Appendix-2

GEOTECHNICAL INVESTIAGTION

APPENDIX – 2 GEOTECHNICAL INVESTIAGTION

1. SCOPE OF WORKS

The Work comprises following schedule:

Schedule 1.1: Mechanical Boring
Schedule 1.2: In-situ Test
Schedule 1.3: Laboratory Test

1.1 MECHANICAL BORING

(1) Location of boreholes and drilling depth
Five (5) numbers of boring in total will be conducted at the proposed sites: 3 boreholes for vertical shafts and 2 boreholes for WWTP. Table below summarizes the required depth of borehole to dig at each site.

Location	Site	Number of boreholes	Borehole Depth required	Remarks
Vertical Shafts	Three points near the WWTP site	3	One borehole approx. 70m and two boreholes approx. 50m each until baring layer	One borehole at A: 70 m, two boreholes at B and C: 50m each
WWTP	Pluit	2	Approx. 50m each until baring layer	Two boreholes in Figure 3
Total	—	5	270 m	

(2) Preparation
In advance to setting up the boring machine on each borehole, the Contractor shall investigate the drilling points and the ground elevation which shall be taken in relation to reference points designated by the client.

(3) Drilling Method
A drilling machine shall be specified on engine driven rotary type with the drilling capacity of more than seventy (70) meters vertical depth with 66 mm or 99 mm hole diameters through hard layer. The Contractor shall pay attention not to deviate from true vertical and to maintain the wall of a drilling hole as smooth as possible, avoiding cavitation due to flushing water and collapse of a drill hole. The static ground water level shall be recorded for each borehole.

(4) Ground water level
Ground water level shall be searched in each borehole.

1.2 IN-SITU TEST AND SAMPLING

(1) Standard Penetration Tests

1) Frequency
A standard penetration test shall be executed in one (1) meter intervals at each borehole.

2) Test Method
A standard penetration test shall be carried out by using a hammer which is the weight of 63.5 kg.

Equipment and test method for standard penetration test shall be specified by U.S. Bureau of Reclamation in Earth Manual or equivalent.

(2) In-situ Permeability Test

In-situ permeability test shall be conducted at five (5) boreholes or excavated pits: three (3) tests at the vertical shaft construction site locations and two (2) tests at the WWTP construction site in accordance with the ASTM D5126 or other equivalent standards.

The test shall be conducted at the following depth for each borehole; first test at between 3 and 5 m, the second test at about 20m, the third test at between 26 and 27 m, the fourth test at about 40 m, and the fifth (last) test at between 45 and 47m.

(3) Sampling

1) Disturbed Samples

Disturbed samples shall be taken from changing soil layers by using a sampler for standard penetration test at least 4 samples at each borehole for vertical shafts and at least 3 samples at each for WWTP, therefore 18 samples in total (=4 samples x 3 boreholes + 3 samples x 2 boreholes) shall be taken.

Location	Disturbed Sample	Total Disturbed Sample No.	Approximate Depth of Sampling
Shaft A, B, and C	4 nos. each	12 nos.	GL -8m, -19m, -30m,-40m
WWTP 1 and 2	3 nos. each	6 nos.	GL -3m, -14m, -20m

One small disturbed sample shall be taken between each two successive SPTs. It shall weigh not less than 0.25 kg and shall be placed immediately in an airtight container, which it should fill. Samples shall be protected to ensure that their temperature does not fall below 5^{o} C. They shall also be protected from direct heat and sunlight.

Samples shall be examined and described by a geotechnical specialist in accordance with the American Standards, the Clause 6.4.3 of American Society for Testing and Materials (hereinafter referred to as ASTM) D420, clause 41 of British Standard (hereinafter referred to as BS) 5930 or equivalent standards.

2) Undisturbed Samples

At each borehole, undisturbed samples shall be taken as shown in Table below, using open tube sampling equipment as described in the clause 2.2 of ASTM D1586, clause 19.4.4 of BS 5930 or equivalent standards.

For predominantly cohesive soils, undisturbed samples by thin-walled tube sampling methods shall be taken for laboratory tests in accordance with ASTM D1587 or equivalent standards.
Followings are expected major important points when the samples are taken based on the existing previous investigation results:

Location		Number of Undisturbed Samples	Approximate Depth of Sampling
1. Vertical Shaft	A	6	GL -3m, -10m, 14m, -27m, -36m, and -49m
	B	4	GL -3m, -14m , -27m, -36m
	C	4	GL -3m, -14m, -27m, -36m
2. WWTP	1	3	GL -4m, -10m, -49m
	2	3	GL -4m, -10m, -49m
3. Total		20	

Before an undisturbed sample is taken, the bottom of the hole shall be carefully cleared of loose materials and where a casing is being used the sample shall be taken below the bottom of the casing. Following a break in the work exceeding one hour, the borehole shall be advanced by 250 mm before undisturbed sampling is resumed.

Where an attempt to take an undisturbed sample is unsuccessful the hole shall be cleaned out for the full depth to which the sampling tube has penetrated and the recovered soil saved as a disturbed sample. A fresh attempt shall then be made from the level of the base of the unsuccessful attempt. Should this second attempt also prove unsuccessful the Contractor shall agree with the Engineer alternative means of sampling.

The samples shall be sealed as soon as possible on the same day to preserve their natural moisture content and in such a manner as to prevent the sealant from entering any voids in the sample.

The depths below ground level at which samples are taken shall be recorded. The level of the top of the sample and the length of sample obtained shall be recorded.

1.3 LOBORATORY TEST

(1) Standard for Testing
It will be stipulated that the laboratory testing and analysis on the soil samples shall be performed in accordance with the standards of the AASHTO, ASTM and BS, unless otherwise specified.

(2) Content of Tests
The laboratory tests required shall consist of:

a) Test for Specific Gravity, ASTM D854-58 or BS test 6

b) Test for Moisture Content, ASTM D2216-71 or BS test 1(A)
c) Test for Density, ASTM D2937-71 or BS test 15(E) or 15 (F)
d) Test for Grain-Size Analysis, ASTM D421-58 and ASTM D422-63 or BS test 7
e) Test for Atterberg Limits,
f) Test for Internal friction angle,
g) Test for Unconfined compressive strength, ASTM D2166-66 or BS test 20
h) Test for Triaxial compression test, ASTM D2850, 4467

(3) Scheduled of laboratory tests

Test	Disturbed Sample Nos.	Undisturbed Sample Nos.	Total Sample Nos.
a) Specific Gravity	18	20	38
b) Moisture Content	18	20	38
c) Density	18	20	38
d) Grain-size Analysis	18	20	38
e) Atterberg Limits	18	20	38
f) Internal friction angle	-	20	20
g) Unconfined compressive strength	-	20	20
h) Triaxial compression test	-	20	20
Total Number	90	160	250

1.4 REPORTING

A copy of draft final report shall be submitted to the JST for approval before submission of the final report.

Upon the completion of the boring, the Contractor shall submit a report in English with examination of the test results as follows

- Daily work records(time, climate, incident if any)
- Exploratory hole logs
- Laboratory test results
- Plan with locations of exploratory holes
- Site location plan
- Recommended type of foundation
- Photographs
- Location Maps

The exploratory hole logs shall be presented to a vertical scale in the form as appropriate. The logs shall contain the following information

- Contract title and site location
- Contractor’s and operator’s name
- Borehole number and location
- Dates and time
- Ground level related to the agreed datum
- Diameters and depths of borehole and casings referred to the agreed datum
- Elevation of each stratum referred to the agreed datum
- The depth at which any water was added
- Records of groundwater
- A summary of groundwater observations
- Description of each stratum in accordance with ASTM D420

- Symbolic legend of strata in accordance with ASTM D420
- Depth of samples taken for laboratory tests

The Contractor shall prepare and submit drawing with the following scale upon the completion of the field survey: 1/100 for Vertical shaft and 1/500 for WWTP and shall include a north point.

The drawings shall be printed out and digital files of all drawings with the format of Auto-CAD and Survey Notes (pdf or Excel) shall be submitted.

The final report shall be submitted to JST by the Contractor with three volumes in total: one original and two copies with three compact disks

1.5 SURVEY LOCATIONS

Survey areas and borehole locations for vertical shafts for trunk sewers are shown in Figure 1and Figure 2. Survey area and borehole locations at the Pulit WWTP site are shown in Figure 1 and Figure 3.

