

ANNEX 1

TECHNICAL SPECIFICATION

CONSTRUCTION WORKS OF TWO (2) LANDFILLS IN CENTRAL SULAWESI

KAWATUNA AND KABONGA LANDFILL

**PALU CITY AND DONGGALA DISTRICT
CENTRAL SULAWESI PROVINCE
AUGUST 2020**

TECHNICAL SPESIFICATIONS

TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	ix
LIST OF FIGURES	x

CHAPTER 1

GENERAL SPECIFICATIONS	1
1.1. DESCRIPTION OF THE PROJECT.....	1
1.1.1. Location of the Project.....	1
1.1.2. Access to the Project Site	1
1.1.3. Project Background	2
1.2. GENERAL EXPLANATION	3
1.2.1. Description of Works.....	3
1.2.2. Scope of Work.....	3
1.2.2.1. Reconstruction of Existing Leachate Treatment Plant (LTP).....	4
1.2.2.2. Structuring and Closing the Existing Zone	4
1.2.2.3. New Landfill Zone and Leachate Collection System Construction.....	5
1.2.2.4. Installation of Drainage.....	6
1.2.2.5. Construction of Internal Access Road.....	6
1.2.2.6. Construction and Installation of Fence and Buffer Zone.....	6
1.2.2.7. Supporting Infrastructure	6
1.2.3. Supervision	7
1.3. CONTRACTOR'S FURTHER SUBMISSIONS	7
1.3.1. Quality Control.....	7
1.3.2. Work Method Statements	8
1.3.3. Daily Report	9
1.3.4. Weekly Report	9
1.3.5. Monthly Report	9
1.3.6. Photographs	10
1.4. DRAWINGS TO BE FURNISHED BY THE CONTRACTOR.....	11
1.4.1. Working Drawings	11
1.4.2. As-built Drawings	13
1.5. RISK OF INCREASING MATERIAL PRICES AND WAGES.....	14
1.6. SIZES AND NOTATIONS	14
1.7. LOADING LIMITS ON ROADS.....	15

TECHNICAL SPESIFICATIONS

1.8.	QUARRY AND CONCRETE AGGREGATES	16
1.9.	BORROW AREAS AND EMBANKMENT MATERIALS	16
1.10.	WORKS TO BE KEPT CLEAR OF WATER.....	17
1.11.	BLASTING	17
1.12.	MATERIALS TO BE FURNISHED BY THE CONTRACTOR	18
1.12.1.	Request for Approval	18
1.12.2.	Substitute Materials.....	18
1.12.3.	Rejected Materials	19
1.13.	PROTECTION OF THE ENVIRONMENT	19
1.14.	OTHER GENERAL REQUIREMENTS	22

CHAPTER 2

TECHNICAL GENERAL SPECIFICATIONS 23

2.1.	PREPARATORY WORK.....	23
2.1.1.	Site Information	23
2.1.2.	Socialization	23
2.1.3.	Technical Regulations	24
2.1.4.	Land Clearing and Leveling of Supporting Building Area	25
2.1.5.	Stockyard Rent.....	25
2.2.	MOBILIZATION AND DEMOBILIZATION EQUIPMENT	26
2.3.	INSTALLATION OF PROJECT SIGNBOARD.....	27
2.4.	CONTRACTOR'S FACILITIES.....	27
2.4.1.	Contractor's Temporary Facilities	27
2.4.2.	Communication System	29
2.4.3.	Contractor's Laboratory and Laboratory Equipment	29
2.4.4.	Medical and First Aid Facilities and HIV/AIDS Prevention Program	31
2.4.5.	Working Water Facilities and Lighting.....	31
2.4.6.	Work Camp for Worker	31
2.4.7.	Project Security	32
2.4.8.	Supplying Project Facilities	32
2.4.9.	Cleanliness and Discipline	32
2.5.	SOIL INVESTIGATIONS AND TESTING	33
2.6.	TOPOGRAPHY SURVEY	33
2.7.	TEMPORARY ACCESS ROAD CONSTRUCTION.....	34
2.8.	CONSTRUCTION PRE-TESTING	34
2.9.	COORDINATION MEETINGS.....	34
2.10.	INSPECTION OF WORK.....	34
2.11.	SAFETY WORK FIELD PROTECTION.....	35
2.12.	HEALTH AND SAFETY ENVIRONMENT (HSE)	35

TECHNICAL SPESIFICATIONS

2.12.1. Protocol Prevention COVID-19 in Construction Project.....	40
2.13. CLEANING AND DEMOLITION	44

CHAPTER 3

EXCAVATIONS, LANDFILLINGS, AND REVETMENTS WORK

45

3.1. SOIL EXCAVATION WORK	45
3.1.1. General Explanation	45
3.1.2. Tolerance Dimensional	45
3.1.3. Safety Excavation Work	45
3.1.4. Workplace Condition.....	46
3.1.5. Correction Inappropriate Occupational	46
3.1.6. Building Utility	46
3.1.7. Workplace Restoration and Temporary Disposal of Work.....	46
3.1.8. Soil Excavation Monitoring Instrument	47
3.1.8.1. Installation Stages	47
3.1.8.2. Monitoring Instrument.....	48
3.2. LANDFILLING WORK	50
3.2.1. General.....	50
3.2.2. Source of Material Use	50
3.3. SOIL COMPACTION	51
3.3.1. Overlay and Compaction	51
3.3.2. Compacted Pile Protection	52
3.3.3. Compaction Trial	52
3.3.4. Measurement.....	53
3.4. SELECTION OF SOIL PILE FOR THE ROAD	53
3.4.1. Soil Pile Standard.....	53
3.4.2. Structure / Subgrade Pile Materials.....	54
3.4.3. Density of Structure / Subgrade Pilling.....	54
3.4.4. Pile Structure / Subgrade Monitoring.....	55
3.5. EXCAVATION DAN WASTE MOVEMENT	57
3.5.1. Explanation	57
3.5.2. Survey	58
3.5.3. Equipment	58
3.5.4. Tolerance Dimension	58
3.5.5. Additional Depth Excavation	58
3.5.6. Excavation Depth Reduction	59
3.5.7. Reporting and Entry.....	59
3.6. WASTE COMPACTION	59
3.6.1. Explanation	59
3.6.2. Equipment	60
3.6.3. Spread and Compaction	60
3.6.4. Compaction Trial	61
3.6.5. Dimension Tolerance	61
3.6.6. Reference Standards.....	61
3.6.7. Measurement.....	61

TECHNICAL SPESIFICATIONS

3.7.	LANDFILLING LIMESTONE WORK.....	62
3.7.1.	General.....	62
3.7.2.	Source of Material Use	62
3.7.3.	Compaction	62
3.7.4.	Compacted Pile Protection	63
3.7.5.	Overlay and Compaction	63
3.7.6.	Measurement.....	63
3.8.	LANDFILLING FERTILE SOIL	64
3.8.1.	General.....	64
3.8.2.	Source of Material Use	64
3.8.3.	Overlay and Compaction	65
3.8.4.	Compaction Trial	65
3.8.5.	Fertile Soil Type	67

CHAPTER 4 CIVIL WORKS..... 67

4.1.	CONCRETE WORK	67
4.1.1.	General.....	67
4.1.2.	Reference Standards.....	67
4.1.3.	Material.....	68
4.1.3.1.	Cement	68
4.1.3.2.	Fine Aggregate (Sand)	69
4.1.3.3.	Coarse Aggregate (Gravel or Coral)	69
4.1.3.4.	Reinforcement Steel	71
4.1.3.5.	Additional Mixture Material.....	74
4.1.3.6.	Water	74
4.1.4.	Concrete Quality	74
4.1.5.	Concrete Mix Design	74
4.1.6.	Concrete Making and Equipment	75
4.1.7.	Concrete Trial.....	75
4.1.8.	Casting.....	76
4.1.9.	Concrete Compressive Strength	79
4.1.10.	Rejection of Concrete Work.....	81
4.1.11.	Casting Implementation	81
4.1.11.1.	Concrete Transport and Casting	81
4.1.11.2.	Concrete Compaction.....	82
4.1.11.3.	The Protections towards the Natural Weather	83
4.1.12.	Treatment	83
4.1.13.	Defects on the	83
4.2.	STEEL WORK	84
4.2.1.	General.....	84
4.2.2.	Reference Standards.....	84
4.2.3.	Material.....	84
4.2.4.	Fabrication	85
4.2.5.	Bolt Installation	86
4.2.6.	Bolt Tightening.....	87

TECHNICAL SPESIFICATIONS

4.3.	LIGHTWEIGHT STEEL ROOF WORK	87
4.3.1.	General Requirements.....	87
4.3.2.	Material Requirements	87
4.3.3.	Pre-Construction Requirements	88
4.3.4.	Implementation Requirements.....	88
4.4.	ROAD WORK.....	89
4.4.1.	Pavement Road	89
4.4.1.1.	Sub Grade Preparation	89
4.4.1.2.	Sub Base Course Work	89
4.4.1.3.	Base Course Work	90
4.4.1.4.	Prime Coat	91
4.4.1.5.	Asphalt Concete (Surface Course).....	92
4.5.	CHANNEL WORK	92
4.5.1.	General.....	92
4.5.2.	Scope of Work.....	93
4.5.3.	Preparatory Work	93
4.5.4.	Execution Work	93

