7 | 84.50 | 84.75 | 5.9 | 2.10 | NP | NP | 2.61 | 0 | 1 | 36 | 29 | 35 | + | + | Grayish Brown | SM | Silty SAND |

**Note** : (*) ; Insufficient Soil for testing
: (+) ; Sample Highly Disturbed

# Table 6.2 Soil Laboratory Test in 1998-1999(1/2)

| Hole No | Sample No | Depth (m) | E50 including plasticity creep area (ton/m2) | E50 in Elastic area (ton/m2) | Poisson's Ratio | Coefficient of Volume Compressibility (m2/kg) | Thickness (m) | Drawdown (m) | Specific Weight of Water (kg/m3) | Settlement (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| WT-3 | DB-2B | 20.40-20.50 | 489 | 1525 | 0.3 | 4.87E-07 | 5 | 2.300 | 1000 | 5.60 |
| WT-3 | DB-3 | 27.20-27.50 | 1464 | 3250 | 0.3 | 2.29E-07 | 5 | 2.300 | 1000 | 2.63 |
| WT-3 | DB-4A | 29.00-29.50 | 174 | 5700 | 0.3 | 1.30E-07 | 5 | 2.300 | 1000 | 1.50 |
| WT-3 | DB-4B | 29.00-29.50 | 8177 | 11450 | 0.3 | 6.49E-08 | 5 | 2.300 | 1000 | 0.75 |
| WT-3 | DB-5A | 33.00-33.45 | 472 | 850 | 0.3 | 8.74E-07 | 5 | 2.300 | 1000 | 10.05 |
| WT-3 | DB-5B | 33.00-33.45 | 396 | 867 | 0.3 | 8.57E-07 | 5 | 2.300 | 1000 | 9.85 |
| WT-3 | DB-6A | 36.10-36.60 | 1015 | 1577 | 0.3 | 4.71E-07 | 5 | 2.300 | 1000 | 5.42 |
| WT-3 | DB-6B | 36.10-36.60 | 1150 | 19400 | 0.3 | 3.83E-08 | 5 | 2.300 | 1000 | 0.44 |
| WT-4 | DB-1 | 9.40-9.60 | 579 | 1367 | 0.3 | 5.43E-07 | 5 | 2.300 | 1000 | 6.25 |
| WT-4 | DB-2A | 18.40-18.80 | 1463 | 2225 | 0.3 | 3.34E-07 | 5 | 2.300 | 1000 | 3.84 |
| WT-4 | DB-2B | 18.40-18.80 | 1314 | 2308 | 0.3 | 3.22E-07 | 5 | 2.300 | 1000 | 3.70 |
| WT-4 | DB-3 | 29.20-29.50 | 786 | 1427 | 0.3 | 5.21E-07 | 5 | 2.300 | 1000 | 5.99 |
| WT-4 | DB-4A | 32.50-32.95 | 8138 | 16250 | 0.3 | 4.57E-08 | 5 | 2.300 | 1000 | 0.53 |
| WT-4 | DB-4B | 32.50-32.95 | 4553 | 7619 | 0.3 | 9.75E-08 | 5 | 2.300 | 1000 | 1.12 |
| WT-4 | DB-5 | 36.75-37.00 | 7498 | 23095 | 0.3 | 3.22E-08 | 5 | 2.300 | 1000 | 0.37 |
| WT-4 | DB-6A | 54.60-55.00 | 2224 | 3926 | 0.3 | 1.89E-07 | 5 | 2.300 | 1000 | 2.18 |
| WT-4 | DB-6B | 54.60-55.00 | 1393 | 1675 | 0.3 | 4.43E-07 | 5 | 2.300 | 1000 | 5.10 |
| WT-4 | DB-7A | 57.10-57.45 | 1154 | 1541 | 0.3 | 4.82E-07 | 5 | 2.300 | 1000 | 5.54 |
| WT-4 | DB-7B | 57.10-57.45 | 1414 | 1414 | 0.3 | 5.25E-07 | 5 | 2.300 | 1000 | 6.04 |
| WT-5 | DB-1 | 14.00-14.50 | 447 | 618 | 0.3 | 1.20E-06 | 5 | 2.300 | 1000 | 13.82 |
| WT-5 | DB-3A | 46.70-47.00 | 1225 | 2286 | 0.3 | 3.25E-07 | 5 | 2.300 | 1000 | 3.74 |
| WT-5 | DB-3B | 46.70-47.00 | 1059 | 1259 | 0.3 | 5.90E-07 | 5 | 2.300 | 1000 | 6.79 |
| WT-5 | DB-4 | 53.60-53.90 | 156 | 1864 | 0.3 | 3.99E-07 | 5 | 2.300 | 1000 | 4.58 |
| WT-5 | DB-5A | 58.50-59.00 | 1819 | 1921 | 0.3 | 3.87E-07 | 5 | 2.300 | 1000 | 4.45 |