Figure 1 Survey Area for the Pilot Project and Drilling Points

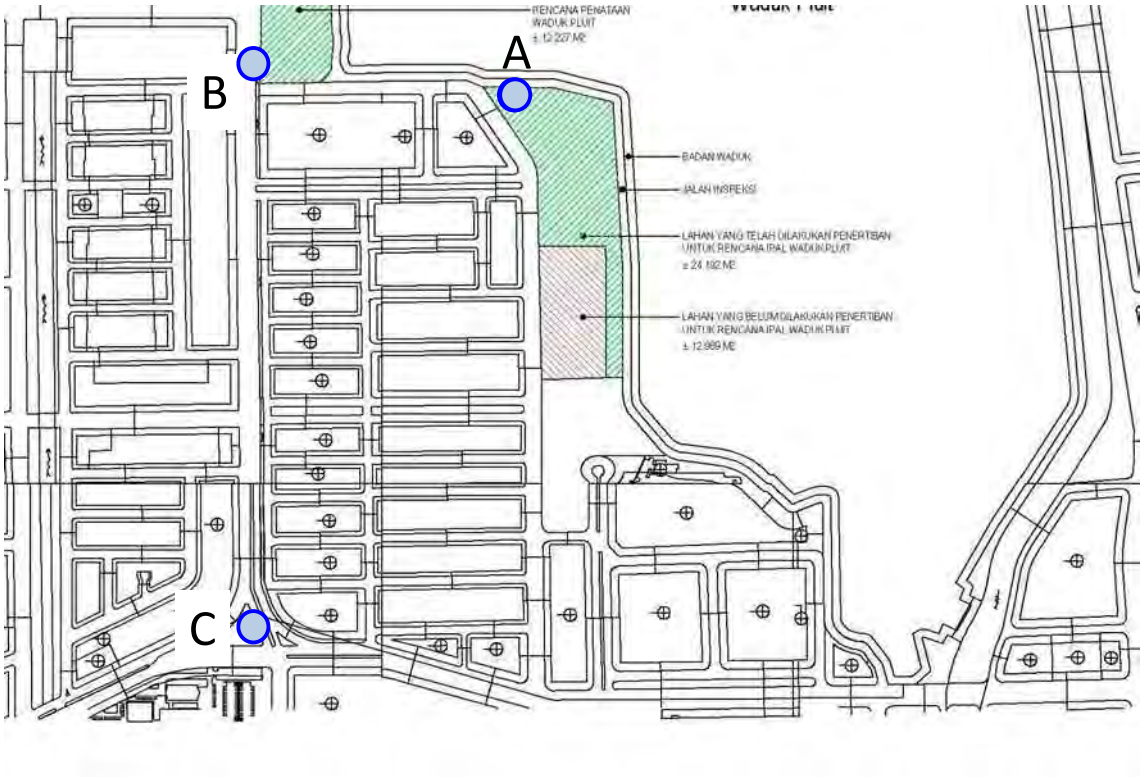
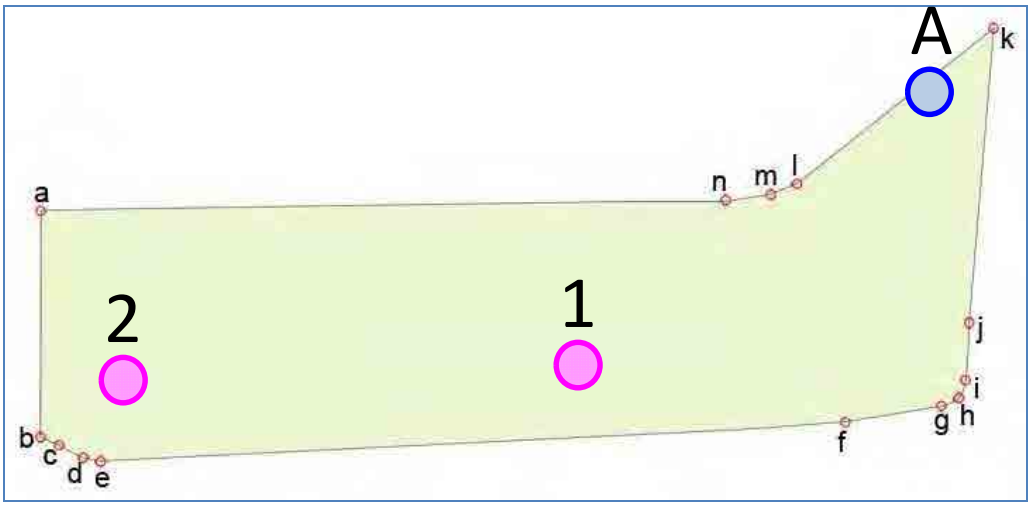


Figure 2 Drilling Points at A, B and C for Vertical Shafts



Coordinate (South - East)

a : 6° 7'19.06"S ; 106° 47'50.64"E
b : 6° 7'19.05"S ; 106° 47'53.52"E
c : 6° 7'18.81"S ; 106° 47'53.63"E
d : 6° 7'18.50"S ; 106° 47'53.78"E
e : 6° 7'18.28"S ; 106° 47'53.82"E
f : 6° 7'8.79"S ; 106° 47'53.28"E
g : 6° 7'7.56"S ; 106° 47'53.09"E
h : 6° 7'7.35"S ; 106° 47'52.99"E
i : 6° 7'7.26"S ; 106° 47'52.76"E
j : 6° 7'7.21"S ; 106° 47'51.98"E
k : 6° 7'6.92"S ; 106° 47'48.27"E
l : 6° 7'9.40"S ; 106° 47'50.25"E
m : 6° 7'9.76"S ; 106° 47'50.40"E
n : 6° 7'10.34"S ; 106° 47'50.49"E

Figure 3 Drilling Points at the site for WWTP

2. Test Methods

2.1 Field Tests

2.1.1 Exploratory Drilling

Access borehole will be sunk for exploratory purpose with insitu tests and undisturbed soil sampling. The borehole diameter will be sufficiently large to allow the insertion of insitu test apparatus and undisturbed soil sampler with minimum diameter of 75 mm (NQ Size). The drilling will be carried out by coring technique by using rotary drilling machine(s). The boring will use pressurized water to loosen the soil for boring. Lithology will be logged by a competent Geotechnical engineer for the description of soil type, consistency or compactness, plasticity, color, degree of cementation if any, and other features that are important for foundation design.

Borehole will be stable from collapsing. When the borehole reach soil layer with high collapsing potential, casing pipe will be provided to protect the borehole wall. In any case, the casing pipe should not be deeper than the borehole and will be at 0.5m above the bottom of the borehole (except during rock coring)

2.1.2 Standard Penetration Test (SPT)

Standards used : ASTM D 1586-97
Sampling interval : 1 m
Equipment used : free fall manual hammer

Standard penetration tests have been done following ASTM D 1586-97.
Test was carried out in each boring hole to obtain a measured of soil resistance to penetration of the sampler. The purpose of performing this test is to determine relative density of coarse grain soil or the consistency of fine grain, which reflect the soil supporting capacity. In the test process, a split barrel sampler is lowered into the bottom of bore hole by drilled rods. The sampler then drives 45 cm into a soil by 140 lbs free falling hammers over a height of 30 in. The automatic drop hammer device is used to maintain free falling and constant height. For the test result, the first 15 cm penetration is not taken in the analysis and considered to be a seating drive. Hence the number of blows to achieve this 15 cm penetration is not including in the N SPT value. The total cumulative numbers of blow count required to drive the sampler to the last 30 cm penetration is recorded as the N value. Soil samples taken from SPT is stored in plastic bag for identification

2.1.3 Undisturbed Sampling

Standards used: ASTM D 1587-97.
Sampling interval: according to request
Equipment used: thin wall sampler

In order to obtain undisturbed samples, a clean bore hole has been drilled to the desired sampling depth. A set of sampler consist of a stainless steel tube attached to the sampler head lowered to the bottom of the bore hole. The sampler is then pushed into the soil without rotation. After penetrating into the soil for approximately 95 % of samples length, the thin wall tube is withdrawn from the borehole. Both end of the tube are then sealed with parafin wax immediately after the tube is separated from the sampler head. Samples are then brought to the laboratory for testing.

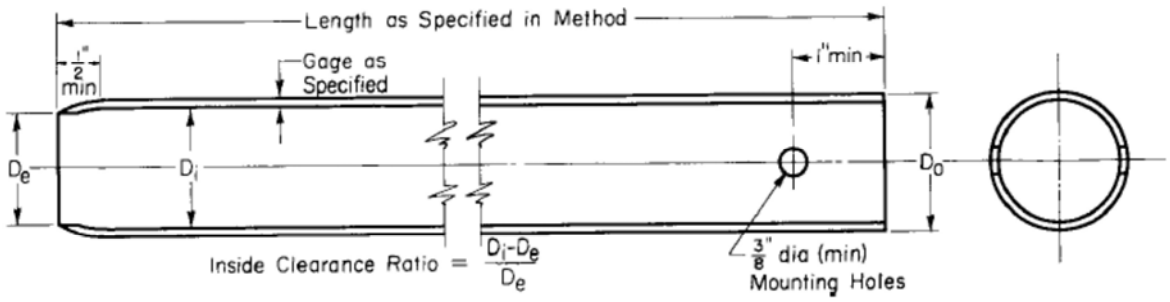


Figure 2.1 UDS Sampler Size

Sampler size:
Outside diameter (Do) = 2”/50.8 mm
Tube Length= 0.65 m

The following table shows the actual depth of the UDS samples taken.

It is realized that some of the samples that must be taken rests in a difficult formation to take samples. Those layers are: 1)Very stiff clays, and 2) Sands.

On those layers we will try to use UDS sampling first, if the results are not satisfactory we will provide alternative sampling method. For sands we will modify the UDS sampler to incorporate a bottom cap that can be opened during pushing into the soil and closed during retraction from the soil. For very stiff clays if UDS samplers can not penetrate then we will use denison sampler (double or triple core barel) or core packer.

Table 2.1 Actual UDS Samples Taken

UDS Sample	Original Depth	Actual Depth
BH - A	-3m, -10m, -14m	-3m, -10m, -14m
BH - B	-3m, -14m, -17m, -36m	-3m, -14m, -17m, -36m
BH - C	-3m, -14m, -17m, -36m	-3m, -14m, -17m, -36m
BH - 01	-4m, -10m, -49m	-4m, -10m, -49m
BH - 02	-4m, -10m, -49m	-4m, -10m, -49m

2.1.4 Permeability Test (Variable Head)

Permeability tests were conducted to obtain the hydraulic conductivity of the soil. To conduct the test, the borehole is sunk to the required testing depth and then is cleaned from the cutting debris. The borehole wall is protected by casing pipes and the test portion of the ground is uncased. The permeability tests done will measure the average hydraulic conductivity of the layer at the uncased borehole.

The borehole must be stopped and wait until the ground water level stabilizes, usually 1 day. The water level in the borehole is then raised by pouring water into the borehole or is lowered by pumping out water depending on the type of the test (falling head or rising head). The rate of the water level to sink or to rise is then measured by recording the water levels in the borehole at several time intervals until the water level returns to normal ground water level. The results is the analyzed to find the basic time lag, to find the permeability value of the soil.

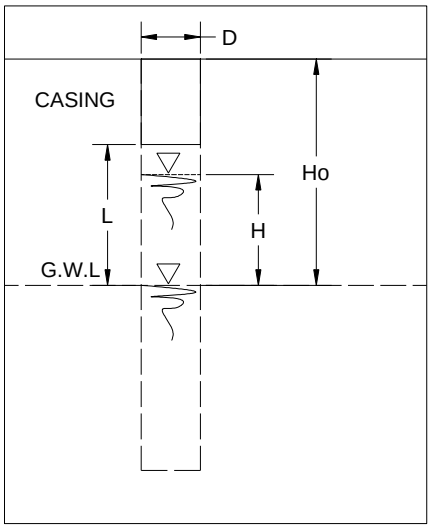


Figure 2.2 Variable Head Permeability Test

2.1.5 Ground Water Observation

Ground water observation is carried out in each bore hole during the drilling works at morning before drilling and afternoon after drilling. The ground water table was determining using Dip meter provided

with sound sensors to produce an amplified audio signal when the probe contacts a water surface. The result of the ground water observation is shown on the following table

2.1.6 Surface Clearing and Cleaning and Restoration

The consultant will clear the surface out of obstructing material such as gravel, concrete pavement, bricks, metal sheets using appropriate tools and within safety regulations. The conusltant will also restore the surface conditon to its original condition but is not a responsibility of the consultant.