CHAPTER 5		
LEACHATE COLLECTION SYSTEM (LCS) AND LEACHATE TREATMENT PLANT (LTP)		94
5.1.	SCOPE OF WORK	94
5.1.1.	General.....	94
5.1.2.	Standard.....	94
5.2.	WORK FOR LEACHATE COLLECTION AND DISTRIBUTOR SYSTEM LANDFILL AREA.....	95
5.2.1.	General Requirements.....	95
5.2.2.	Pipeline Technical Requirements	95
5.2.3.	Scope of Pipeline Work.....	96
5.2.4.	The Things Need to be Considered	97
5.2.5.	Pipe Testing	97
5.2.6.	Changing the Directions of Laying Pipe.....	97
5.2.7.	Gravel's Work	97
5.3.	REHABILITATION WORK OF EXISTING LEACHATE TREATMENT PLANT (LTP).....	98
5.3.1.	General.....	98
5.3.2.	Sump Pit.....	98
5.3.3.	Anaerobic Pond	98
5.3.4.	Facultative Pond.....	98
5.3.5.	Maturation Pond	98
5.3.6.	Wetland Pond	99

TECHNICAL SPESIFICATIONS

CHAPTER 6	
COVER SOIL WORK.....	100
6.1. LANDFILLING FERTILE SOIL	100
6.1.1. General.....	100
6.1.2. Source of Material Use	100
6.1.3. Overlay and Compaction	100
6.1.4. Compaction Trial	101
6.1.5. Measurement.....	101
6.2. PROCUREMENT AND INSTALLATION OF GEOSYNTHETIC CLAY LINER (GCL) WORK.....	102
6.2.1. General.....	102
6.2.2. Storage and Installation	102
6.2.3. Specification Requirement	103
 CHAPTER 7	
SUPPORTING FACILITIES AND ARCHITECTURAL WORK	105
7.1. GENERAL.....	105
7.2. INSTALLATION WORK.....	105
7.3. FINISHING WALL WORK	106
7.3.1. Plastering Wall Work.....	106
7.3.2. Ceramic Wall Work	109
7.3.3. Aluminum Frame Gypsum Partition Work	110
7.4. FLOOR FINISHING WORK	112
7.4.1. Concrete Rebate Work	112
7.4.2. Ceramic Floor Work.....	113
7.5. FRAME, DOOR AND WINDOW WORK.....	114
7.5.1. Aluminum Frame Work.....	114
7.5.2. Alumunium Frame Doors and Windows Work	117
7.5.3. Teak Plywood Door Frame of Work	119
7.6. GLASS AND MIRROR WORK.....	120
7.7. KEY AND HANGER TOOLS WORK.....	123
7.8. CEILING WORK	124
7.8.1. Gypsum Board Ceiling Work	124
7.8.2. GRC Ceiling	124
7.9. FRAME COVER WORK	124
7.9.1. Wooden Cover Frame.....	124
7.10. ROOF COVER WORK.....	126
7.10.1. Zincalume/Metal Roof Cover	126
7.11. PAINTING WORK.....	127
7.12. SANITARY WORK.....	130
7.13. PLUMBING WORK	133

TECHNICAL SPESIFICATIONS

7.13.1. Clean Water Installation.....	133
7.13.2. Wastewater Installation	135

CHAPTER 8 GAS PIPE WORK 137

8.1. SCOPE OF WORK	137
8.1.1. Procurement and Installation of Perforated and Non-Perforated Solid (8" and 12") HDPE Pipes for Kawatuna Landfill	138
8.1.2. Procurement and Installation of Perforated and Non-Perforated Solid (6") HDPE Pipes for Kabonga Landfill	138
8.1.3. Gravel 50-70 mm for Gas Capture.....	139
8.1.4. Manufacture of gas pipe Casing dia 800 mm Plat thickness of at least 0.8 mm	139
8.1.5. Box Joint K-250 Work	140

CHAPTER 9 BUFFER ZONE AND PERIMETER FENCE WORK 140

9.1. BUFFER ZONE WORK.....	142
9.2. PLANTING WORKS.....	142
9.3.1. General Requirements.....	142
9.3.2. Preparation and Implementation Requirements	143
9.3. MAINTENANCE AND TREATMENT OF PLANTS.....	143
9.4.1. Maintenance Period.....	143
9.4.2. Initial Maintenance.....	143
9.4.3. Procedures for Post-Planting Maintenance	144
9.4.4. Maintenance Schedule.....	145
9.4. PERIMETER FENCE WORK	145

CHAPTER 10 MECHANICAL AND ELECTRICAL WORK 147

10.1. ELECTRICAL WORK.....	147
10.1.1. General.....	147
10.1.2. Electrical Installation	150
10.1.2.1. Scope of Work.....	150
10.1.2.2. Equipment and Material	150
10.1.2.3. Implementation	156
10.1.3. Pump.....	160
10.1.3.1. Pump Controller	160
10.1.3.2. Motor.....	160
10.1.3.3. Pump.....	160

TECHNICAL SPESIFICATIONS

10.1.3.4. PhotoVoltaic Panels	160
10.1.3.5. Investigation and Testing	161
10.1.4. Lightning Protection System	162

TECHNICAL SPESIFICATIONS

LIST OF TABLES

Table 1.	Occupational Health and Safety Management Measures	36
Table 2.	Groundwater Management Measures.....	37
Table 3.	Air Quality Management Measures.....	38
Table 4.	Noise and Vibration Management Measures	39
Table 5.	Traffic Management Measures.....	39
Table 6.	Waste Management Measures.....	39
Table 7.	Social Impact Management Measures	40
Table 8.	Material Geosynthetic Clay Liner Specifications.....	104
Table 9.	Softscape Detail Work.....	140
Table 10.	Planting Implementation	140
Table 11.	Pump Head and Capacity	162

TECHNICAL SPESIFICATIONS

LIST OF FIGURES

Figure 1.	Inclinometer Installment Detail.....	49
Figure 2.	Settlement Plate Installment Detail	57
Figure 3.	Leveling by Motor Grader	89
Figure 4.	Laying and Compaction.....	90
Figure 5.	Laying and Compaction.....	91
Figure 6.	Spraying Prime Coat	91
Figure 7.	Laying & Compaction Asphalt Concrete	92

TECHNICAL SPESIFICATIONS

CHAPTER 1 GENERAL SPECIFICATIONS

The implementation of the Consulting Service For The Design and Construction Supervision For Two (2) Landfills in Central Sulawesi will be carried out into a number of sub activities according to what will be listed in the contract documents with details to be further determined.

1.1. DESCRIPTION OF THE PROJECT

1.1.1. Location of the Project

The construction work site of Two Landfills in Central Sulawesi; (from now on referred to as “the Project”) is located in the Central Sulawesi Province (Palu City and Donggala District). The construction work sites are called Kawatuna Landfill (Palu City) and Kabonga Landfill (Donggala District).

The two landfills sit on a gently undulating hilly area covered with waste, bushes, and grasses, having a total area of about 16,75 ha for Kawatuna Landfill and 2,85 ha for Kabonga Landfill.

1.1.2. Access to the Project Site

The international air flight services for Palu and Donggala are not yet available, the nearest international airport is through Sultan Hasanuddin International Airport in Makassar, South Sulawesi.

The domestic air flight service for Palu is available at Mutiara SIS Al-Jufrie Airport, a 10-30 minute drive from Palu city. The seaport of Pantoloan is also functioning as an open port for Central Sulawesi.

The domestic air flight services for Donggala is not available. The Project site is linked to Palu City with the asphalt and concrete paved roads in good condition.

TECHNICAL SPESIFICATIONS

Climatic Conditions

The following general information indicates the conditions at the site which may be expected, but does not relieve the Contractor in anyway from the obligation to consult all available data. EMPLOYER and the Engineer accept no responsibility whatsoever for the accuracy of the information, and any risk consequent upon the interpretation of such data is to be entirely borne by the Contractor.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
<u>Average monthly rainfall at Palu (mm)</u>												
36,3	14,5	359,2	210	93,7	40,8	213,6	11,2	7,6	30,2	86,1	23,9	1.127,1
<u>Average monthly temperatures at Palu (°C)</u>												
28,2	28,4	27,8	27,8	28,3	27,1	27,4	28,3	28,7	28,5	29,2	28,7	28,2
<u>Average monthly rainfall at Donggala (mm)</u>												
418,5	18	59	196,5	86	226,5	70,5	12	5,5	187	50	104	1.433,5

1.1.3. Project Background

In 2018 Indonesia was struck by two particularly severe natural disasters: a 7.0 magnitude earthquake in West Nusa Tenggara (NTB) on August 5 and, less than eight weeks later - on September 28 - a 7.4 magnitude earthquake, followed by a tsunami and a rare phenomenon known as 'soil liquefaction', in Central Sulawesi.

In Central Sulawesi, over 2,096 people are known to have died as a result of the disaster, with more than 4,438 people seriously injured and 1,373 people missing. 68,451 houses were estimated to have been directly damaged and over 173,522 people are displaced. Affected public service infrastructure includes 176 health facilities (among which two hospitals, in Palu and Sigi, have been severely impacted) and 1,509 education buildings (ranging from elementary schools to universities). Local economic infrastructure has not been immune to damage: 13 market places and 9,718 Ha of agricultural land have been adversely impacted- with extensive losses being reported in other sectors, such as fisheries and public administration.

The programmatic response, Beyond the immediate humanitarian and relief assistance, EMPLOYER has initiated engagement with national and local governments and international partners in support of Central Sulawesi and NTB's recovery efforts. The Sulawesi / Lombok Programme for Earthquake and Tsunami Infrastructure Reconstruction Assistance ('PETRA' in short) has been designed to

TECHNICAL SPESIFICATIONS

contribute to such transition: from the immediate response to *longer-term recovery*.

- a) Rehabilitation and reconstruction of partially and fully damaged infrastructure for critical public services; and
- b) Rehabilitation of affected communities' economic infrastructure to promote more resilient and sustainable livelihoods.

1.2. GENERAL EXPLANATION

1.2.1. Description of Works

The work is determined based on the unity of types and forms of the results of the implementation as a whole based on their functions and uses, such as the work of building a Sanitary Landfill cell block or leachate treatment plant and others.