# Table 6.2 Soil Laboratory Test in 1998-1999(2/2)

| Hole No | Sample No | Depth (m) | E50 including plasticity creep area (ton/m2) | E50 in Elastic area (ton/m2) | Poisson's Ratio | Coefficient of Volume Compressibility (m2/kg) | Thickness (m) | Drawdown (m) | Specific Weight of Water (kg/m3) | Settlement (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| WT-7 | DB-2B | 19.00-19.60 | 428 | 1625 | 0.3 | 4.57E-07 | 5 | 2.300 | 1000 | 5.26 |
| WT-7 | DB-3 | 23.00-23.40 | 346 | 771 | 0.3 | 9.63E-07 | 5 | 2.300 | 1000 | 11.08 |
| WT-7 | DB-4A | 27.15-27.50 | 2411 | 7667 | 0.3 | 9.69E-08 | 5 | 2.300 | 1000 | 1.11 |
| WT-7 | DB-4B | 27.15-27.50 | 3411 | 7400 | 0.3 | 1.00E-07 | 5 | 2.300 | 1000 | 1.15 |
| WT-7 | DB-5A | 35.50-35.80 | 401 | 1663 | 0.3 | 4.47E-07 | 5 | 2.300 | 1000 | 5.14 |
| WT-7 | DB-5B | 35.50-35.80 | 475 | 1813 | 0.3 | 4.10E-07 | 5 | 2.300 | 1000 | 4.71 |
| WT-7 | DB-6A | 46.20-46.75 | 618 | 1115 | 0.3 | 6.66E-07 | 5 | 2.300 | 1000 | 7.66 |
| WT-7 | DB-6B | 46.20-46.75 | 718 | 1905 | 0.3 | 3.90E-07 | 5 | 2.300 | 1000 | 4.48 |
| *WT-7* | *DB-7* | *48.25-48.50* | *890* | *1500* | *0.3* | *4.95E-07* | 5 | 2.300 | *1000* | *5.70* |
| WT-8 | DB-1 | 9.40-9.80 | 362 | 383 | 0.3 | 1.94E-06 | 5 | 2.300 | 1000 | 22.31 |
| WT-8 | DB-3A | 45.50-45.90 | 918 | 923 | 0.3 | 8.05E-07 | 5 | 2.300 | 1000 | 9.26 |
| WT-8 | DB-3B | 45.50-45.90 | 927 | 927 | 0.3 | 8.01E-07 | 5 | 2.300 | 1000 | 9.22 |
| WT-8 | DB-4A | 53.05-53.35 | 1220 | 1771 | 0.3 | 4.19E-07 | 5 | 2.300 | 1000 | 4.82 |
| WT-8 | DB-4B | 53.05-53.35 | 992 | 1149 | 0.3 | 6.47E-07 | 5 | 2.300 | 1000 | 7.44 |
| WT-8 | DB-6 | 80.00-80.40 | 1060 | 1096 | 0.3 | 6.78E-07 | 5 | 2.300 | 1000 | 7.79 |
| WT-8 | DB-7 | 84.50-84.75 | 332 | 453 | 0.3 | 1.64E-06 | 5 | 2.300 | 1000 | 18.86 |

2) Additional 6 Consolidation Tests from the Surface Soil in 1998

Six additional consolidation tests were carried out in February 1998 because no soil sample was available to apply consolidation test from core drilling of that the former investigation stage. The 6 samples were taken by hand from the top artificial reclamation layer as shown in Figure 6.1. The test result is almost same as the Banteai Kdei conservation team. The results are shown in Table 6.3.