2.2 Laboratory Tests

The laboratory soil test will be carried out on selected undisturbed sampling following the ASTM standard, as below:

2.2.1 Unit weight ASTM D2937

Unit weight is measured by driving a hollow cylinder ring into the undisturbed sample. The volume of the ring is known, therefore by weighing the hollow cylinder ring, the unit weight of the soil may be determined. Standard used is ASTM D2937.

2.2.2 Natural moisture content ASTM D2216

Natural moisture content is determined by drying soil sample in an oven for minimun 12 hours and by reduction of weight we can determine the natural moisture content. Standard used is ASTM D2216.

2.2.3 Atterberg limits ASTM D4318

Atterberg limits that are determined are:

1. Liquid limit using the Casagrande Method
2. Plastic limit using the Hand Rolling Method

By knowing the liquid limit and plastic limit we can determine the Index Properties of the soil. Standard used is ASTM D4318.

2.2.4 Grain size analysis (sieve + hydrometer) ASTM D422

Grain Size analysis uses the wet sieving methd where all of the appropriate soil samples are soaked into a hydrometer that will calculate the coefficients for grain size <200 sieve no. After that the soil is dried and sieved with the following sieve sizes: Standard used is ASTM D422.

Table 2.2 Grain size analysis

No.	Opening	No.	Opening	No.	Opening
	mm		mm		mm
3"	101.600	3/8"	9.525	100	0.149
2"	75.000	4	4.760	200	0.074
1 1/2"	38.100	8	2.380		
1"	25.400	20	0.840		
3/4"	19.050	40	0.420		
1/2"	12.700	80	0.177		

2.2.5 Specific gravity ASTM D854

Specific gravity of soil is determined with the water pycnometer method. By replacing the the water with soil, we can determine the specific gravity of soil. Standard used is ASTM D854.

2.2.6 Triaxial Compression Tests (UU) ASTM D2850.

UU Triaxial Compression is a compression tests which the soil sample is subjected to a confining pressure. Confining pressure is generated by pressurized water. The sample is then stressed by using constant strain. This test method covers determination of the strength and stress-strain relationships of a cylindrical specimen of either undisturbed or remolded cohesive soil. No drainage is allowed for the sample. The results gives stress-strain relationship in total stress, which is not corrected for pore water pressure. The tests is done three times using the same soil or remolded soil to find the undrained shear strength. Standard used is ASTM D2850.

The specimen used is:

Specimen Diameter 3.800 cm

Specimen Height 7.600 cm

Specimen Area 11.341 cm^2

Figure 2.3 Triaxial Test Machine

3. Survey Results

3.1 Location of Boreholes

There are 5 boreholes, 4 at the Pluit Reservoir / Taman burung and 1 at Tugu Atma Jaya. The locations of borehles are shown in figure below.

Figure 3.1 Sites of Borehole

3.2 Drilling

Drilling was done using continuous coring method or wash boring according to the client request. Groundwater levels were monitored during the drilling.

Table 3.1 Borehole Coordinates and Ground Water Level

Borehole	North	East	Elevation (m)	Average GWL (m)	Method
BH - A	9323290.621	698953.066	0.4	2.83	Continuous Coring
BH - B	9323111.129	698942.904	-0.033	2.49	Continuous Coring
BH – C	9323351.378	698833.686	0.06	2.43	Continuous Coring
BH - 01	9323388.089	698567.135	0.76	2.61	Continuous Coring
BH - 02	9322695.235	698544.255	-0.061	2.57	Continuous Coring

3.3 Permeability Testing Results

Permeability tests were done on 5 boreholes with the target of testing the sand layer. The tests performed is a simple falling head test with the full casing extended until the depth of the layer that is going to be tested. The calculation used is (Hvorslev, 1951) at steady flow of water. The result of the testing Is shown below:

Table 3.2 Falling Head Permeability Testing Results

Borehole No	Depth of Borehole (m)	Depth of Casing Tip (m)	Basic Time Lag (s)	Average Permeability (cm/s)
BH - A	26	25	2400	9.88E-05
BH - A	33	30	n/a	1.44E-05
BH - A	40	37	n/a	3.31E-05
BH - B	26	25	1200	1.98E-04
BH - B	33	32	3000	7.90E-05
BH - B	40	37	13000	8.12E-06
BH - C	26	25	n/a	2.36E-05
BH - C	33	31	n/a	6.43E-05
BH - C	40	38	n/a	5.16E-06
BH - 01	4	4	n/a	6.98E-04
BH - 02	4	4	n/a	3.79E-04

3.4 Subsurface Soil Stratigraphy

The following tables show the result of the drilling.

3.4.1 Soil Type BH-A

Table 3.3 Soil Type at BH-A

Layer No	Depth	Layer Name	Soil Type	SPT Value
1	0.00 – 0.75	Concrete , Boulders		-
2	0.75 – 13.00	Silty CLAY	silty CLAY, homogenous, light brown - brown, very soft, high to medium plasticity, moist	1
3	13.00 – 14.00	-	CORE LOSS	
4	14.00 – 15.00	Silty CLAY	silty CLAY, homogenous, brown, firm, medium plasticity, moist	1-5
5	15.00 – 19.50	Sandy CLAY	Sandy CLAY, brown, firm, low plasticity, moist	12 - >50
6	19.50 – 21.00	Sandy CLAY	Sandy CLAY with Boulders/gravel, brown, hard, low plasticity, moist	>50
7	21.00 – 25.00	Sandy CLAY	Sandy, brown mottled tan, hard, low plasticity, moist	>50
8	25.00 – 41.50	Silty CLAY	silty CLAY, light brown – dark brown – brown mottled tan and gray, soft - firm, medium plasticity, moist	15 - >50
9	41.50 – 42,50	Sandy CLAY	Sandy, brown, hard, low plasticity, moist	27 - >50
10	42.50 – 43.50	SANDSTONE	SANDSTONE with gravel, brown hard, dense	>50
11	43.50 – 44.50	Gravelly CLAY	Gravelly CLAY, brown, hard, Dense, moist	>50
12	44.50 – 54.50	Silty CLAY	silty CLAY, brown mottled tan – brown mottled gray, soft - hard, low - medium plasticity, moist	18 - 36
13	54.50 – 64.00	Loose SAND	Loose sand, gray, hard, dense, moist	32 – 50
14	64.00 – 70.45	Silty CLAY	silty CLAY, brown – light brown, hard, low plasticity, moist	16 - 22

3.4.2 Soil Type BH-B

Table 3.4 Soil Type at BH-B

Layer No	Depth	Layer Name	Soil Type	SPT Value
1	0.00 – 1.00	Silty CLAY	silty CLAY with trash, brown, very soft, medium plasticity, moist	-
2	1.00 – 3.00		silty CLAY, homogeneous, brown, very soft, medium plasticity, moist	1
3	3.00 – 4.00	Clayey SAND	Clayey SAND, , 90% sand, dark brown, very soft, low plasticity, moist	1
4	4.00 – 10.00	Silty CLAY	silty CLAY, brown-dark brown, very soft-firm, high plasticity, moist	1
5	10.00 – 13.00	Clayey SILT	Clayey SILT, brown, very soft, medium plasticity, moist	1
6	13.00 – 15.00	Silty CLAY	silty CLAY, reddish brown mottled gray, firm, medium plasticity, moist	8 -10
7	15.00 – 25.00		silty CLAY, light brown-brown, firm, medium plasticity, moist	43 - >50
8	25.00 – 27.00	Clayey SAND	clayey SAND, 80% sand, dark brown-black, hard, dense	>50
9	27.00 – 29.00	Silty CLAY	silty CLAY, brown, hard, medium plasticity, moist	14 - 21
10	29.00 – 30.00	Sandy CLAY	sandy CLAY, gray 50% sand, firm, low plasticity, moist	14 - 23
11	30.00 – 38.00	Silty CLAY	silty CLAY, reddish brown mottled tan and gray-light brown mottled tan and gray-light brown-brown, firm, medium plasticity, moist	17 - 50
12	38.00 – 40.50	Clayey SAND	clayey SAND, 90% sand, gray, hard, dense	39 - 50
13	40.50 – 46.00	Silty CLAY	silty CLAY, brown mottled tan and gray, firm-hard, low-medium plasticity, moist	14 - >50
14	46.00 – 47.00		silty CLAY, brown mottled tan and gray, hard, medium plasticity, moist	31 - >50
15	47.00 – 48.00	Gravelly CLAY	Gravelly CLAY, brown, hard, Dense, moist	47 - >50
16	48.00 – 49.00	Silty CLAY	silty CLAY, brown mottled tan and gray, hard, low plasticity, moist	42 - 47
17	49.00 – 49.45	Sandy CLAY	Sandy CLAY, brown, firm, medium plasticity, moist	42

3.4.3 Soil Type BH-C

Table 3.5 Soil Type at BH-C

Layer No	Depth	Layer Name	Soil Type	SPT Value
1	0.00 – 8.00	Silty CLAY	silty CLAY, reddish brown, soft, medium plasticity, moist	1
2	8.00 – 16.00		silty CLAY, brown soft, medium plastic, moist	1 - 14
3	16.00 – 19.00		silty CLAY, light brown, firm, medium plastic, moist	14 - >50
4	19.00 – 21.00	Silty CLAY	silty CLAY, light brown, hard, medium plastic, moist	>50
5	21.00 – 25.00	SANDSTONE	SANDSTONE, light brown, hard, hard density, moist	29 - >50
6	25.00 – 32.00	Silty CLAY	silty CLAY, brown, firm, medium plasticity, moist	9 - 29
7	32.00 – 35.00		silty CLAY, gray, firm, medium plasticity, moist	25 – 50
8	35.00 – 36.00		silty CLAY, brown mottled tan and gray, firm, medium plasticity, moist	>50
9	36.00 – 38.00		silty CLAY, dark brown, hard, medium plasticity, moist	>50
10	38.00 – 40.00	Gravelly STONE	GRAVEL and STONE, brown, hard, dense, moist	43 - >50
11	40.00 – 41.00	silty SAND	silty SAND, black, hard, loose, low plasticity, moist	25 - 43
12	41.00 – 44.00	Silty CLAY	silty CLAY, light brown, firm, medium plasticity, moist	16 - 25
13	44.00 – 46.00		silty CLAY, gray,firm, medium plasticity, moist	>50
14	46.00 – 47.00		sitly CLAY with some boulders, brown, very hard, low plasticity	16 - >50
15	47.00 – 49.45		silty CLAY, black, firm, medium plasticity, moist	16 -26