The implementation of activities on the landfill rehabilitation work can be divided into several sections of work, namely:

- Reconstruction of existing Leachate Treatment Plant (LTP);
- Rehabilitation of existing zone leachate pipelines;
- Structuring and closing the existing zone;
- New landfill zone and leachate collection system construction;
- Installation of gas pipe;
- Installation of drainage;
- Construction of internal access road;
- Construction and installation of fence and buffer zone;
- Construction of operational office;
- Construction of mechanical workshop;
- Construction of guardhouse;
- Construction of Material Recovery Facility (MRF);

1.2.2. Scope of Work

The Works to be executed under the Contract contains the execution, completion and maintenance of the following civil works, and the remedying of any defects therein, all as more particularly indicated and described in the Drawings and other documents comprising the Contract. The features of the Works are summarized as follows:

TECHNICAL SPESIFICATIONS

1.2.2.1. Reconstruction of Existing Leachate Treatment Plant (LTP)

1. Anaerobic Pond;
 - a) Pond construction using Concrete with quality K-250 (Cement Type 5);
2. Facultative Pond;
3. Maturation Pond;
 - a) Pond construction using Concrete with quality K-250 (Cement Type 5);
4. Wetland Pond;
 - a) Pond construction using Concrete with quality K-250 (Cement Type 5);
 - b) Soft gravel layer (diameter of 12-20 mm) with 20 cm thickness and rough gravel layer (diameter 20-40 mm) with 30 cm thickness;
 - c) Planting of water plants for example *akar wangi* and others that have the same type which also noted in design note;
5. Indicator Pond;
 - a) Pond construction using Concrete with quality K-250 concrete (Cement Type 5);
6. Sum Pit;
 - a) Soil Excavation;
 - b) Lean concrete of K-125 quality;
 - c) Sum Pit Concrete with the quality of K-250 (Cement Type 5);
7. LTP Area;
 - a) Asphalt pavement for road inspection;
 - b) Drainage channel with river stone masonry;
 - c) River Stone Masonry 1:3 for LTP Slope Protection.

1.2.2.2. Structuring and Closing the Existing Zone

- 1) Excavation, Waste Transfer;
- 2) Waste Compacting;
- 3) Gas Pipe;
 - a) Procurement and installation of perforated and non-perforated (12") HDPE gas pipes;
 - b) Procurement and installation of non-perforated galvanized (6") gas pipes;
 - c) Procurement and installation of a 12" solid HDPE gas pipe to a 6" galvanized pipe;
 - d) Gravel 50-70 mm for protecting the gas capture pipe;

TECHNICAL SPESIFICATIONS

- e) Manufacture of gas pipe casings from iron plates with a minimum diameter of 800 mm and a minimum plate thickness of at least 0.8 mm;
- f) Procurement and Installation of Gas Pipe Accessories;
- 4) Cover Soil;
 - a) intermediate cover of 30 cm.

1.2.2.3. New Landfill Zone and Leachate Collection System Construction

- 1) Excavation and Waste Transfer;
- 2) Landfilling limestone material is compacted;
- 3) Landfill Zone Work;
 - a) Landfilling limestone material is compacted;
 - b) Landfilling sand thickness of 10 cm;
 - c) GCL Procurement (1 layer of GCL consist of Geomembrane, Geotextile dan Bentonite) and Installation Work;
 - d) GCL Angkor (1 layer of GCL consist of Geomembrane, Geotextile dan Bentonite) Installation Work;
 - e) Procurement and Installation of half Perforated and non-perforated HDPE solid (16") pipe for Kawatuna;
 - f) Procurement and Installation of HDPE solid half Perforated (12") leachate pipes for Kawatuna;
 - g) Procurement and Installation of half Perforated and non-perforated HDPE solid (12") pipe for Kabonga;
 - h) Procurement and Installation of HDPE solid half Perforated (6") leachate pipes for Kabonga;
 - i) Procurement and Installation of Perforated HDPE solid (12") gas pipes for Kawatuna;
 - j) Procurement and Installation of Perforated HDPE solid (8") gas pipes for Kawatuna (Closed Zone);
 - k) Procurement and Installation of Perforated HDPE solid (6") gas pipes for Kabonga;
 - l) Gravel 50-70 mm for protecting the gas and leachate pipe;
 - m) Manufacture of gas pipe casings from iron plates with a minimum diameter of 800 mm and a minimum plate thickness of 0.8 mm;
 - n) K-175 Concrete Locking Works for locking GCL and K-225 for connection of gas pipes and leachate pipes.

TECHNICAL SPESIFICATIONS

1.2.2.4. Installation of Drainage

- 1) Construction of drainage channels measuring 570x300x400 mm with river stone masonry.

1.2.2.5. Construction of Internal Access Road

- 1) Form and upgrade the road with Class-A material
- 2) Pavement Road where specified in the drawings.

1.2.2.6. Construction and Installation of Fence and Buffer Zone

- 1) The Fence;
 - a) The fence from brick masonry;
 - b) The fence of the office area;
- 2) Buffer Zone;
 - a) Manohara Tree (trunk diameter min 5 cm, height min 3 m);
 - b) Japanese Knotweed Tree (trunk diameter min 5 cm, height min 3 m).

1.2.2.7. Supporting Infrastructure

- 1) Operational Office;
- 2) Mechanical Workshop;
- 3) Guardhouse;
- 4) Material Recovery Facility (MRF);
- 5) Lighting Work;
- 6) Electrical Installation;
 - a) Substation Building;
 - b) Panel;
 - c) NYFGBY Cable;
 - Existing Transformer to the MDB;
 - MDB to the LTP;
 - MDB to the Operational Office;
 - MDB to the Mechanical Workshop;
 - MDB to the Guardhouse;
 - MDB to the Material Recovery Facility (MRF);
 - d) Lightning protection and grounding.

TECHNICAL SPESIFICATIONS

- 7) Clean water installation of office area;
 - a) PVC Pipe AW dia 1”;
 - b) Water Tank 2000 lt;
 - c) Water Tower, t = 6 m;
 - d) Clean water pump with the capacity of 0,5 lt/sec, head = 15 m.

The Contractor shall perform all work as described this document and EMPLOYER strategies, plans and procedures to provide all services required to construct, install, test and deliver a complete and operable facility. The Contractor shall provide all adequate and competent construction management, personnel, supervision, staff, labour, construction planning, scheduling, documentation, construction quality, health safety & environment (HSE) and testing devices in order to complete the Work in accordance with the Standard of Performance.

1.2.3. Supervision

Supervision for this work will be carried out by Engineer (PT. Arkonin Engineering Manggala Pratama JV with PT. Indokoei International). This Engineer was assigned by the project owner which is UNDP.

The Engineer’s tasks are supervising the implementation of the work and the skills of the Contractor who carry out the work. Duties and orders can be given in oral and written and it is contained in a formal daily report.

The Engineer does not have the authority to exempt the Contractor from the obligations specified in the employment agreement (Contract).

The Engineer has to refuse the execution of a work or use of materials that do not meet the conditions in the contract documents, and reduce the power of the giver of the task not to order the demolition.

1.3. CONTRACTOR’S FURTHER SUBMISSIONS

1.3.1. Quality Control

Within no later than 10 (ten) days after being appointed by EMPLOYER, the Contractor must immediately send a work plan to be approved by EMPLOYER/Engineer, including:

TECHNICAL SPESIFICATIONS

- The schedule and sequence of work implementation and the methods that will be used in carrying out the work, to be discussed and agreed by EMPLOYER/Engineer;
- Full details of the organizational structure and personnel list that will be assigned in the field, for being verified and approved by EMPLOYER/Engineer accordance to personnel as specified in Contractor's bid;
- Personal schedule that is arranged in a table and diagram form;
- Material procurement schedule;
- Equipment procurement schedule;
- Procedure for implementation both technically and administratively;
- A training program of his personnel;
- Working format and form; and
- Procedure of the quality control activities related to the daily construction work on Site in collaboration with the Engineer

With the approval of the work plan or other information by EMPLOYER/Engineer, it does not mean exempting Contractor from a duty of responsibility stated in the contract.

1.3.2. Work Method Statements

Before the Contractor starts work on any Permanent or Temporary Works the contractor shall submit to the Engineer for review, comment or approval, Detailed Construction Method Statements. The Detailed Construction Method Statements must contain the following, but not limited to:

- Mobilization;
- Land development required for the landfill site, leachate treatment plant site, sorting plant site, and other related facilities;
- Landfill cells including, geosynthetic clay liner (GCL) and granular material layer and leachate collection pipe system;
- Leachate treatment plant;
- Sorting plant (MRF);
- Other building infrastructure;
- Electrical distribution system;
- Roads and road pavement, and drainage.

TECHNICAL SPESIFICATIONS

1.3.3. Daily Report

In the daily report, note the following:

- Progress of daily work, incoming materials and equipment, the number of workers who work, and weather conditions;
- Duties and orders that are given by the Engineer;
- Changes in the work carried out, either additional work or less work;
- The daily report has signatures from Contractor and The Engineer, and will be used as the next report file.

1.3.4. Weekly Report

The Contractor shall prepare and submit to the Engineer a weekly report in a format agreed with the Engineer, covering the following items:

- A detailed list of work proposed for the following week;
- A summary of progress for the preceding week against that planned;
- Records of Contractor's Equipment and labor;
- Cumulative value of progress this week (in per cent);
- Bill of Quantity volume and progress in each job;
- Progress/Weight in per cent for each work item (Last week, current week and total); and
- Complete a collection of daily reports in one week. The weekly report looks at the physical development of the building.