The calculation of deformation value was used a coefficient of volume compressibility (Mv). It is also same as the unconfined compression result as shown in Table 6.3. The 6 samples were collected from paddy field or clayey top soil by hand. Because the result is not likely representative underground condition, the actual field records from the monitoring were applied for the evaluation of land movement.

The monitoring records of land movement of LTb (In front of Angkor Wat) is compiled in Annex 3.4.1 “Hydrogeology”. The evaluation result of the influence to the Angkor Wat by the ground water exploitation is mentioned in Main Report, Chapter 4.2.4 “Groundwater”.

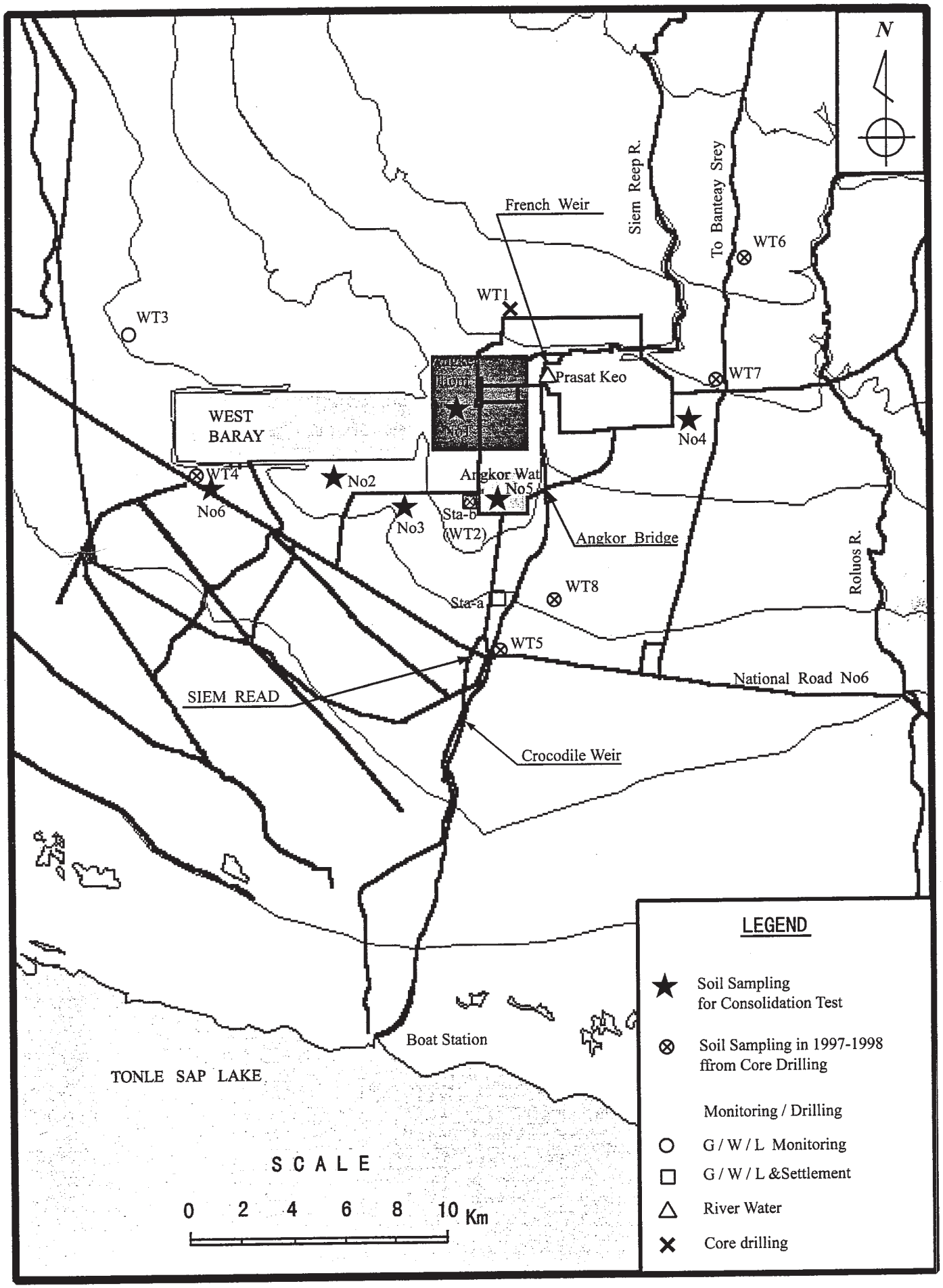


**Figure 6.1 Location Map of Soil Sampling for Consolidation Test**

# Table 6.3 Consolidation Test Results (1/3)

Location: Bayon Well No.87 Sample No. 1

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consolidation (d) cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | 0.0170 | | 18.992 | 0.0895 | 0.00639 | 6.394E-07 | 2.0 | 1.0 | 1000 | 0.00128 | 1.28 |
| 1 | 0.14 | | | 18.983 | | | | | | | | | |
| | | 0.12 | 0.0410 | | 18.963 | 0.2162 | 0.01802 | 1.802E-06 | 2.0 | 1.0 | 1000 | 0.00360 | 3.60 |
| 2 | 0.26 | | | 18.942 | | | | | | | | | |
| | | 0.25 | 0.1100 | | 18.887 | 0.5824 | 0.02330 | 2.330E-06 | 2.0 | 1.0 | 1000 | 0.00466 | 4.66 |
| 3 | 0.51 | | | 18.832 | | | | | | | | | |
| | | 0.51 | 0.2880 | | 18.688 | 1.5411 | 0.03022 | 3.022E-06 | 2.0 | 1.0 | 1000 | 0.00604 | 6.04 |
| 4 | 1.02 | | | 18.544 | | | | | | | | | |
| | | 1.00 | 0.2960 | | 18.396 | 1.6090 | 0.01609 | 1.609E-06 | 2.0 | 1.0 | 1000 | 0.00322 | 3.22 |