3.4.4 Soil Type BH-01

Table 3.6 Soil Type at BH-01

Layer No	Depth	Layer Name	Soil Type	SPT Value
1	0.00 – 0.50	Silty CLAY	silty CLAY, brown, very soft, medium plasticity, moist	-
2	0.50 – 1.00	Concrete	TRASH, CONCRETE and coarse SAND	1
3	1.00 – 6.00	Sandy CLAY	sandy CLAY, brown, very soft, low plasticity, moist	1
4	6.00 – 10.00	Silty CLAY	silty CLAY, homogenous, brown, soft, high plasticity, moist	1 - 4
5	10.00 – 11.00	Sandy CLAY	sandy CLAY, light brown, firm, low plasticity, moist	4

6	11.00 – 16.00	Silty CLAY	silty CLAY, light grey mottled tan-light brown-brown, soft-firm, medium plasticity, moist,	4 - 18
7	16.00 – 17.00	SANDSTONE	SANDSTONE, brown, hard, dense, moist	18 - 50
8	17.00 – 18.00	Silty CLAY	silty CLAY, brown mottled gray, hard, low plasticity, moist	43 - 50
7	18.00 – 20.00	Silty CLAY	silty CLAY, brown, firm, medium plasticity, moist	43 - >50
8	20.00 – 25.00	Sandy CLAY	sandy CLAY, brown, hard, low plasticity, moist	>50
9	25.00 – 27.00	SANDSTONE	SANDSTONE, brown to black, hard, dense, moist	>50
10	27.00 – 30.00	Silty CLAY	silty CLAY, gray, firm, medium plasticity, moist	22 - >50
11	30.00 – 33.00		silty CLAY, brown mottled tan, firm, medium plasticity, moist	24 - 50
12	33.00 – 35.00	Sandy CLAY	sandy CLAY, light brown, firm, low plasticity, moist	26 - 29
13	35.00 – 37.00	Sandy SILT	sandy SILT, light brown, firm, medium plasticity, moist	26 - 37
14	37.00 – 40.00	Silty CLAY	silty CLAY, brown, low plasticity, moist	26 -37
15	40.00 – 42.00	SANDSTONE	SANDSTONE, grey, firm, dense, moist	26 - >50
16	42.00 – 45.00	Silty CLAY	silty CLAY, light grey, hard to firm, medium plasticity, moist	25 - >50
17	45.00 – 46.00		silty CLAY, brown, hard to firm, medium plasticity, moist	23 - 29
18	46.00 – 50.45		silty CLAY, gray, hard to firm, medium plasticity, moist	23 - 33

3.4.5 Soil Type BH-02

Table 3.7 Soil Type at BH-02

Layer No	Depth	Layer Name	Soil Type	SPT Value
1	0.00 – 0.50	Gravelly CLAY	gravelly CLAY, reddish brown, soft, medium plastic, moist	-
2	0.50 – 1.00	CONCRETE	CONCRETE	-
3	1.00 – 1.50	Gravelly CLAY	gravelly CLAY, brown, soft, medium plasticity, moist	1
4	1.50 – 2.50	Silty CLAY	silty CLAY, homogenous, brown, very soft, medium plasticity, moist	1
5	2.50 – 10.00	Clayey SILT	clayey SILT, brown, very soft, medium plasticity, moist	1
6	10,00 – 14.00	Silty CLAY	silty CLAY, brown mottled tan, soft, medium plasticity, moist	1 - 2
7	14.00 – 15.00	Sandy CLAY	sandy CLAY, 10% sand, brown, soft, medium plasticity, moist	2
8	15.00 – 16.00	Gravelly SAND	gravelly SAND, gray, hard, dense, moist	2 - >50
9	16.00 – 17.00	Silty CLAY	silty CLAY, light brown, hard,	>50

			medium plastic, moist	
10	17.00 – 18.00	GRAVEL	GRAVEL, brown, hard, moist	>50
11	18.00 – 20.00	Sandy CLAY	sandy CLAY with gravel, brown, hard, low plasticity	>50
12	20.00 – 23.00	SANDSTONE	SANDSTONE, brown, hard, dense, moist	21 - >50
13	23.00 – 32.00	Silty CLAY	silty CLAY, brown – light brown mottle tan and gray, firm, medium plasticity, moist	17 - 26
14	32.00 – 34.00	CLAY	CLAY, light gray, firm, medium plasticity, moist	21 - 26
15	34.00 – 36.00	Sandy CLAY	sandy CLAY , gray, firm, medium plasticity, moist	21 - 50
16	36.00 – 37.00	SANDSTONE	SANDSTONE, gray, firm, moist	30 - 50
17	37.00 – 40.00	Silty CLAY	silty CLAY , gray, firm, medium plasticity, moist	18 - 30
18	40.00 – 42.00	Sandy SILT	sandy SILT, gray, soft, medium plasticity, moist	21 - >50
19	42.00 – 43.00	SANDSTONE	SANDSTONE, gray, hard, moist	23 - >50
20	43.00 – 47.00	Silty CLAY	silty CLAY, light brown, firm, medium plasticity, moist	16 - 23
21	47.00 – 48.00	Sandy CLAY	sandy CLAY, gray, firm, medium plasticity, moist	16 - 17
22	48.00 – 50.45	Silty CLA	silty CLAY, dark brown, firm, medium plasticity, moist	17 - 19

3.5 Lab Test Soil

17 Undisturbed soil samples were taken either using thin wall sampler, deilson sampler or triple tube core barrel and 18 SPT samples. The following table shows the tests done on the samples. The lab test summary is presented on APPENDIX C Soil Lab Test Results.

3.5.1 Index Properties

The most important index properties are bulk weight, moisture content and specific gravity. Those values can be straight away taken from the lab testing results but irregular values will be noted and judged.

Table 3.8 Index Properties Parameter

No	Point ID	Depth (m)	Wn (%)	γ n (gr/cm^3)	γ d (gr/cm^3)	Void Ratio e	Porosity n	Sr (%)	GS
1	BH - A (UDS)	3	53.85	1.867	1.214	1.099	0.524	100	2.55
2	BH - A (UDS)	~~10~~	~~81.94~~	~~1.854~~	~~1.019~~	~~1.534~~	~~0.605~~	~~100~~	2.58

No	Point ID	Depth (m)	Wn (%)	γ n (gr/cm^3)	γ d (gr/cm^3)	Void Ratio e	Porosity n	Sr (%)	GS
3	BH - A (UDS)	14	72.67	1.827	1.058	1.367	0.577	100	2.50
4	BH - A (SPT)	2	-	-	-	-	-	-	2.62
5	BH - A (SPT)	3	-	-	-	-	-	-	2.58
6	BH - A (SPT)	5	-	-	-	-	-	-	2.61
7	BH - A (SPT)	16	-	-	-	-	-	-	2.48
8	BH - B (UDS)	3	70.20	1.754	`1.030	1.485	0.598	100	2.56
9	BH - B (UDS)	14	69.73	1.709	1.007	1.505	0.601	100	2.52
10	BH - B (UDS)	27	74.19	1.662	0.954	1.771	0.639	100	2.64
11	BH - B (UDS)	36	35.17	1.972	1.459	0.801	0.445	100	2.63
12	BH - B (SPT)	29	-	-	-	-	-	-	2.52
13	BH - B (SPT)	32	-	-	-	-	-	-	2.52
14	BH - B (SPT)	40	-	-	-	-	-	-	2.57
15	BH - B (SPT)	41	-	-	-	-	-	-	2.47
16	BH - C (UDS)	3	65.83	1.810	1.091	1.385	0.581	100	2.60
17	BH - C (UDS)	14	56.36	1.692	1.082	1.417	0.586	100	2.62
18	BH - C (UDS)	27	62.30	1.814	1.118	1.379	0.580	100	2.66
19	BH - C (UDS)	36	49.23	1.859	1.246	1.034	0.508	100	2.53
20	BH - C (SPT)	1	-	-	-	-	-	-	2.60
21	BH - C (SPT)	17	-	-	-	-	-	-	2.50
22	BH - C (SPT)	18	-	-	-	-	-	-	2.43
23	BH - 01 (UDS)	4	82.23	1.677	0.920	1.786	0.641	100	2.56
24	BH - 01 (UDS)	10	100.23	1.613	0.806	2.339	0.701	100	2.69
25	BH - 01 (UDS)	49	56.26	1.780	1.139	1.228	0.551	100	2.54

No	Point ID	Depth (m)	Wn (%)	γ n (gr/cm^3)	γ d (gr/cm^3)	Void Ratio e	Porosity n	Sr (%)	GS
26	BH - 01 (SPT)	47	-	-	-	-	-	-	2.58
27	BH - 01 (SPT)	48	-	-	-	-	-	-	2.60
28	BH - 01 (SPT)	50	-	-	-	-	-	-	2.56
29	BH – 02 (UDS)	4	127.16	1.517	0.668	2.791	0.736	100	2.53
30	BH – 02 (UDS)	10	57.43	1.914	1.216	1.047	0.511	100	2.49
31	BH – 02 (UDS)	49	45.62	2.043	1.403	0.795	0.443	100	2.52
32	BH - 02 (SPT)	7	-	-	-	-	-	-	2.64
33	BH - 02 (SPT)	11	-	-	-	-	-	-	2.55
34	BH - 02 (SPT)	36	-	-	-	-	-	-	2.47
35	BH - 02 (SPT)	40	-	-	-	-	-	-	2.60

3.5.2 Atterberg Limits

Atterberg limits is used to know the value of plasticity. The following table shows most of the samples are high plasticity soils.