1.3.5. Monthly Report

The Contractor shall prepare and submit to the Engineer at regular monthly intervals and in a form to be agreed with the Engineer five (5) copies of the monthly report containing the following:

- Physical progress of the Works, in detailed form, up to the preceding month and estimated progress for the current month;
- Rate of progress based on the Working Program;
- An estimate of payment from the EMPLOYER to the Contractor for the current month;
- A summary of the Contractor's staff at the Site, technicians, skilled and unskilled labor employed for the Work in the preceding month;

TECHNICAL SPESIFICATIONS

- A summary of the Contractor's construction machinery used for the Work, which presents type and specifications, operation hours of each equipment in the preceding month, current situation of each equipment;
- Quantities of major items of materials and plant supplied and consumed in the preceding month with the inventory of such materials;
- Details of all material tests and their results;
- Progress photographs;
- Safety report;
- Weather report (weather details for daily temperature and rainfall are to be obtained from the adjacent meteorological station); and
- Information required by the Contractor.

The first monthly progress report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work that is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

1.3.6. Photographs

The Contractor shall prepare digital photographs and video (30 minutes duration) with Drone (minimum and/or equal to DJI Phantom 3 specification) and SLR Camera (12 Megapixels) showing the monthly progress of the Works and submit them to the Engineer as part of the Contractor's Monthly Report.

At 0%, 25%, 50%, 75%, 100% progress and at substantial completion of the Works the Contractor shall make arrangements to have photographs taken (from the same location on each occasion) of each sections of Works for submission to the Engineer. Each set of photographs submitted shall contain one photograph at every building and structure.

Prints of the photographs shall be at least 12cm x 8cm in size, suitably referenced and bound in albums of at least A4 size which shall have the date and names of the Works (or Sections). Name of Employer, the Engineer and the Contractor shall be

TECHNICAL SPESIFICATIONS

printed on the cover. One (1) set of electric file recorded in external hard disk with minimum capacity of 2 Terra Byte and three (3) sets of colour prints in albums shall be submitted to the Engineer within (30) days at 0%, 25%, 50%, 75% and 100% progress and at substantial completion of the Works.

1.4. DRAWINGS TO BE FURNISHED BY THE CONTRACTOR

1.4.1. Working Drawings

The Contractor shall submit Working Drawings following the requirements of clause 4.1 of the General Conditions of Contract, or as requested by the Engineer. This drawings apply for all temporary and permanent works to be constructed by or supplied and installed by Contractor, sub-contractors or suppliers.

All working Drawings to be submitted by the Contractor for the Engineer's approval shall be in English, and all dimensions shall be in the metric system. Symbols shall be in accordance with approved standards. All Drawings submitted for approval shall conform to ISO paper sizes A1 to A4. Title block and numbering shall be of approved by the Engineer.

The Contractor shall, except as specifically noted elsewhere in the Contract, submit the working Drawings in a logical order to the Engineer for review or approval at least one (1) week prior to the execution of the Works. Working drawings for the items which will be fabricated outside of Indonesia and shipped to the Site shall be submitted four (4) weeks prior to shipment of the items for the approval of the Engineer.

The term "Working Drawing" shall also be understood to include Design Drawings, Construction Drawings and Shop Drawings supported with design calculation notes and other information as necessary.

Working Drawings shall be prepared based upon the Contract Drawings and Specification requirements, and shall contain sufficient detail to show or include:

- (a) Working Drawings of temporary works for the construction of Permanent Works.
- (b) Working Drawings of the performances in the construction of Permanent Works as necessary for showing the construction methods.

TECHNICAL SPESIFICATIONS

- (c) Working Drawings of concrete reinforcement as well as bar bending and cutting list.
- (d) Working Drawings for building and architectural works, showing for details of concrete structures, reinforcement, foundation, walls, beams, columns, roofs, waterproof, drains, finishing, stairs, doors, ceiling and other items shown in the Contract Drawings.
- (e) Working Drawings for plumbing works.
- (f) Working Drawings for electrical works, showing for details of all necessary items for electrical works shown in the Contract Drawings.
- (g) Working drawings of all structural steel and associated metal works.
- (h) Working drawings of miscellaneous metal works.
- (i) Other drawings necessary for the performance of each part of the Works in accordance with the Contract.

The Contractor shall submit three (3) copies of drawings in a form approved by the Engineer, for the Engineer's review and approval not less than thirty (30) calendar days prior to the time he plans to start construction of any particular item of the Works. The Contractor shall also allow sufficient time for modification, correction and resubmission where so required by the Engineer. Of the Working Drawings approved by the Engineer, two (2) copies shall be retained by the Engineer, and the one (1) copy shall be returned marked "Approved", "Approved Except as Noted", or "Returned for Correction".

The notations "Approved" and "Approved Except as Noted" will authorize the Contractor to proceed with the work covered by such Drawings, subject to the correction as indicated thereon by the Engineer. When returned Drawings have the notation "Returned for Correction", the Contractor shall make the necessary revisions on the Drawings and shall resubmit prints for approval in the same manner as for new Drawings. This procedure shall be continued until the Drawings are marked "Approved". The Engineer tries to complete his review of the modified or re-submitted Drawings within fourteen (14) days; however, this will depend on the number and complexity thereof.

TECHNICAL SPESIFICATIONS

The Contractor shall keep one (1) copy of each approved Working Drawing on Site for the reference of the Engineer's staff and to mark, for later use in the preparation of As-built drawings, any amendments due to all Site changes, variations and instructions. These drawings shall be subject to the Engineer's regular inspection, and if not found to incorporate all amendments the Contractor shall update the drawings within three (3) working days.

Working Drawings from subcontractors, manufacturers, suppliers or the like, shall be thoroughly reviewed by the Contractor before submission to the Engineer. Such review by the Contractor shall include a study of all technical and dimensional aspects together with a review for co-ordination purposes to ensure that the work indicated on the Working drawings is correctly co-ordinated according to the constraints of all other related works.

The Engineer's review, comment or approval of working drawings shall not relieve the Contractor from any responsibility under the Contract, or from the necessity of furnishing material or performing work required by the Contract Drawings and Specifications that shall, in the event of any dispute, take precedence over Working Drawings.

Fabrication, manufacture or construction of any part of the works shall not commence until the working drawings have been approved in writing by the Engineer, No change shall be made to any drawing so approved without the permission of the Engineer. Unless otherwise stipulated in the Contract, all costs incurred by the Contractor in complying with the requirement of this Sub-clause shall be deemed to be included in relevant unit prices of the Works in the Bill of Quantity.

1.4.2. As-built Drawings

Before substantial completion and Taking-Over of the Works, the Contractor shall carry out an As-built survey of the Works and shall prepare As-built Drawings based on this survey and any amendments noted on the site record working drawings and submit the As-built drawings to the Engineer for his approval.

TECHNICAL SPESIFICATIONS

As-built drawings shall accurately represent the Works as constructed and show all dimensions and construction details, incorporating the effect of all Site changes, variations and instructions.

After making revision requested by the Engineer and getting approval from the Engineer, the Contractor shall prepare and submit in the following manner and quantity:

- One (1) set of original and five (5) sets of photocopy of As-built Drawings in A-3 size,
- Should the preceding two (2) sets of drawings submitted for Engineer's review be approved without any revision by the Engineer, the two (2) sets of the preceding drawings can be deemed to be as the final copy of the relevant As-built Drawings.
- One sets of the electronic document files in Hard Disk.
- The Works shall not be considered to be complete for the purposes of Taking Over until such As-Built Drawings have been submitted to and approved by the Engineer.

1.5. RISK OF INCREASING MATERIAL PRICES AND WAGES

- a. If during the implementation of the work there is a price increase, Contractor cannot submit a request for a review and calculation of the additional price or demand an additional fee. Contractor is deemed to have taken into account the factors mentioned above when submitting the bid price.
- b. Price increases should not be a reason to degrade or reduce the quality of work, reduce the volume of work, and / or slow down the time to complete the work as specified in the contract.
- c. If there is an increase in prices due to government policy in monetary or other fields, it will be determined later by EMPLOYER.

1.6. SIZES AND NOTATIONS

- a. All sizes in architectural, structural, mechanical and electrical drawings are finished sizes unless there are other provisions that will be explained later.
- b. If there are any differences or discrepancies in size and notation, it must be confirmed by the Engineer.

TECHNICAL SPESIFICATIONS

- c. Complete Construction Drawings (Architecture, Structure, Mechanical/Electrical, and technical specifications) can be obtained through the Engineer with the acknowledgement of EMPLOYER.
- d. Contractor must examine and understand the entire process and technical work so that they can adjust the program and work in an integrated and simultaneous manner.
- e. Contractor is required to provide SHOP DRAWINGS made in 3 (three) copies; 1 (one) set for Contractor, 1 (one) set for EMPLOYER and 1 (one) set for the Engineer.
- f. During the execution of work, Contractor is obliged to put marks in certain colour on the drawing of parts of the building that have been carried out, including if there are changes from the original drawing.
- g. Before each part of the work is started, Contractor is required to submit SHOP DRAWING and must obtain approval from EMPLOYER assisted by the Engineer.
- h. If there are differences between SHOP DRAWINGS and technical requirements/specifications, then the technical requirements/specifications prevail, unless specified otherwise by EMPLOYER/Engineer.
- i. If there are hesitance of the drawings, Contractor must submit to EMPLOYER/Engineer at least 1 (one) week before being implemented.
- j. The difference cannot be used as an excuse by Contractor to claim on the execution time.

1.7. LOADING LIMITS ON ROADS

The Contractor shall use every reasonable means to ensure that all loading limits and other limitations on roads are observed, and in the event of it being necessary to move any extraordinary load of equipment and plant or pre-construction unit or part of the Works the Contractor shall before moving such extraordinary load obtain all necessary permits and approvals from any authorities and comply with all other lawful requirements.

The Contractor shall abide by all limitation laws and regulations relating to the use of public transportation routes. He shall make any necessary repair or replacement as the case may be to any structure on the route which is damaged by the Contractor as a result of his own negligence. Such repair or replacement shall be satisfactory

TECHNICAL SPESIFICATIONS

to the Engineer or the appropriate government authorities. The limitations on public road shipments vary according to the conditions of the road and bridges. It shall be the Contractor's responsibility to confirm the limitation on all road shipments.