| 5 | 2.02 | | | 18.248 | | | | | | | | | |
| | | 2.02 | 0.3140 | | 18.091 | 1.7357 | 0.00859 | 8.592E-07 | 2.0 | 1.0 | 1000 | 0.00172 | 1.72 |
| 6 | 4.04 | | | 17.934 | | | | | | | | | |
| | | -3.02 | -0.0240 | | 17.946 | | | | | | | | |
| 7 | 1.02 | | | 17.958 | | | | | | | | | |
| | | -0.76 | -0.0210 | | 17.969 | | | | | | | | |
| 8 | 0.26 | | | 17.979 | | | | | | | | | |

Location: Bayon Well No.87 Sample No. 2

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consolidation (d) cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | -0.057 | | 19.029 | -0.2996 | -0.02140 | | 0.5 | 1.0 | 1000 | 0.00000 | 0.00 |
| 1 | 0.14 | | | 19.057 | | | | | | | | | |
| | | 0.12 | 0.012 | | 19.051 | 0.0630 | 0.00525 | 5.249E-07 | 0.5 | 1.0 | 1000 | 0.00026 | 0.26 |
| 2 | 0.26 | | | 19.045 | | | | | | | | | |
| | | 0.25 | 0.016 | | 19.037 | 0.0840 | 0.00336 | 3.362E-07 | 0.5 | 1.0 | 1000 | 0.00017 | 0.17 |
| 3 | 0.51 | | | 19.029 | | | | | | | | | |
| | | 0.51 | 0.023 | | 19.018 | 0.1209 | 0.00237 | 2.371E-07 | 0.5 | 1.0 | 1000 | 0.00012 | 0.12 |
| 4 | 1.02 | | | 19.006 | | | | | | | | | |
| | | 1 | 0.03 | | 18.991 | 0.1580 | 0.00158 | 1.580E-07 | 0.5 | 1.0 | 1000 | 0.00008 | 0.08 |
| 5 | 2.02 | | | 18.976 | | | | | | | | | |
| | | 2.02 | 0.03 | | 18.961 | 0.1582 | 0.00078 | 7.833E-08 | 0.5 | 1.0 | 1000 | 0.00004 | 0.04 |
| 6 | 4.04 | | | 18.946 | | | | | | | | | |
| | | -3.02 | -0.009 | | 18.951 | | | | | | | | |
| 7 | 1.02 | | | 18.955 | | | | | | | | | |
| | | -0.76 | -0.015 | | 18.963 | | | | | | | | |
| 8 | 0.26 | | | 18.970 | | | | | | | | | |