Table 3.9 Atterberg Limits Parameter

No	Point ID	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
1	BH - A (UDS)	3	47.29	36.09	11.20	ML
2	BH - A (UDS)	10	69.29	46.14	23.14	MH
3	BH - A (UDS)	14	57.97	30.38	27.59	MH
4	BH - A (SPT)	2	70.84	44.61	26.23	MH
5	BH - A (SPT)	3	96.29	50.43	45.86	MH
6	BH - A (SPT)	5	83.39	57.28	26.11	MH
7	BH - A (SPT)	16	43.98	33.51	10.47	ML
8	BH - B (UDS)	3	39.48	27.15	12.32	ML
9	BH - B (UDS)	14	85.96	30.38	55.58	CL
10	BH - B (UDS)	27	42.96	33.28	9.68	ML
11	BH - B (UDS)	36	84.75	40.93	43.83	MH
12	BH - B (SPT)	29	99.70	52.73	46.96	MH
13	BH - B (SPT)	32	98.92	55.80	43.13	MH
14	BH - B (SPT)	40	74.55	42.32	32.23	MH
15	BH - B (SPT)	41	55.81	36.51	19.29	MH
16	BH - C (UDS)	3	49.98	32.46	17.52	ML

No	Point ID	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
17	BH - C (UDS)	14	101.69	39.94	61.75	CH
18	BH - C (UDS)	27	55.97	42.96	13.01	MH
19	BH - C (UDS)	36	95.42	53.55	41.87	MH
20	BH - C (SPT)	1	75.43	49.23	26.20	MH
21	BH - C (SPT)	17	58.59	45.73	12.86	MH
22	BH - C (SPT)	18	118.06	79.49	38.57	MH
23	BH - 01 (UDS)	4	44.92	25.79	19.13	CL
24	BH - 01 (UDS)	10	81.40	49.25	32.15	MH
25	BH - 01 (UDS)	49	83.55	43.91	39.63	MH
26	BH - 01 (SPT)	47	68.35	41.86	26.49	MH
27	BH - 01 (SPT)	48	123.16	37.68	85.48	CH
28	BH - 01 (SPT)	50	67.04	41.92	25.12	MH
29	BH – 02 (UDS)	4	82.48	55.19	27.28	MH
30	BH – 02 (UDS)	10	44.56	39.46	5.10	ML
31	BH – 02 (UDS)	49	91.67	51.61	40.06	MH
32	BH - 02 (SPT)	7	87.60	60.65	26.95	MH
33	BH - 02 (SPT)	11	56.69	40.29	16.40	MH
34	BH - 02 (SPT)	36	61.60	41.50	20.10	MH
35	BH - 02 (SPT)	40	46.72	34.28	12.44	ML

3.5.3 Grain Size

Grain size distribution can be used to determine some of the basic soil parameter. The following table shows composition of soil.

Table 3.10 Grain Size Limits Parameter

No	Point ID	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	% finer by weight passing no. 200 sieve
1	BH - A (UDS)	3	0.36	35.92	23.36	40.36	63.72
2	BH - A (UDS)	10	1.79	23.20	1.64	73.38	75.01
3	BH - A (UDS)	14	0.00	52.12	14.07	33.81	47.88
4	BH - A (SPT)	2	0.00	65.54	9.52	24.94	34.46
5	BH - A (SPT)	3	0.00	3.22	38.02	58.76	96.78
6	BH - A (SPT)	5	0.00	5.53	7.83	86.64	94.47
7	BH - A (SPT)	16	11.43	41.29	21.75	25.53	47.28
8	BH - B (UDS)	3	0.09	56.90	5.63	37.38	43.01

No	Point ID	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	% finer by weight passing no. 200 sieve
9	BH - B (UDS)	14	0.00	4.27	30.18	65.54	95.73
10	BH - B (UDS)	27	0.00	48.06	29.26	22.69	51.94
11	BH - B (UDS)	36	0.00	3.38	53.39	43.23	96.62
12	BH - B (SPT)	29	0.00	45.58	11.83	42.59	54.42
13	BH - B (SPT)	32	0.00	4.14	22.96	72.90	95.86
14	BH - B (SPT)	40	0.00	18.04	32.97	48.99	81.96
15	BH - B (SPT)	41	0.00	49.10	19.29	31.61	50.90
16	BH - C (UDS)	3	0.00	13.02	42.91	44.08	86.98
17	BH - C (UDS)	14	0.00	24.37	36.49	39.15	75.63
18	BH - C (UDS)	27	1.51	33.78	40.86	23.84	64.70
19	BH - C (UDS)	36	0.30	17.41	40.31	41.99	82.29
20	BH - C (SPT)	1	3.58	12.26	26.14	58.02	84.15
21	BH - C (SPT)	17	0.00	56.39	17.08	26.53	43.61
22	BH - C (SPT)	18	0.00	47.63	14.42	37.95	52.37
23	BH - 01 (UDS)	4	0.00	34.81	18.62	46.58	65.19
24	BH - 01 (UDS)	10	1.03	7.64	15.24	76.08	91.32
25	BH - 01 (UDS)	49	0.00	4.79	47.80	47.40	95.21
26	BH - 01 (SPT)	47	0.00	37.84	32.07	30.09	62.16
27	BH - 01 (SPT)	48	0.00	6.64	41.02	52.33	93.36
28	BH - 01 (SPT)	50	6.71	32.49	38.13	22.67	60.80
29	BH – 02 (UDS)	4	1.06	5.51	19.76	73.67	93.43
30	BH – 02 (UDS)	10	0.37	51.93	16.06	31.64	47.71
31	BH – 02 (UDS)	49	0.00	3.49	49.80	46.71	96.51

No	Point ID	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	% finer by weight passing no. 200 sieve
32	BH - 02 (SPT)	7	0.00	31.95	28.55	39.50	68.05
33	BH - 02 (SPT)	11	0.00	0.97	43.82	55.21	99.03
34	BH - 02 (SPT)	36	0.00	53.51	33.55	12.94	46.49
35	BH - 02 (SPT)	40	0.00	31.95	28.55	39.50	68.05

3.5.4 Engineering Properties

Engineering properties is used to provide data for engineer. In this project, The Engineering Properties test was conducted are Triaxial UU, Unconfiend Triaxial CU and Consolidation.

Table 3.11 Engineering Properties

No	Point ID	Depth (m)	Triaxial UU		Unconnfined		
			C kg/cm^2	Ø Degree	quu kg / cm^3	qur kg / cm^3	si kg / cm^3
1	BH - A (UDS)	3	2.580	0.253	0.206	0.063	3.242
2	BH - A (UDS)	10	3.040	0.211	0.069	0.004	18.799
3	BH - A (UDS)	14	13.295	0.081	0.536	0.148	3.620
4	BH - B (UDS)	3	8.425	0.111	0.089	0.054	1.640
5	BH - B (UDS)	14	10.485	0.076	0.408	0.240	1.704
6	BH - B (UDS)	27	1.605	1.273	0.569	0.184	3.093
7	BH - B (UDS)	36	5.171	0.931	2.199	0.394	5.582
8	BH - C (UDS)	3	5.517	0.138	0.136	0.018	7.511
9	BH - C (UDS)	14	13.234	0.152	0.517	0.208	2.487
10	BH - C (UDS)	27	0.401	0.363	0.247	0.140	1.762
11	BH - C (UDS)	36	10.545	0.743	0.783	0.894	0.876
12	BH - 01 (UDS)	4	0.458	0.259	0.036	0.015	2.474
13	BH - 01 (UDS)	10	4.248	0.168	0.033	0.015	2.250
14	BH - 01 (UDS)	49	11.853	0.915	1.700	1.010	1.682
15	BH – 02 (UDS)	4	5.286	0.075	0.039	0.011	3.599
16	BH – 02 (UDS)	10	9.953	0.159	0.195	0.021	9.068
17	BH – 02 (UDS)	49	21.960	0.407	1.209	0.675	1.792

4. Borelogs

In the followings, the borelogs are presented.

BORING NUMBER 1

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

PROJECT Soil Investigation
LOCATION Pluit, North Jakarta
CLIENT Dacrea Engineering Consultants

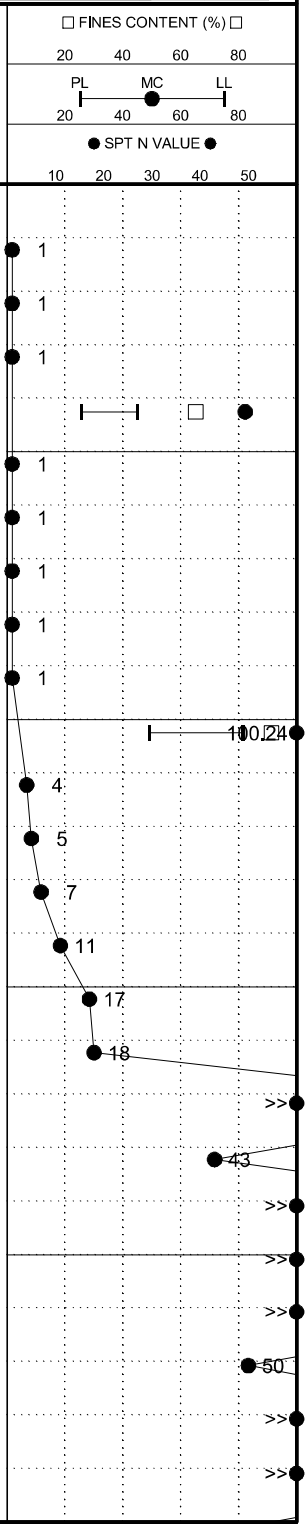
DATE STARTED 5/4/14 **COMPLETED** 5/13/14
NORTHING,EASTING,ELEV. 9323388.089 , 698567.135 , 0.76 m

DRILLER Sukirno
GROUND WATER LEVELS, AVERAGE: 2.61

DRILLING METHOD Continuous Coring
LOGGED BY M Hirzan **CHECKED BY** Andrianto HN
REMARKS

DATE	START	END	DATE	START	END	DATE	START	END
06/05/2014	0.40 m	1.30 m	07/05/2014	1.20 m	2.90 m	08/05/2014	2.90 m	3.25 m
09/05/2014	2.80 m	3.00 m	10/05/2014	2.75 m	3.50 m	11/05/2014	2.70 m	3.25 m
12/05/2014	3.00 m	2.80 m	13/05/2014	2.50 m	3.50 m			