1.8. QUARRY AND CONCRETE AGGREGATES

The Contractor shall be responsible for the supply of aggregates of concrete, stone and rock materials in sufficient quality and quantity. These are used for concrete aggregate, stone masonry, gravel metalling of roads, drainage filter and so on.

The Contractor shall be responsible for finding out such sites for quarry and concrete aggregates. The Contractor shall make necessary arrangement of quality test for those materials in accordance with relevant Technical Specifications. The sampling for test shall be done in the presence of the Engineer. The Engineer keeps the right to instruct the kind and number of test at each site and at each sample. The Engineer shall also maintain the right to instruct the Contractor to carry out sampling and quality test whenever the Engineer determines necessary.

The Engineer's review, comment or approval of materials in this Clause shall not relieve the Contractor from any responsibility under the Contract or performing the Work required by the Technical Specifications.

The Contractor shall make his own arrangement, obtain necessary permit from authorities concerned, and pay all fees and royalties. Unless otherwise stipulated in the Contract, all costs incurred by Contractor in complying with requirement of this Clause shall be deemed to be included in relevant unit prices in the Bill of Quantities.

1.9. BORROW AREAS AND EMBANKMENT MATERIALS

The Contractor shall be responsible for the supply of all types of qualitative embankment materials in sufficient quality and quantity. The Contractor shall be responsible for finding out such sites for embankment materials. The Contractor shall make necessary arrangement of quality test for those materials in accordance with relevant Technical Specifications. The sampling for test shall be done in the presence of the Engineer. The Engineer keeps the right to instruct the kind and number of test at each site and at each sample. The Engineer shall also maintain

TECHNICAL SPESIFICATIONS

the right to instruct the Contractor to carry out sampling and quality test whenever the Engineer determines the necessity.

The Engineer's review, comment or approval of materials in this Clause shall not relieve the Contractor from any responsibility under the Contract or performing the Work required by the Technical Specifications.

The Contractor shall make his own arrangement, obtain necessary permit from authorities concerned, and pay all fees and royalties. Unless otherwise stipulated in the contract, all costs incurred by Contractor in complying with requirement of this Clause shall be deemed to be included in relevant unit prices in the Bill of Quantities.

1.10. WORKS TO BE KEPT CLEAR OF WATER

Excavated areas are to be properly drained and kept free from standing water. The Contractor shall construct and maintain all temporary drains, water sources and other works, and shall carry out all pumping that may be necessary to exclude water from the works when the construction is in progress. All such temporary works shall be removed at a time approved by the Engineer when the Works are completed.

All costs incurred by the Contractor in complying with the requirements of this Clause shall be deemed to be included in the unit prices for excavation and concrete except where a separate item for the temporary dewatering work at particular site appears in the Bill of Quantities.

1.11. BLASTING

The Contractor shall no make use for any explosive without the express permission in writing of the public or other authority concerned. The use and storage of all explosives in the storage shall be subject to their approval and shall be the satisfaction of the Engineer.

The Contractor shall further arrange at his own expense safety men and facilities for the protection of public and others during blasting operations. Where blasting is permitted it shall be carried out strictly in accordance with arrangement previously agreed in writing by the Engineer.

TECHNICAL SPESIFICATIONS

1.12. MATERIALS TO BE FURNISHED BY THE CONTRACTOR

1.12.1. Request for Approval

When making submissions of Requests for Approval to the Engineer the Contractor shall comply with the formal administrative procedures of the Engineer, regarding format, numbering and content of submissions.

All Requests for Approval submitted by the Contractor shall be clear and comprehensive to permit full and detailed review by the Consultant readily. The submissions for items of materials shall, therefore, include the following enclosures, prior to ordering, fabrication or construction:

- (a) Full documentary description, with manufacturers' original brochures.
- (b) Compliance listings showing in simple tabulated form, a listing of all related items of the Specification compared with the proposed item indicating "yes" or "no" for each.
- (c) Results of testing to demonstrate compliance with requirements.
- (d) Samples.
- (e) Schedule and methodology for any related factory and site testing.

The Contractor shall allow the Engineer at least 3 (three) days for review and response to any submitted Request for Approval.

1.12.2. Substitute Materials

In the case of Employer's priorities or other causes, materials or equipment required by the Specification become unavailable, substitute materials or equipment may be used provided that no substitute materials or equipment shall be used without the written approval of the UNDP/Engineer. This written approval shall state the amount of the adjustment, if any, to be made in favour of the UNDP/Engineer.

The UNDP/Engineer's decision as to where substitution shall be permitted and as to what substitute materials or equipment should be used shall be final and conclusive. If the approved substitute materials or equipment are of less value to the EMPLOYER or involve less cost to the Contractor than those specified, adjustment shall be made in favour of the EMPLOYER, and where the amount involved or the importance of the substitution warrants, a Variation Order as covered by the Conditions of

TECHNICAL SPESIFICATIONS

Contract will be issued, otherwise the adjustment will be handled by deduction from payments to the Contractor on the basis of prices stated in the written approval. No payments in excess of unit prices in the Bill of Quantities will be made because of substitution of one material or equipment for another, or because of the use of one alternative material or equipment in place of another.

Similarly, where a material or equipment has been specified by an manufacture's trade name, the product of another manufacturer will be accepted provided that, in the opinion of the Engineer, it is in all respects of equivalent or higher quality.

1.12.3. Rejected Materials

If any materials, constructional Plant or manufactured articles prove to be, in the judgement of the Engineer or as a result of testing, unsound or of inferior quality or in any way unsuitable for the works in which it is proposed to employ them, such materials, Plant or manufactured articles shall not be used in the Works but shall be branded, and shall forthwith be removed from the Site and replaced at the Contractor's expense and in each case as the Engineer shall direct.

1.13. PROTECTION OF THE ENVIRONMENT

The Contractor shall minimise, as far as is practically possible, the effects of all his and his subcontractors' activities upon the environment and shall implement and monitor measure to prevent:

(1) Contamination of ground surfaces, groundwater, surface water, rivers and streams

The Contractor shall keep the site free at all times from:

- Possibility of drop on material which could contaminate the ground surface from the transportation, asphalt mixing plant and road construction, vehicle service station, solid waste at any open land or in the location after cut and fill work.
- The concrete batching plant, outflow of base camp waste water, septic tank installation and absorption trench is assumed not to contaminate the ground water by a proper measure such as temporary drainage or pipe to a temporary treatment pond before flowing to the nearest river.

TECHNICAL SPESIFICATIONS

- The flow of site drainage and waste water should collected by a temporary drainage to the temporary treatment pond before flowing to the nearest river or streams.
- The Contractor shall build a shallow well (d = 8 - 10 m) at three points, two (2) near the riverside and one (1) near the settlement (housing) area of the people.

(2) Unsanitary or unsafe storage or discharge of drain, sewer and surface water

The Contractor shall keep the Site free at all times from surface water and effluents, from whatever cause arising. Contractor shall also provide such temporary drains, channels, ditches, soakaways and connections to drainage as are necessary to prevent pollution of agricultural land, existing drains, rivers or other watercourses.

(3) Unsanitary storage or disposal of solid wastes

The treatment to collect solid waste, the Contractor shall provide brick masonry with concrete frame disposal box by sufficient capacity at such strategic locations. The design and locations shall be proposed to the Engineer for approval. There are three classifications of solid waste standard of Gas Emission of old vehicle and the State Minister of Environment Decree.

- Organic waste (the notification color is green)
- Un-organic waste (the notification colour is yellow)
- The hazardous waste, i.e. un-used bulb lamp and neon lamp, un-used battery of vehicle, printer powder and etc. This type of waste will be managed by special treatment, or transported to the outside of the Project location. The Contractor shall submit the proposal for the Engineer approval.

(4) Emissions to air, including smoke, gases or smells

The Contractor shall follow good construction site practice guidelines, important to reduce emission to air, including smoke, gases, or smells. The Contractor shall conduct all his operations of the works such as to control emission level (including smoke and gasses) generated are kept with the limit

TECHNICAL SPESIFICATIONS

stated by the Indonesian government. This was stated in the decree of Minister of Environment Decree No. 5 Year 2006, regarding Standard of Gas Emission of Old vehicle and the Minister of Environment Decree No. 50 year 1996 according to Standard of Old dated November 29, 1996.

(5) Excessive energy and water consumption

The Contractor shall use an energy and water saving construction method as much as possible. The Contractor shall submit an energy plan and sources. The energy work method shall be attached with comparison calculation of energy consumption at day and night working time. If there is no case to connect with Municipal Water Agency supply, the Contractor shall set up a recycling water consumption system by construction of one (1) deep well for further water supply use.

(6) Damage to the existing infrastructures such as roads, bridges and etc., by movement of heavy vehicles

As for the physical environmental components, disturbance of amenity and impacts on public facilities, environmental monitoring shall be undertaken by direct observation. The Contractor shall apply mitigation measures to damages, and provide temporary reinforcement of roads at vulnerable location and repair damages caused by his vehicles. The observation method will be used for this matter to investigate all damages which occurred from the Project activities. It is necessary to conduct a procedure/system from the people which having any complaint to the Project. On the regular meeting this complaints will be discussed and instructed to the Contractor to repair all the reliable damages.

(7) Dust, noise and vibration level increase as a result of construction activities

The Contractor shall follow good construction site practice guidelines to reduce dust, noise, and vibration levels. The Contractor shall conduct all his operation of the works such as noise levels and dust generated are kept with the limit stated in the degree of the State Minister of Environmental Number: Kep-48/Men LH/1996, dated October 25, 2006.

The Contractor shall sprinkle clean water over surface of temporary road or access roads by use of tank-trucks regularly to minimize occurrence of dust hazard to the residents during the dry season.