## Table 6.3 Consolidation Test Results (2/3)

Location: West of Angkor Wat(3k Sample No.: 3

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consoli-dation (d cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | -0.083 | | 19.042 | -0.4359 | -0.03114 | | 0.5 | 1.0 | 1000 | 0.00000 | 0.00 |
| 1 | 0.14 | | | 19.083 | | | | | | | | | |
| | | 0.12 | 0.056 | | 19.055 | 0.2939 | 0.02449 | 2.449E-06 | 0.5 | 1.0 | 1000 | 0.00122 | 1.22 |
| 2 | 0.26 | | | 19.027 | | | | | | | | | |
| | | 0.25 | 0.054 | | 19.000 | 0.2842 | 0.01137 | 1.137E-06 | 0.5 | 1.0 | 1000 | 0.00057 | 0.57 |
| 3 | 0.51 | | | 18.973 | | | | | | | | | |
| | | 0.51 | 0.096 | | 18.925 | 0.5073 | 0.00995 | 9.946E-07 | 0.5 | 1.0 | 1000 | 0.00050 | 0.50 |
| 4 | 1.02 | | | 18.877 | | | | | | | | | |
| | | 1.00 | 0.174 | | 18.790 | 0.9260 | 0.00926 | 9.260E-07 | 0.5 | 1.0 | 1000 | 0.00046 | 0.46 |
| 5 | 2.02 | | | 18.703 | | | | | | | | | |
| | | 2.02 | 0.422 | | 18.492 | 2.2821 | 0.01130 | 1.130E-06 | 0.5 | 1.0 | 1000 | 0.00056 | 0.56 |
| 6 | 4.04 | | | 18.281 | | | | | | | | | |
| | | -3.02 | 0.01 | | 18.276 | | | | | | | | |
| 7 | 1.02 | | | 18.271 | | | | | | | | | |
| | | -0.76 | -0.029 | | 18.970 | | | | | | | | |
| 8 | 0.26 | | | 18.300 | | | | | | | | | |

Location: West of Angkor Wat(3k Sample No.: 4

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consoli-dation (d cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | -0.05 | | 19.025 | -0.2628 | -0.01877 | | 1.0 | 1.0 | 1000 | 0.00000 | 0.00 |
| 1 | 0.14 | | | 19.050 | | | | | | | | | |
| | | 0.12 | 0.051 | | 19.025 | 0.2681 | 0.02234 | 2.234E-06 | 1.0 | 1.0 | 1000 | 0.00223 | 2.23 |
| 2 | 0.26 | | | 18.999 | | | | | | | | | |
| | | 0.25 | 0.039 | | 18.980 | 0.2055 | 0.00822 | 8.219E-07 | 1.0 | 1.0 | 1000 | 0.00082 | 0.82 |
| 3 | 0.51 | | | 18.960 | | | | | | | | | |
| | | 0.51 | 0.071 | | 18.925 | 0.3752 | 0.00736 | 7.356E-07 | 1.0 | 1.0 | 1000 | 0.00074 | 0.74 |
| 4 | 1.02 | | | 18.889 | | | | | | | | | |
| | | 1.00 | 0.109 | | 18.835 | 0.5787 | 0.00579 | 5.787E-07 | 1.0 | 1.0 | 1000 | 0.00058 | 0.58 |
| 5 | 2.02 | | | 18.780 | | | | | | | | | |
| | | 2.02 | 0.228 | | 18.666 | 1.2215 | 0.00605 | 6.047E-07 | 1.0 | 1.0 | 1000 | 0.00060 | 0.60 |
| 6 | 4.04 | | | 18.552 | | | | | | | | | |
| | | -3.02 | -0.318 | | 18.711 | | | | | | | | |
| 7 | 1.02 | | | 18.870 | | | | | | | | | |
| | | -0.76 | 0.182 | | 18.779 | | | | | | | | |
| 8 | 0.26 | | | 18.688 | | | | | | | | | |