DEPTH (m)	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
	0	silty CLAY, brown, very soft, medium plasticity, moist							
		TRASH, CONCRETE and coarse SAND	SPT 1		1				
		sandy CLAY, brown, very soft, low plasticity, moist	SPT 2		1				
			SPT 3		1				
5			UD 1			0.26	0.46	0.04	
	-5		SPT 4		1				
		silty CLAY, homogenous, brown, soft, high plasticity, moist	SPT 5		1				
			SPT 6		1				
			SPT 7		1				
10			SPT 8		1				
	-10	sandy CLAY, light brown, firm, low plasticity, moist	UD 2			0.17	4.25	0.03	
		silty CLAY, light grey mottled tan, medium plasticity, moist, firm	SPT 9		1-2-2 (4)				
		light brown, soft	SPT 10		2-2-3 (5)				
			SPT 11		3-3-4 (7)				
		brown	SPT 12		2-5-6 (11)				
15			SPT 13		2-7-10 (17)				
	-15	SANDSTONE, brown, hard, dense, moist	SPT 14		4-7-11 (18)				
		silty CLAY, brown mottled gray, hard, low plasticity, moist	SPT 15		11-30-20/4				
		silty CLAY, brown, firm, medium plasticity, moist	SPT 16		10-18-25 (43)				
			SPT 17		35-50/3				
20									
	-20	sandy CLAY, brown, hard, low plasticity, moist	SPT 18		32-50/3				
			SPT 19		50/14				
			SPT 20		50				
			SPT 21		50/14				
25			SPT 22		35-50/3				



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

(Continued Next Page)

BORING NUMBER 1

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

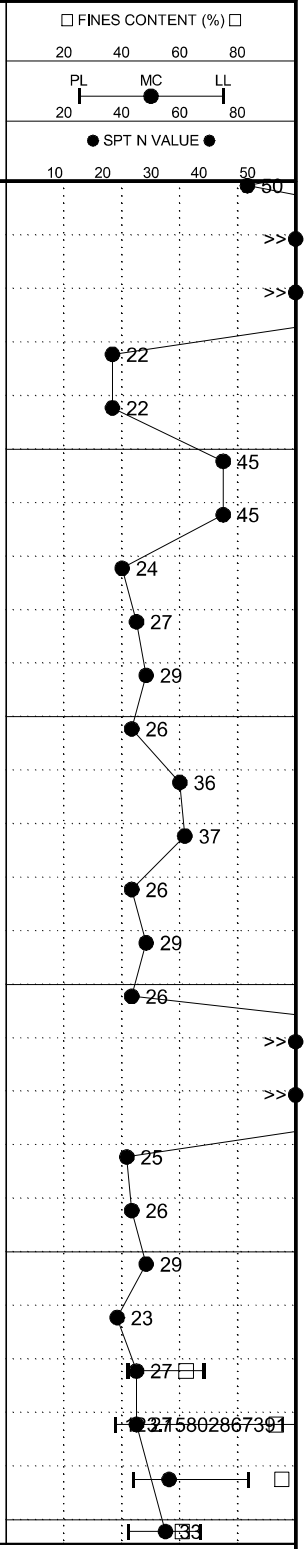
PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
	-25		SANDSTONE, brown to black, hard, dense, moist	SPT 23		50				
				SPT 24		50/14				
			silty CLAY, gray, firm, medium plasticity, moist	SPT 25		50/14				
				SPT 26		7-9-13 (22)				
				SPT 27		9-10-12 (22)				
30	-30		silty CLAY, brown mottled tan, firm, medium plasticity, moist	SPT 28		10-20-25 (45)				
				SPT 29		13-18-27 (45)				
				SPT 30		6-11-13 (24)				
			sandy CLAY, light brown, firm, low plasticity, moist	SPT 31		7-12-15 (27)				
				SPT 32		9-12-17 (29)				
35	-35		sandy SILT, light brown, firm, medium plasticity, moist	SPT 33		7-11-15 (26)				
				SPT 34		9-15-21 (36)				
			silty CLAY, brown, low plasticity, moist hard	SPT 35		10-15-22 (37)				
				SPT 36		8-12-14 (26)				
				SPT 37		7-13-16 (29)				
40	-40		SANDSTONE, grey, firm, dense, moist	SPT 38		5-11-15 (26)				
				SPT 39		50/14				
			silty CLAY, light grey, hard to firm, medium plasticity, moist	SPT 40		50/13				
				SPT 41		8-10-15 (25)				
				SPT 42		9-11-15 (26)				
45	-45		silty CLAY, brown, hard to firm, medium plasticity, moist	SPT 43		11-13-16 (29)				
			silty CLAY, gray, hard to firm, medium plasticity, moist	SPT 44		8-10-13 (23)				
				SPT 45		6-11-16 (27)				
				SPT 46		8-13-14 (27)				
				UD 3			0.92	11.85	1.70	
50				SPT 47		8-15-18 (33)				

Bottom of borehole at 50.45 meters.



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER 2

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

PROJECT Soil Investigation
LOCATION Pluit, North Jakarta
CLIENT Dacrea Engineering Consultants

DATE STARTED 5/18/14 **COMPLETED** 5/23/14
NORTHING,EASTING,ELEV. 9322695.235 , 698544.255 , -0.061 m

DRILLER Waluyo
GROUND WATER LEVELS, AVERAGE: 2.57

DRILLING METHOD Continuous Coring
LOGGED BY M Hirzan **CHECKED BY** Andrianto HN
REMARKS

DATE	START	END	DATE	START	END	DATE	START	END
18/05/2014	N/A. m	1.50 m	19/05/2014	1.40 m	3.50 m	20/05/2014	1.70 m	3.50 m
21/05/2014	1.20 m	3.75 m	22/05/2014	2.10 m	3.60 m	23/05/2014	2.25 m	3.75 m

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			gravelly CLAY, reddish brown, soft, medium plastic, moist							
			CONCRETE	SPT 1		1				
			gravelly CLAY, brown, soft, medium plasticity, moist	SPT 2		1				
			silty CLAY, homogenous, brown, very soft, medium plasticity, moist	SPT 3		1				
			clayey SILT, brown, very soft, medium plasticity, moist	UD 1			0.08	5.29	0.04	
5	-5			SPT 4		1				
				SPT 5		1				
				SPT 6		1				
				SPT 7		1				
				SPT 8		1				
10	-10		silty CLAY, brown mottled tan, soft, medium plasticity, moist	UD 2			0.16	9.95	0.19	
				SPT 9		1-1-1 (2)				
				SPT 10		1-1-1 (2)				
				SPT 11		1-1-1 (2)				
15	-15		sandy CLAY, 10% sand, brown, soft, medium plasticity, moist	SPT 12		1-1-1 (2)				
			gravelly SAND, gray, hard, dense, moist	SPT 13		1-1-1 (2)				
			silty CLAY, light brown, hard, medium plastic, moist	SPT 14		22-50/10				
			GRAVEL, brown, hard, moist	SPT 15		24-50/11				
			sandy CLAY with gravel, brown, hard, low plasticity	SPT 16		50				
20	-20			SPT 17		50				
			SANDSTONE, brown, hard, dense, moist	SPT 18		50				
				SPT 19		50/10				
				SPT 20		50/8				
			silty CLAY, brown, firm, medium plasticity, moist	SPT 21		7-9-12 (21)				
25	-25			SPT 22		7-7-10 (17)				

FINES CONTENT (%) 20 40 60 80
PL MC LL
SPT N VALUE 10 20 30 40 50

(Continued Next Page)

BORING NUMBER 2

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

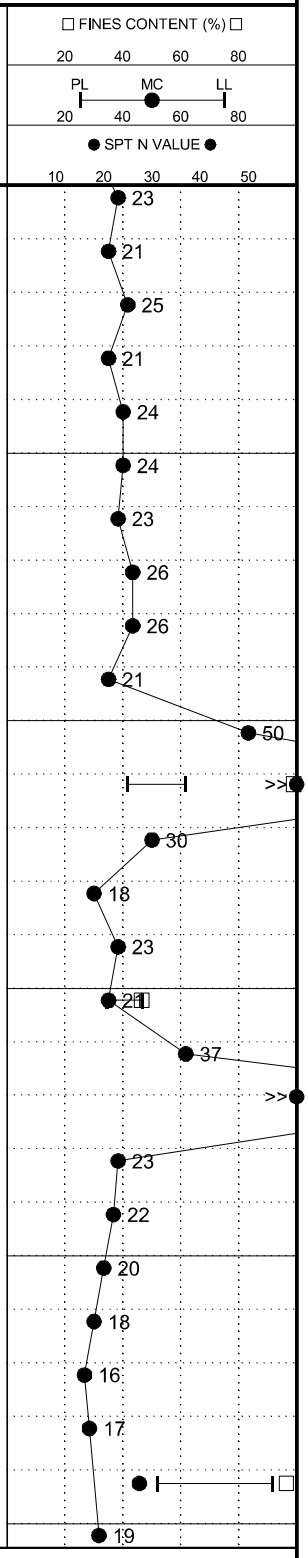
PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			silty CLAY, brown, firm, medium plasticity, moist *(continued)*	SPT 23		7-10-13 (23)				
				SPT 24		7-9-12 (21)				
				SPT 25		7-11-14 (25)				
			light brown mottled tan and gray	SPT 26		7-9-12 (21)				
				SPT 27		7-10-14 (24)				
30	-30			SPT 28		7-10-14 (24)				
				SPT 29		7-9-14 (23)				
			CLAY, light gray, firm, medium plasticity, moist	SPT 30		7-11-15 (26)				
				SPT 31		8-11-15 (26)				
			sandy CLAY , gray, firm, medium plasticity, moist	SPT 32		6-9-12 (21)				
35	-35			SPT 33		13-25-25 (50)				
			SANDSTONE, gray, firm, moist	SPT 34		15-25-25/7				
			silty CLAY , gray, firm, medium plasticity, moist	SPT 35		8-13-17 (30)				
				SPT 36		6-8-10 (18)				
				SPT 37		7-10-13 (23)				
40	-40		sandy SILT, gray, soft, medium plasticity, moist	SPT 38		7-10-11 (21)				
				SPT 39		12-16-21 (37)				
			SANDSTONE, gray, hard, moist	SPT 40		50/5				
			silty CLAY, light brown, firm, medium plasticity, moist	SPT 41		7-10-13 (23)				
				SPT 42		7-10-12 (22)				
45	-45			SPT 43		7-9-11 (20)				
				SPT 44		7-9-9 (18)				
			sandy CLAY, gray, firm, medium plasticity, moist	SPT 45		7-7-9 (16)				
			silty CLAY, dark brown, firm, medium plasticity, moist	SPT 46		7-8-9 (17)				
				UD 3			0.41	21.96	1.21	
50	-50			SPT 47		7-8-11 (19)				

Bottom of borehole at 50.45 meters.