TECHNICAL SPESIFICATIONS

(8) Social jealousy caused by the use of imported labor

The Contractor shall be encouraged to recruit local labor whenever appropriate. In relation to the local government appeal to use the local manpower, the Contractor shall recruit the local labor as well as could fulfil the working requirement. In the monthly report the Contractor shall report the employment of workers, which consist of local labor and imported labor.

These requirements shall be met through the constant and careful attention by the Contractor's management and staff of all Site and off-Site activities, and by instruction to all staff and labor in these matters.

1.14. OTHER GENERAL REQUIREMENTS

The work that must be carried out by Contractor is:

- a. Procurement, security and supervision of all kinds of equipment, tools and materials used in the implementation.
- b. Installation, testing and maintenance of all materials and equipment within the specified time limit.
- c. Workforce deployment according to needs, expertise and skills.
- d. Overtime work if working conditions require it.

TECHNICAL SPESIFICATIONS

CHAPTER 2

TECHNICAL GENERAL SPECIFICATIONS

Before starting the work, the contractor must prepare all the necessary things related to this work implementation, except for certain considerations and with the approval of the Consultant/Employer. The contractor must have completed licensing with the environment, local government and other relevant agencies related to the implementation of this work. All costs required regarding licensing and outreach and other work (Provision of Site Office, Labor Camp, Warehouse, Temporary Access Roads, Documentation and Reporting) are the responsibility of the contractor and should be included in the bid price.

2.1. PREPARATORY WORK

2.1.1. Site Information

Before starting the work, Contractor must understand the conditions of the site or other things that might affect the implementation of the work and must have taken into account all the consequences. Contractor must pay special attention to the regulations on the location of the workplace, material placement, security and continuity of operations during the work.

Contractor must study carefully all parts of the drawings, Technical Specifications and agenda in the bidding document, in order to adjust to the field conditions so that the work can be completed properly.

2.1.2. Socialization

The Contractor shall carry out Public Consultation and Socialization meeting at the construction site in cooperation with the Engineer. The Contractor shall invite participant and to explain about the overall work schedule and work method at the village level as follows:

- (a) Survey works
- (b) Respective construction works with its scale and construction periods

The meeting shall be carried out at least one (1) week before the commencement of the Works. The schedule of meeting and contents of the materials for the meeting shall be submitted to the Engineer for approval at least two (2) weeks before the

TECHNICAL SPESIFICATIONS

meeting unless otherwise directed by the Engineer. The results of Public Consultation and Socialization shall be reported to the Engineer within two (2) weeks after the meeting.

All cost incurred by the Contractor to carryout Public Consultations and Socialization described in the above shall be deemed to be included in the Lamp Sum Price therefore in the Bill of Quantity.

2.1.3. Technical Regulations

Some rules that are used for this work include:

- a. Indonesia Industrial Standard (SNI); All SNI related to the quality of building and landfill construction;
- b. Instruksi Menteri PUPR Nomor: 02/IN/M/2020 tentang Protokol Pencegahan Penyebaran Corona Virus Desease 2019 (COVID-19) dalam Penyelenggaraan Jasa Konstruksi;
- c. All Standards / Codes/ Guidelines that can be implemented on specific works which issued by Institutions / Professional Associations / Producers Associations / National Testing Institutions or from other countries, to the extent that these are deemed relevant;
- d. Other Standards, Codes of Practice and Specifications issued by International Bodies or Organisations may also be referred to where particularly stated in the Specification or where approved in writing by the Engineer. Examples of other acceptable standards are given below:
 - 'AASHTO' or 'AASHO' means the American Association of State Highway and Transportation Officials.
 - 'ACI' means the American Concrete Institute.
 - 'AGMA' means the American Gear Manufacturers Association.
 - 'AISC' means the American Institute of Steel Construction.
 - 'AISI' means the American Iron and Steel Institute.
 - 'ANSI' means the American National Standard Institute.
 - 'ASME' means the American Society of Mechanical Engineer.
 - 'ASTM' means American Society for Testing and Materials.
 - 'AWS' means the American Welding Society.
 - 'AWWA' means the American Water Works Association.

TECHNICAL SPESIFICATIONS

- 'BS' means the British Standard Institution.
- 'DIN' means the Deutsches Institut fur Normalisierung.
- 'IEC' means the International Electrotechnical Commission.
- 'IEEE' means the Institute of Electrical and Electronics Engineer.
- 'ISO' means the International Standards Organization.
- 'NACE' means the National Association of Corrosion Engineer.
- 'NEC' means the National Electrical Code.
- 'NEMA' means the National Electrical Manufacturers Association.
- 'USBR' means the United States Bureau of Reclamation.

These references shall in every case be deemed to include the latest edition or issue of such Standards and shall be submitted in their official English translations.

If it turns out that in the work plan and these requirements there are contradictions/abnormalities/deviations from the regulations as stated in paragraph (1) above, then Contractor shall use requirements stated in those standards.

2.1.4. Land Clearing and Leveling of Supporting Building Area

During the implementation period of the work, the Contractor must maintain the Work free from the accumulation of the remaining building materials, dirt and rubbish, which are caused by the work implementation. At the time of work completion, all remaining building materials and unused materials, set, equipment and machinery must removed from the Work area in ready to use condition and accepted by Engineer and EMPLOYER.

1. Contractors are not permitted to dispose of hazardous waste, such as chemical liquids, oil and similar wastes into existing channels or sanitation.
2. The contractor is not allowed to dispose of the remaining building materials into the sea or waterways.

2.1.5. Stockyard Rent

In the case of maintaining and storing work equipment, materials and others, the Contractor is obliged to rent a place as a location for storage and interim storage (material alert) by taking into account the transportation lane and the mobility

TECHNICAL SPESIFICATIONS

flow of the material and its transport facilities with a close location enough to the work location.

2.2. MOBILIZATION AND DEMOBILIZATION EQUIPMENT

Mobilization relates to the transportation of equipment and personnel Contractor from the origin place to the field where it will be used, based on the construction program and schedule proposed by the contractor.

Demobilization must be made after written approval from EMPLOYER and is the basis for the removal of contractor equipment from the field. The contractor must complete the equipment needed and required for the execution of the work. If considered important in carrying out the work appropriates with the contract, the EMPLOYER may instruct the contractor to complete additional equipment.

a. Labor Mobilization

Labors for Landfill Rehabilitation development are mobilized no later than 2 weeks after assignment.

b. Mobilization and Demobilization of Major Equipments that must be provided at minimum includes:

- Excavator;
- Dumptruck;
- Water tanker;
- Bulldozer;
- Whell Loader;
- Motor Grader;
- Vibro Roller;
- Sheep Foot Roller;
- Etc.

c. Contractor must prepare and procure work equipment and auxiliary equipment that will be used at the project site in accordance with the scope of work and take into account all transportation costs.

d. Contractor must maintain order and smoothness during the journey of heavy equipment that uses public roads so as not to disturb traffic.

e. The Engineer / EMPLOYER has the right to order and add equipment or reject equipment that is not appropriate or does not meet the requirements.

TECHNICAL SPESIFICATIONS

- f. When the work has been completed, Contractor is obliged to immediately demobilize all the equipment, repair the damage caused and clean up all the dirt/debris caused by the process of mobilization/demobilization.
- g. In addition to providing the necessary tools as intended in paragraph (1), Contractor must provide supporting tools so that they can work in any condition, such as tents for working on rainy days, scaffolding on the sides outside buildings or other places that need it, as well as Occupational Health and Safety (OHS) equipment and others.
- h. Contractor must demobilize after the contract is completed. As for the demobilization activities carried out, including the dismantling of all installation and construction equipment and all the excess materials, are based on the approval of the supervision Engineer.

2.3. INSTALLATION OF PROJECT SIGNBOARD

- a. The contractor must install the project signboard with the contents/writing appropriates with the specified format, the project signboard must be installed in a location that is easily visible and coordinated with the Engineer and EMPLOYER.
- b. Project signboard by the size of 80x120 cm made of plywood with a thickness of 12 mm or other materials appropriates with the provisions and required by Engineer and EMPLOYER and installed on wooden/iron posts and planted firmly into the ground.

2.4. CONTRACTOR'S FACILITIES

2.4.1. Contractor's Temporary Facilities

The Contractor shall provide, maintain and subsequently remove Temporary Facilities as the following but not limited to necessary for the execution of the Works.

- (a) Office buildings (Contractor's Site Office);
- (b) Stores;
- (c) Workshops;
- (d) Motor pools and repair shops;
- (e) Laboratory;
- (f) Contractor's staff quarters;
- (g) Contractor's labor camp;

TECHNICAL SPESIFICATIONS

- (h) Temporary fencing;
- (i) Others as required.

In addition, within the Contractor's Site Offices, the Contractor shall provide and furnish the adequately light and air-conditioned rooms for the exclusive use of the Engineer's staff and Engineer staff through the construction period. A minimum space shall be 30 m² for each room and following facilities shall be provided for each room:

- (a) 4 sets of working desks with chair;
- (b) 1 set of meeting table with 6 chairs;
- (c) 1 set of water dispenser (cool & hot water);
- (d) 1 set of photocopy machine (Max. A3 size) with voltage stabilizer (1set for Engineer and Engineer use).

The Contractor shall be responsible for finding out such areas for the Temporary Facilities in or reasonably near the Site, and shall make his own arrangement to obtain necessary permit from authorise concerned, and pay all fees and costs as may be required.

The Contractor shall maintain all Temporary Facilities in a condition fit for their purpose and in a clean, safe and sanitary condition. Consequently the Contractor shall be responsible for sewage and waste disposal, cleaning and the provision of fire extinguishers.

The Contractor shall provide a sufficient clean water supply system to all the Temporary Facilities and other places of work on the Site. The Contractor's water supply system shall be subject to the Engineer's approval.