## Table 6.3 Consolidation Test Results (3/3)

Location: WT4 Sample No.: 5

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consolidation (d) cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | -0.065 | | 19.033 | -0.3415 | -0.02439 | | 1.0 | 1.0 | 1000 | 0.00000 | 0.00 |
| 1 | 0.14 | | | 19.065 | | | | | | | | | |
| | | 0.12 | 0.065 | | 19.033 | 0.3415 | 0.02846 | 2.846E-06 | 1.0 | 1.0 | 1000 | 0.00285 | 2.85 |
| 2 | 0.26 | | | 19.000 | | | | | | | | | |
| | | 0.25 | 0.08 | | 18.960 | 0.4219 | 0.01688 | 1.688E-06 | 1.0 | 1.0 | 1000 | 0.00169 | 1.69 |
| 3 | 0.51 | | | 18.920 | | | | | | | | | |
| | | 0.51 | 0.109 | | 18.866 | 0.5778 | 0.01133 | 1.133E-06 | 1.0 | 1.0 | 1000 | 0.00113 | 1.13 |
| 4 | 1.02 | | | 18.811 | | | | | | | | | |
| | | 1.00 | 0.129 | | 18.747 | 0.6881 | 0.00688 | 6.881E-07 | 1.0 | 1.0 | 1000 | 0.00069 | 0.69 |
| 5 | 2.02 | | | 18.682 | | | | | | | | | |
| | | 2.02 | 0.175 | | 18.595 | 0.9411 | 0.00466 | 4.659E-07 | 1.0 | 1.0 | 1000 | 0.00047 | 0.47 |
| 6 | 4.04 | | | 18.507 | | | | | | | | | |
| | | -3.02 | -0.017 | | 18.516 | | | | | | | | |
| 7 | 1.02 | | | 18.524 | | | | | | | | | |
| | | -0.76 | -0.04 | | 18.544 | | | | | | | | |
| 8 | 0.26 | | | 18.564 | | | | | | | | | |

Location: WT4 Sample No.: 6

| Weight level | Vertical Stress (P) kg/cm² | (dp) kg/cm² | Consolidation (d) cm | Sample hight(h) cm | Average hight(h) cm | Compression Strain dε % | Coefficiet of volume compressibility(mv) cm²/kg | m²/kg | Thickness of layer m | Drawdown of groundwater m | Density of water (kg/m³) | Consolidation settlement m | mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | | 19.000 | | | | | | | | | |
| | | 0.14 | -0.026 | | 19.013 | -0.1367 | -0.00977 | | 0.5 | 1.0 | 1000 | | |
| 1 | 0.14 | | | 19.026 | | | | | | | | | |
| | | 0.12 | 0.021 | | 19.016 | 0.1104 | 0.00920 | 9.203E-07 | 0.5 | 1.0 | 1000 | 0.00046 | 0.46 |
| 2 | 0.26 | | | 19.005 | | | | | | | | | |
| | | 0.25 | 0.04 | | 18.985 | 0.2107 | 0.00843 | 8.428E-07 | 0.5 | 1.0 | 1000 | 0.00042 | 0.42 |
| 3 | 0.51 | | | 18.965 | | | | | | | | | |
| | | 0.51 | 0.045 | | 18.943 | 0.2376 | 0.00466 | 4.658E-07 | 0.5 | 1.0 | 1000 | 0.00023 | 0.23 |
| 4 | 1.02 | | | 18.920 | | | | | | | | | |
| | | 1.00 | 0.044 | | 18.898 | 0.2328 | 0.00233 | 2.328E-07 | 0.5 | 1.0 | 1000 | 0.00012 | 0.12 |
| 5 | 2.02 | | | 18.876 | | | | | | | | | |
| | | 2.02 | 0.047 | | 18.853 | 0.2493 | 0.00123 | 1.234E-07 | 0.5 | 1.0 | 1000 | 0.00006 | 0.06 |
| 6 | 4.04 | | | 18.829 | | | | | | | | | |
| | | -3.02 | 0 | | 18.829 | | | | | | | | |
| 7 | 1.02 | | | 18.829 | | | | | | | | | |
| | | -0.76 | -0.02 | | 18.839 | | | | | | | | |
| 8 | 0.26 | | | 18.849 | | | | | | | | | |