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER A

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

PROJECT Soil Investigation
LOCATION Pluit, North Jakarta
CLIENT Dacrea Engineering Consultants

DATE STARTED 5/3/14 **COMPLETED** 5/14/14
NORTHING,EASTING,ELEV. 9323290.621 , 698953.066 , 0.4 m

DRILLER Waluyo
GROUND WATER LEVELS, AVERAGE: 2.83

DRILLING METHOD Continuous Coring

LOGGED BY M Hirzan **CHECKED BY** Andrianto HN

REMARKS

DATE	START	END	DATE	START	END	DATE	START	END
03/05/2014	N/A. m	1.00 m	04/05/2014	1.10 m	2.65 m	05/05/2014	2.70 m	3.50 m
07/05/2014	3.75 m	3.70 m	10/05/2014	3.70 m	3.85 m	12/05/2014	2.60 m	2.70 m
13/05/2014	2.70 m	2.80 m						

DEPTH (m)	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
	0	CONCRETE BOULDERS							
		silty CLAY, brown, homogenous, very soft, medium plasticity, moist	SPT 1		1				
			SPT 2		1				
			UD 1						
5			SPT 3		1				
	-5		SPT 4		1				
			SPT 5		1				
			SPT 6		1				
			SPT 7		1				
			SPT 8		1				
10									
	-10	silty	UD 2			0.21	3.04	0.07	
			SPT 9		1				
		light brown	SPT 10		1				
		CORE LOSS	SPT 11		1				
		silty CLAY, brown, homogenous, firm, medium plasticity, moist	UD 3			0.08	13.29	0.54	
15									
	-15	sandy CLAY, brown, firm, low plasticity, moist	SPT 12		4-5-7 (12)				
			SPT 13		10-15-18 (33)				
		hard	SPT 14		50/12				
			SPT 15		23-50/10				
			SPT 16		50/5				
20		sandy CLAY with boulders/gravel, brown, hard, low plasticiy, moist							
	-20		SPT 17		50/7				
		sandy CLAY, brown mottled tan, hard, low plasticity, moist	SPT 18		50/5				
			SPT 19		50/5				
			SPT 20		50/9				
25			SPT 21		19-35-15/5				

(Continued Next Page)

BORING NUMBER A

PT. Tigenco Graha Persada
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PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm^2)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm^2)	TRIAXIAL CU phi' (DEGREES)	FINES CONTENT (%) / SPT N VALUE
	-25		silty CLAY, dark brown, firm, medium plasticity, moist	SPT 22		9-12-15 (27)					27
				SPT 23		14-22-50 (72)					>>
				SPT 24		7-9-11 (20)					20
				SPT 25		6-7-7 (14)					14
			brown mottled tan, soft	SPT 26		7-7-9 (16)					16
30	-30			SPT 27		6-7-9 (16)					16
			light brown, firm	SPT 28		6-7-9 (16)					16
			brown mottled tan	SPT 29		6-8-10 (18)					18
				SPT 30		7-8-10 (18)					18
				SPT 31		7-9-10 (19)					19
35			brown mottled gray								
	-35			SPT 32		7-9-11 (20)					20
				SPT 33		8-10-10 (20)					20
				SPT 34		8-10-10 (20)					20
			brown	SPT 35		7-7-8 (15)					15
				SPT 36		7-8-6 (14)					14
40			dark brown, firm								
	-40		light brown mottled tan, soft	SPT 37		6-6-7 (13)					13
				SPT 38		10-15-27 (42)					42
			sandy CLAY, brown, hard, low plasticity, moist	SPT 39		21-50/12					>>
			SANDSTONE with gravel, brown, hard, dense	SPT 40		50					50
			gravelly CLAY, brown, hard, low plasticity, moist	SPT 41		50					50
45			silty CLAY, brown mottled tan, hard, low								
	-45		plasticity, moist brown mottle gray, soft, medium plasticity, moist	SPT 42		7-8-10 (18)					18
				SPT 43		7-9-10 (19)					19
				SPT 44		8-9-10 (19)					19
			brown, firm	SPT 45		8-10-13 (23)					23
				SPT 46		8-10-14 (24)					24
50	-50			SPT 47		10-13-1 (14)					14
				SPT 48		10-13-17 (30)					30
				SPT		10-15-17					32

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GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER A

PT. Tigenco Graha Persada
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PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)	FINES CONTENT (%) / SPT N VALUE
			silty CLAY, brown mottled tan, hard, low plasticity, moist *(continued)*	49		(32)					34
				SPT 50		10-15-19 (34)					36
				SPT 51		10-15-21 (36)					
55	-55		loose SAND, gray, hard, dense, moist	SPT 52		12-13-19 (32)					32
				SPT 53		12-15-21 (36)					36
				SPT 54		12-15-25 (40)					40
				SPT 55		12-17-25 (42)					42
			hard density	SPT 56		15-20-30 (50)					50
60	-60			SPT 57		15-20-30/10					>>
				SPT 58		15-25-25 (50)					50
				SPT 59		15-25-25/7					>>
				SPT 60		17-25-25/5					>>
			silty CLAY, brown-light brown, hard, low plasticity, moist	SPT 61		17-32-18/5					>>
65	-65			SPT 62		7-7-11 (18)					18
				SPT 63		7-9-10 (19)					19
				SPT 64		7-7-9 (16)					16
				SPT 65		7-8-10 (18)					18
				SPT 66		7-8-9 (17)					17
70	-70			SPT 67		7-10-12 (22)					22

Bottom of borehole at 70.45 meters.

GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER B

PT. Tigenco Graha Persada
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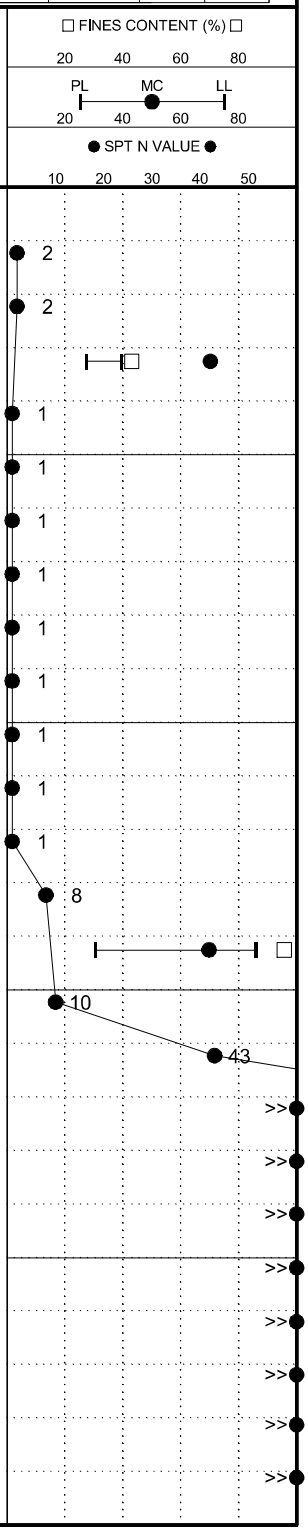
Telephone: (62) 21 86600710

PROJECT Soil Investigation
LOCATION Pluit, North Jakarta
CLIENT Dacrea Engineering Consultants
DATE STARTED 5/10/14 **COMPLETED** 5/18/14
NORTHING,EASTING,ELEV. 9323111.129 , 698942.904 , -0.033 m
DRILLER Sartono
GROUND WATER LEVELS, AVERAGE: 2.49
DRILLING METHOD Continuous Coring
LOGGED BY M Hirzan **CHECKED BY** Andrianto HN
REMARKS

DATE	START	END	DATE	START	END	DATE	START	END
10/05/2014	N/A. m	1.80 m	11/05/2014	1.50 m	3.40 m	12/05/2014	1.50 m	3.70 m
13/05/2014	1.60 m	3.15 m	14/05/2014	1.40 m	3.35 m	15/05/2014	1.20 m	3.80 m
18/05/2014	1.70 m	4.30 m						

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			silty CLAY with trash, brown, very soft, medium plasticity, moist							
			silty CLAY, brown, very soft, medium plasticity, moist	SPT 1		1-1-1 (2)				
				SPT 2		1-1-1 (2)				
			clayey SAND, 90% sand, dark brown, very soft, low plasticity	UD 1			0.11	8.43	0.09	
5	-5		silty CLAY, brown, very soft, high plasticity, moist	SPT 3		1				
			dark brown	SPT 4		1				
				SPT 5		1				
				SPT 6		1				
			firm, medium plasticity	SPT 7		1-1				
				SPT 8		1-1				
10	-10		clayey SILT, brown, very soft, medium plasticity, moist	SPT 9		1-1				
				SPT 10		1-1				
				SPT 11		1-1				
			silty CLAY, reddish brown mottled gray, firm, medium plasticity, moist	SPT 12		3-4-4 (8)				
15	-15			UD 2			0.08	10.49	0.41	
			silty CLAY, brown, firm, medium plasticity, moist	SPT 13		2-4-6 (10)				
				SPT 14		6-14-29 (43)				
				SPT 15		8-15-35/12				
				SPT 16		10-17-35/10				
			light brown	SPT 17		15-25-25/7				
20	-20			SPT 18		9-20-30/8				
				SPT 19		11-21-29/10				
			brown	SPT 20		10-21-29/8				
				SPT 21		20-50/10				
25	-25			SPT 22		26-50/7				



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GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER B