The Contractor shall make his own arrangements for a sufficient electricity supply to all the Temporary Facilities and to and about the Site for the construction of the Works. The Contractor shall install, operate and maintain the electricity supply, including generating plant, equipment, wiring and fittings as are necessary, to ensure a sufficient supply of electricity until the end of the Defects Notification Period, and then remove the installations upon completion.

TECHNICAL SPESIFICATIONS

Within thirty (30) days of receipt of the Notice to Proceed, the Contractor shall submit to the Engineer for his approval, detailed construction plan of the Temporary Facilities, which contains location and layout plan of the buildings, stores, motor pools, laboratory, Engineer's Site Office, and water and electric supply systems.

Within thirty (30) days after his receipt of Engineer's approval, the Contractor shall start the construction works of the Temporary Facilities, and complete within one hundred twenty (120) days.

2.4.2. Communication System

The Contractor is responsible to install one each of public telephone system at the Contractor's Site Office and the Engineer's Site Office respectively for the communication from and to the Engineer's Main Offices, Engineer's Site Office at the Contractor's own expense. If the public telephone system is not available, the contractor shall provide another telecommunication system accepted by the Engineer. At the end of the Defect Liability Period, the Contractor shall remove the communication system.

The temporary communication system including the above mobile hand phones shall allow free use of their employees and workman, or any persons authorised to be on the Site by the Employer or the Engineer, except for the charge of international communication.

2.4.3. Contractor's Laboratory and Laboratory Equipment

The Contractor shall provide a fully serviced, equipped and staffed laboratory on the Site within ninety (90) days of his receipt of the Engineer's approval as stated in the Bill of Quantity or directed by the Engineer.

The laboratory shall be equipped to carry out all sampling and testing stated in the Specifications. The Contractor shall make arrangements with an approved testing agency to carry out the others tests or directed by the Engineer.

Within sixty (60) days of the Contractor's receipt of the Notice to Proceed he shall submit, to the Engineer for his approval, details of the laboratory construction and a complete list of all equipment, apparatus, and incidentals and consumables to be provided and maintained throughout the Contract. The equipment shall include

TECHNICAL SPESIFICATIONS

such items as, but not be limited to, the following. The number of equipment shall be sufficient to carry out all sampling and testing stated in the Specifications.

- (a) Concrete cylinder moulds for compression strength test (JIS A 1108, JIS A 1132) or equivalent;
- (b) Mortar moulds (JIS A 1129, JIS A 1132);
- (c) Small electric concrete mixer;
- (d) Aggregate sieves (JIS A 1102);
- (e) Concrete slump test equipment (JIS A 1101);
- (f) Air meter for test JIS A 1116;
- (g) Concrete curing tank (large);
- (h) Soil sieves (JIS A 1204);
- (i) Field density test equipment (JIS A 1214);
- (j) Soil compaction test equipment (JIS A 1210);
- (k) Ovens (not less than 20 liter capacity);
- (l) Scales (100 kg, 50 kg, 1 kg, 100 g);
- (m) Pans for materials (steel made, 1.5 x 1.5 m);
- (n) Thermometers;
- (o) Atterberg Limits Test Equipment (JIS A1205);
- (p) Cone Penetrometer (JIS A 1228).

The Contractor shall regularly check and re-calibrate all laboratory equipment to ensure that at all times it indicates true and accurate readings.

All other tests required by the Specifications and which cannot be carried out in the Contractor's laboratory shall be undertaken by an approved testing agency in accordance with the Engineer's instruction, and the cost of all fees and charges shall be deemed to be included in the relevant unit prices.

The Contractor shall provide a fully serviced, equipped and staffed laboratory on the Site within sixty (60) days of his receipt of the Engineer's approval as stated in the Bill of Quantity or directed by the Engineer. The Contractor shall transfer the laboratory equipment to the Engineer when the works have been completed.

TECHNICAL SPESIFICATIONS

2.4.4. Medical and First Aid Facilities and HIV/AIDS Prevention Program

The Contractor shall make all necessary arrangements on Site for first-aid facilities in a suitable building or as necessary or as stipulated in relevant regulations of authorities concerned. The first-aid facility shall be available for all the Contractor's employees and those of his subcontractors.

The Contractor shall also furnishing and maintaining the necessary HIV/AIDS prevention program in compliance with the requirements stipulated in Clause 6.7 of the General Conditions of Contract.

2.4.5. Working Water Facilities and Lighting

1. For the sake of carrying out the work during the project, Contractor must calculate the cost of providing clean water for working water, drinking water for workers and bathroom water.
2. The water in question is clean, whether coming from PAM or water sources, as well as the procurement and installation of water distribution pipes to carry out work and for the site office, Contractor offices, bathrooms/toilets or other places deemed necessary.
3. Contractor must also provide a source of electricity to carry out the work, the needs of Project Supervisor/Engineer and lighting of the project at night as security during the project lasts 24 hours a day.
4. Procurement of lighting can be obtained from the PLN connection or by procuring a Generator Set, and all permits for such work are the responsibility of Contractor. The procurement of lighting facilities includes the procurement and installation of installations and armature, electrical sockets and switches/panels.

2.4.6. Work Camp for Worker

1. Contractor must make work camp and building a place for rest and place of prayer for Contractor's workers.
2. Work station is a building with an area that is sufficient to work for a worker/executive worker and has a fairly good condition, protected from the influence of weather that can hamper the smooth work.

TECHNICAL SPESIFICATIONS

2.4.7. Project Security

1. Contractor must guarantee the safety of the project, both for Contractor belongings, The Engineer project manager, as well as maintaining the integrity of the existing buildings from the disruption of the executing workers or damage due to work implementation.
2. Contractor must place security officers 24 hours a day, divided into 3 (three) shifts, and must always carry out security checks every day after finishing work.
3. To control and maintain the working order of its workers, each Contractor worker is required to wear a special identification that must be worn on the part of the body that is easily visible to security personnel.
4. Contractor's workers are not permitted to stay overnight on site unless security officers are on duty at night.

2.4.8. Supplying Project Facilities

1. Contractor must also calculate the consumption costs for meetings / meetings with EMPLOYER or his representative and the guest assigners who are interested in the project.
2. Fire extinguisher units must be placed on each floor of the building with a radius of approximately 50 meters, inside the Project office and other places that require them.

2.4.9. Cleanliness and Discipline

1. Hoarding of materials in warehouses or the yards must be arranged in such a way as not to interfere safety of work/public and also to facilitate the inspection and research of materials by the Engineer and EMPLOYER.
2. Contractor is required to make urinals and toilets for workers in certain places approved by The Engineer to ensure cleanliness and health in the project.
3. Implementing workers are not permitted to:
 - a. Stay overnight at a place of work except with the permission of the Engineer / EMPLOYER.
 - b. Cook at work except with the permission of the Engineer.
 - c. Bring in food, drink, cigarette vendors, etc. at work.
 - d. Exiting the work location freely.
4. Other regulations regarding the order will be issued by the Engineer / EMPLOYER at the time of implementation.

TECHNICAL SPESIFICATIONS

2.5. SOIL INVESTIGATIONS AND TESTING

If deemed necessary, the Contractor should conduct a land investigation to obtain underground information for landfill construction planning outside the 100 m radius of the soil investigation that has been carried out by the Consultant and the Geological Agency.

In terms of determining the location point that becomes the soil investigation location can be adjusted to the field conditions approved by the Engineer and EMPLOYER.

Laboratory Analysis and Reports on Laboratory Results are included in the price of implementing job offers appropriates with the provisions of the Government Regulation of the Republic of Indonesia Number 61 of 2002, concerning Tariffs on Non-Tax State Revenues Applicable to the Department of Settlements and Regional Infrastructure.

2.6. TOPOGRAPHY SURVEY

The contractor must conduct a Topographic Survey or Mapping that aims to create a topographic map that contains the latest information on the state of the land surface or mapped area with adequate contour intervals and can represent contours in the work area for both sloping and flat land.

The information presented includes physical/detail conditions both natural and man-made as well as the state of relief (high and low) surface of the land or area of the measurement area. The need to present the data on topographic survey results must refer to planning documents and as instructed by the Engineer and EMPLOYER.

TECHNICAL SPESIFICATIONS

2.7. TEMPORARY ACCESS ROAD CONSTRUCTION

The construction of this temporary access road, covering the roads needed to bring in the heavy equipment, work roads and access roads to the Directors keet or work area, which is the responsibility of the Contractor.

After all work is completed, the Contractor must be willing to repair it in the event of damage, and it is the Contractor's responsibility to return the road construction to its original position.

2.8. CONSTRUCTION PRE-TESTING

Some tests that must be done before the work is done are:

- a. Field inspection of soil compaction trial results or subbase (or layer resulting from grading work). The type of inspection is to use ASTM D 1556 standard sand cone for every 1000 m² of compacted land area.
- b. Paving test with K-225 and K-350.
- c. Concrete sampling test K-175, K-225, K-250 and K-350.
- d. Limestone test uses Indonesian National Standard (SNI) 1738:2012.

2.9. COORDINATION MEETINGS

Coordination Meetings are held periodically during the construction process, both weekly and monthly in the context of monitoring and evaluating the implementation of work in the field, it is carried out until the completion of the construction work.

If needed, coordination meetings can also be held at certain times according to needs or appropriates with the direction of the Engineer and EMPLOYER.

2.10. INSPECTION OF WORK

The work inspection process must be in accordance with the technical specifications and basic design in the contract documents as well as the conditions listed in the planning document that has been approved by the Engineer and the EMPLOYER.

TECHNICAL SPESIFICATIONS

2.11. SAFETY WORK FIELD PROTECTION

- a. The contractor is required to maintain field security for the goods belonging to the project, Engineer and EMPLOYER and those belonging to third parties in the field.
- b. For these purposes, the contractor must make a safety fence made of wood or other materials at the expense of the contractor.
- c. If there is a loss of building materials that have been approved by the Engineer and EMPLOYER, both those that have been installed and those that have not, it becomes the responsibility of the contractor and are not counted as additional work.
- d. If the wildfire is happened, the contractor is responsible for the consequences, both in the form of goods and life safety. For this reason, the contractor is required to provide ready-to-use fire extinguishers which are placed in locations that will be determined later by the Engineer and EMPLOYER and are recommended to insure against fire hazards.