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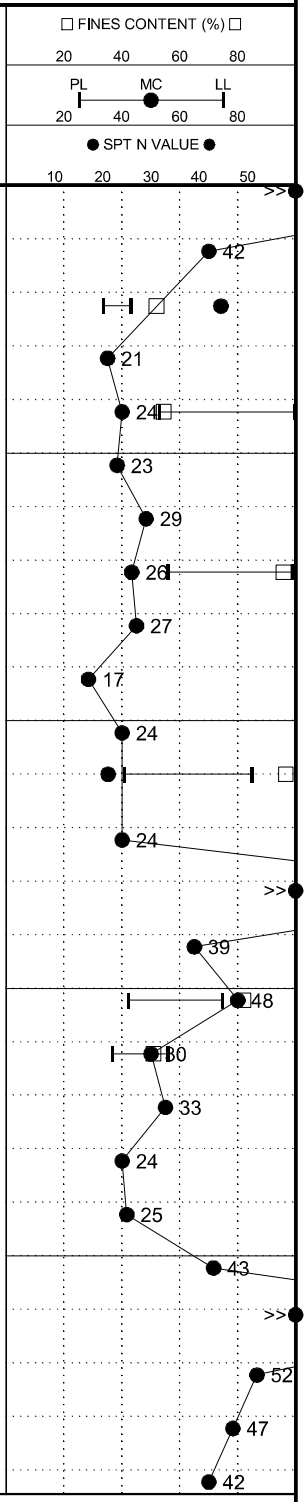
PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			clayey SAND, 80% sand, dark brown, hard, loose	SPT 23		25-50/5				
			black	SPT 24		10-17-25 (42)				
			silty CLAY, brown, hard, medium plasticity, moist	UD 3			1.27	1.60	0.57	
				SPT 25		5-8-13 (21)				
			sandy CLAY, 50% sand, firm, low plasticity, mosit	SPT 26		6-9-15 (24)				
30	-30		silty CLAY, reddish brown mottled tan and gray, firm, medium plasticity, moist	SPT 27		6-10-13 (23)				
				SPT 28		6-11-18 (29)				
				SPT 29		8-11-15 (26)				
			light brown mottled tan and gray	SPT 30		7-12-15 (27)				
				SPT 31		6-7-10 (17)				
35	-35		light brown	SPT 32		6-9-15 (24)				
							0.93	5.17	2.20	
			brown	SPT 33		6-10-14 (24)				
			clayey SAND, gray, 90% sand, hard, loose sand	SPT 34		15-21-30/5				
				SPT 35		8-10-29 (39)				
40	-40		silty CLAY, brown mottled tan and gray, firm, low-medium plasticity, moist	SPT 36		10-18-30 (48)				
				SPT 37		8-12-18 (30)				
				SPT 38		9-14-19 (33)				
				SPT 39		5-9-15 (24)				
				SPT 40		8-11-14 (25)				
45	-45		hard	SPT 41		11-18-25 (43)				
			silty CLAY, brown mottled tan and gray, hard, medium plasticity, moist	SPT 42		31-25/5				
			gravelly CLAY, brown, hard, dense, moist	SPT 43		10-21-31 (52)				
			silty CLAY, brown mottled tan and gray, hard, low plasticity, moist	SPT 44		12-18-29 (47)				
			sandy CLAY , brown, firm, medium plasticity, moist	SPT 45		10-17-25 (42)				

Bottom of borehole at 49.45 meters.



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

BORING NUMBER C

PT. Tigenco Graha Persada
Jl. Pahlawan Revolusi 100BJakarta Timur 14340
Telephone: (62) 21 86600710

PROJECT Soil Investigation
LOCATION Pluit, North Jakarta
CLIENT Dacrea Engineering Consultants

DATE STARTED 4/25/14 **COMPLETED** 5/22/14
NORTHING,EASTING,ELEV. 9323351.378 , 698833.686 , 0.06 m

DRILLER Waluyo
GROUND WATER LEVELS, AVERAGE: 2.43

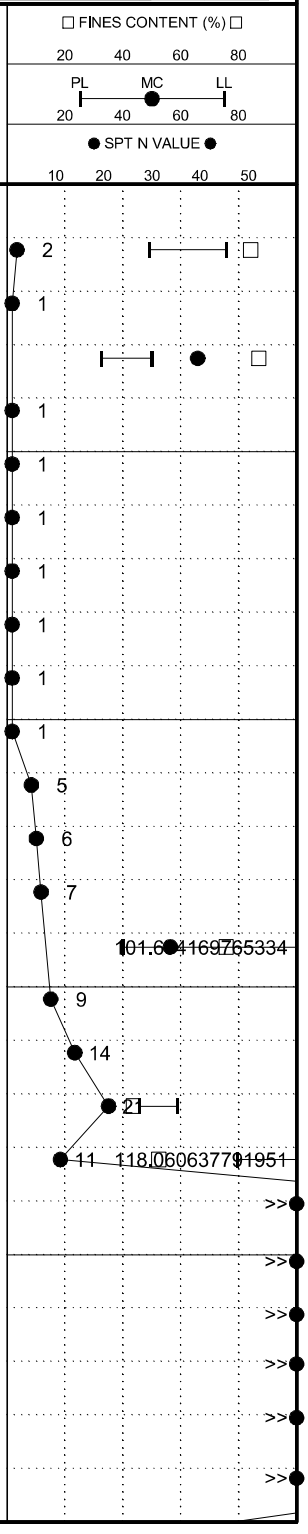
DRILLING METHOD Continuous Coring

LOGGED BY M Hirzan **CHECKED BY** Andrianto HN

REMARKS

DATE	START	END	DATE	START	END	DATE	START	END
25/04/2014	N/A. m	1.20 m	29/04/2014	1.50 m	2.30 m	30/04/2014	1.50 m	3.00 m
12/05/2014	2.00 m	3.00 m	14/05/2014	2.10 m	3.50 m	16/05/2014	2.00 m	3.30 m
17/05/2014	2.10 m	3.30 m	20/05/2014	2.00 m	3.00 m	21/05/2014	2.10 m	3.10 m
22/05/2014	2.00 m	3.20 m						

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			silty CLAY, reddish brown, soft, medium plasticity, moist	SPT 1		1-1-1 (2)				
				SPT 2		1				
				UD 1			0.14	5.52	0.14	
5	-5			SPT 3		1				
				SPT 4		1				
				SPT 5		1				
				SPT 6		1				
			silty CLAY, brown soft, medium plastic, moist	SPT 7		1				
				SPT 8		1				
10	-10			SPT 9		1				
				SPT 10		2-2-3 (5)				
				SPT 11		3-3-3 (6)				
				SPT 12		3-3-4 (7)				
				UD 2			0.15	13.23	0.52	
15	-15			SPT 13		4-4-5 (9)				
			silty CLAY, light brown, firm, medium plastic, moist	SPT 14		4-6-8 (14)				
				SPT 15		7-9-12 (21)				
				SPT 16		4-5-6 (11)				
			silty CLAY, light brown, hard, medium plastic, moist	SPT 17		50/10				
20	-20			SPT 18		21-50/10				
			SANDSTONE, light brown, hard, hard density, moist	SPT 19		15-50/9				
				SPT 20		50/9				
				SPT 21		50/10				
25			silty CLAY, brown, firm, medium plasticity, moist	SPT 22		20-35-15/6				



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14

(Continued Next Page)

BORING NUMBER C

PT. Tigenco Graha Persada
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Telephone: (62) 21 86600710

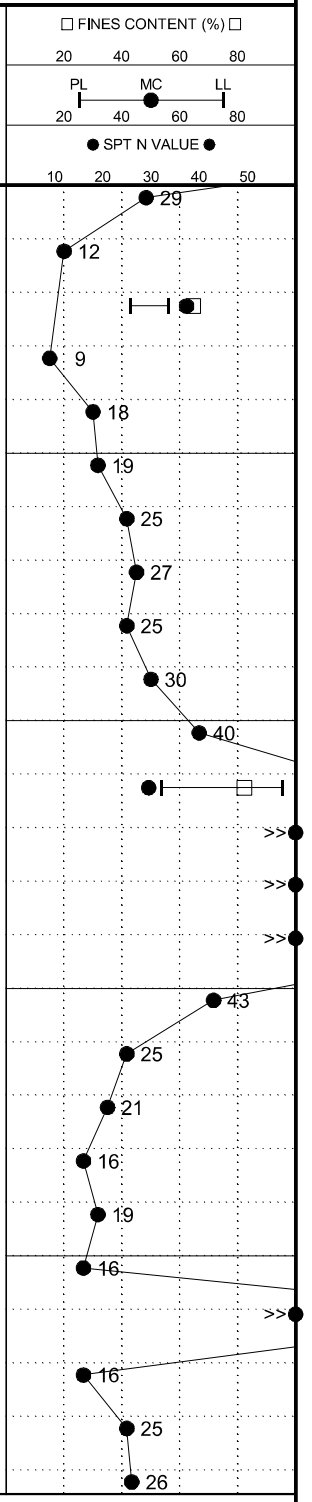
PROJECT Soil Investigation

LOCATION Pluit, North Jakarta

CLIENT Dacrea Engineering Consultants

DEPTH (m)	ELEVATION (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	TRIAXIAL UU C. (kg/cm²)	TRIAXIAL UU phi. (DEGREES)	UNCONFINED Qu (kg/cm²)	TRIAXIAL CU phi' (DEGREES)
			silty CLAY, brown, firm, medium plasticity, moist *(continued)*	SPT 23		7-12-17 (29)				
				SPT 24		4-5-7 (12)				
				UD 3			0.36	0.40	0.25	
				SPT 25		3-3-6 (9)				
				SPT 26		4-7-11 (18)				
30	-30			SPT 27		5-7-12 (19)				
				SPT 28		5-9-16 (25)				
			silty CLAY, gray, firm, medium plasticity, moist	SPT 29		5-10-17 (27)				
				SPT 30		6-9-16 (25)				
				SPT 31		8-12-18 (30)				
35	-35		silty CLAY, brown mottle dtan and gray, firm, medium plasticity, moist	SPT 32		11-17-23 (40)				
			silty CLAY, dark brown, hard, medium plasticity, moist	UD 4			0.74	10.54	0.78	
				SPT 33		30-50/3				
			GRAVEL and STONE, brown, hard, dense, moist	SPT 34		50/12				
				SPT 35		50/13				
40	-40		silty SAND, black, hard, loose, low plasticity, moist	SPT 36		10-18-25 (43)				
			silty CLAY, light brown, firm, medium plasticity, moist	SPT 37		7-10-15 (25)				
				SPT 38		6-8-13 (21)				
				SPT 39		5-7-9 (16)				
45	-45		silty CLAY, gray,firm, medium plasticity, moist	SPT 40		6-8-11 (19)				
				SPT 41		4-6-10 (16)				
			sitly CLAY with some boulders, brown, very hard, low plasticity	SPT 42		35-50/3				
			silty CLAY, black, firm, medium plasticity, moist	SPT 43		6-7-9 (16)				
				SPT 44		8-10-15 (25)				
				SPT 45		7-10-16 (26)				

Bottom of borehole at 49.45 meters.



GEOTECH BH PLOTS-GENERAL DACREA-PLUIT.GPJ GINT STD A4 ASTM LAB.GDT 6/11/14