2.12. HEALTH AND SAFETY ENVIRONMENT (HSE)

- a. Provide labour, materials, equipment and other assistive devices to carry out work as stated in this technical specifications with good and perfect results.
- b. The price of this work is included in the preparatory work scope, if it is not listed on the work item then this work remains an obligation that must be carried out.
- c. Indicators of success are the implementation of the project in an orderly, safe and no work accidents that occur in the project environment.
- d. The Construction Contract must provide for the implementation of the following plans:
 - Occupational Health and Safety
 - Groundwater
 - Air Quality
 - Noise and Vibration
 - Erosion, Drainage and Sediment Control
 - Traffic Management
 - Waste Management
 - Monitoring Social Impacts, and
 - Stakeholder Engagement

TECHNICAL SPESIFICATIONS

Environmental quality monitoring is carried out at the location that has the potential to cause pollution impacts on environmental components such as air quality, noise, vibration, surface water, groundwater, as well as social-economic and public health.

The scope of work includes the following matters:

- 1) Doing work preparations;
- 2) Collecting data in the field both primary and secondary;
- 3) Analyze the data obtained and provide recommendations for follow up to environmental management.

Monitoring of environmental quality with the parameters above for ambient air, water (groundwater and surface water), noise and odour is done in 2 points for each landfill area. The following is a monitoring table related to environmental impacts that must be monitored and managed by when pre-construction, during construction and operation phase, including:

Table 1. Occupational Health and Safety Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
OHS1: Health and safety issue of the construction workers	OHS1.1 Establishment of an OHS organisation with clear roles, responsibilities, authority and resources.	Project start	Project manager	Annual review of compliance with key regulations.
	OHS1.2 Conduct safety induction before work start. PPE utilization for workers. Conduct regular site inspections, submit reports and oversee corrective action.	Construction and operation phases	Project manager	Monthly or as directed by EMPLOYER

TECHNICAL SPESIFICATIONS

Table 2. Groundwater Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
GW1: Increase of gross pollutants, hydrocarbons, metals and other chemical pollutants into the groundwater and/or surface water environment.	GW1.1 Conduct regular surface and groundwater quality monitoring in the location where the groundwater is likely to be impacted, including assessing the changes to groundwater quality.	Construction and operation phases	Project manager	Two monthly or as directed by EMPLOYER.
	GW1.2: Prevent contaminated surface water from entering aquifers via boreholes and wells - protect from runoff and flooding and keep surrounds clean.	All phases	All personnel	On-going
	GW1.3: Designated areas for storage of fuels, oils, chemicals or other hazardous liquids should have compacted impermeable bases and be surrounded by a bund to contain any spillage. Refuelling to be undertaken in areas away from water systems.	Entire construction and operation phase	All personnel	On-going

TECHNICAL SPESIFICATIONS

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
	GW1.4: Check all vehicles, equipment and material storage areas daily for possible fuel, oil and chemical leaks. Undertake refuelling at designated places away from water systems.	All phases	All personnel	Daily and maintain records
	GW 1.5: Minimise the use of herbicides, pesticides and other chemicals and use only biodegradable herbicides that have minimal impact on water quality and fauna. Use only as per directions.	All phases	All personnel	Monthly reporting to EMPLOYER

Table 3. Air Quality Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
AQ1: Increase in dust levels at sensitive receptors.	AQ1.1 Implement effective dust management measures in all areas during design, construction and operation.	Pre and during construction	All personnel	Daily and maintain records
	AQ1.2: Source sufficient water of suitable quality for dust suppression activities complying with any water restrictions.	During construction	Project manager	Daily and maintain records

TECHNICAL SPESIFICATIONS

Table 4. Noise and Vibration Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
N1: Increased noise levels	N1.1 Select plant and equipment and specific design work practices to ensure that noise emissions are minimized during construction and operation.	Pre and during construction	Contractor	Maintain records
	N1.2: Specific noise reduction devices such as silencers and mufflers shall be installed as appropriate to site plant and equipment.	Pre and during construction	Contractor	Maintain records
	N1.3 Consultation with nearby residents in advance of construction if noise-generating construction activities are to be carried out.	Construction phase	All personnel	Daily and maintain records
	N1.4 All incidents, complaints and non-compliances related to noise shall be reported in accordance with the site incident reporting procedures and summarized in the register.	Construction phase	Project manager	Maintain records
N2. Vibration due to construction	N2.1 Identify properties and structures that will be sensitive to vibration impacts resulting from construction and operation of the project.	Pre and during construction	Contractor	Maintain records
	N2.2 Design to give due regard to temporary and permanent mitigation measures for noise and vibration from construction and operational vibration impacts.	Pre-construction	Contractor	Maintain records
	N1.4 All incidents, complaints and non-compliances related to vibration shall be reported in accordance with the site incident reporting procedures and summarized in the register.	Construction phase	Project manager	Maintain records

Table 5. Traffic Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
TM1: Disruption due to Project vehicular traffic.	TM1.1: Consultation with the local communities concerning measures to minimise adverse environmental and social impacts due to project traffic.	Pre and during construction phase	Project manager	Maintain records
	TM1.2: Ensure project vehicles are properly serviced and maintained especially concerning the noise and engine emissions.	Construction phase	Project manager	Maintain records

TECHNICAL SPESIFICATIONS

Table 6. Waste Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
WM1: Production of waste and excessive use of resources	WM1.1: Preference shall be given to materials that can be used to construct the project that would reduce the direct and indirect waste generated.	Pre and during construction	Contractor	Maintain records
	WM1.2: Daily waste management practices shall be carried out.	Pre-construction	Contractor	Maintain records
	WM1.3: The use of construction materials shall be optimised and where possible a recycling policy adopted.	Entire construction and operation phase	Contractor	Maintain records
	WM1.4: Separate waste streams shall be maintained i.e. general domestic waste, construction and contaminated waste. Specific areas on site shall be designated for the temporary management of the various waste streams.	During construction	Contractor	Daily and maintain records
	WM1.5: Any contaminated waste shall be disposed of at an approved facility.	During construction	Contractor	Maintain records
	WM1.6: Fuel and lubricant leakages from vehicles and plant shall be immediately rectified.	Entire construction and operation phase	Contractor	Maintain records
	WM1.7: Disposal of waste shall be carried out in accordance with the Government of Indonesia requirements.	During construction	Contractor	Maintain records

Table 7. Social Impact Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
D1: Negative perception and/or social tension related to the change of land use or GBVH incident	D1.1: Carry out community consultation on the purpose and benefits of making changes to land use.	Pre-construction	Project manager	Maintain records
	D1.2: Get community buy-in on any change of land use.	Pre-construction	Project manager	Maintain records
	D1.3: Ensure compliance with gender-sensitive Grievance Redress Mechanism process.	Entire construction and operation phase	Project manager	Maintain records
D2: Public nuisance caused by construction/operation activities (e.g. noise, dust etc)	D2.1: Carry out community consultation before undertaking activities.	Pre-construction	Project manager	Maintain records
	D2.2: Implement appropriate management plans (groundwater, air, EDSCP).	Construction and operation	Site supervisor	Daily and maintain records
	D2.3: Ensure compliance with the	Entire construction	Project manager	Maintain records

TECHNICAL SPESIFICATIONS

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
	Grievance Redress Mechanism process.	and operation phase		

2.12.1. Protocol Prevention COVID-19 in Construction Project

1. Introduction

- a. This protocol is intended as a general guide for owner/user/organizer with consultant, contractor, Subcontractor, Vendor/Supplier and Fabricator, foreman and workers in preventing COVID-19 outbreak in the construction project.
- b. This protocol is part of the overall policy to realize the safety of construction. Safety of construction is occupational safety and health; Public safety; and safety of the environment in every phase of construction (life cycle of building and infrastructure development).
- c. This protocol is valid in construction projects organized by the Government and/or local governments and/or National State-Owned Enterprises (BUMN), as well as private and/or joint investments. Each stakeholder in a construction project can follow up on the implementation of this Protocol following their respective company policies.

2. Establishment Preventive Task Force COVID-19

- a. The owner/user/organizer with consultant Supervisor and/or contractor shall form the COVID-19 preventive Taskforce.
- b. The Taskforce is at least 5 (five) persons consisting of Chairman concurrently member and 4 (four) members representing owner/user/organizer, consultant, contractor, subcontractor, Supplier Vendor.
- c. The Task Force shall have the duties, responsibilities and authorities to conduct: (i) socialization, (ii) education, (iii) promotion of techniques and (iv) the method of prevention of COVID-19 in the field project, (v) examination of potentially infected persons, whether managers, engineers, architects, employees/staff, foreman, workers and project guests, (vi) identify potential COVID-19 hazards in the site, (vii) health checks related to the potential for COVID-19 infection of all workers and project guests, (viii) monitoring the health conditions of workers and controlling

TECHNICAL SPESIFICATIONS

mobilization/demobilization of workers, and (ix) procurement of health facilities in the field.

3. Provision of Health Facilities in The Site

- a. Contractors must provide a clinic room in the site equipped with adequate health facilities, such as oxygen cylinders, body temperature meters (Thermoscan), blood pressure gauges, medicines, and medical personnel.
- b. The contractor shall have the operational cooperation of health protection and Prevention of COVID-19 with the hospital and/or public health centre with the project site for emergency measures (emergency).
- c. Contractors must provide body temperature measuring facilities (thermoscan), handwashing with soap disinfectant (hand sanitizer) include handwashing facilities, tissue, masks in the Office and site projects for managers, engineers, architects, employees/staff, foreman, workers and project guests.

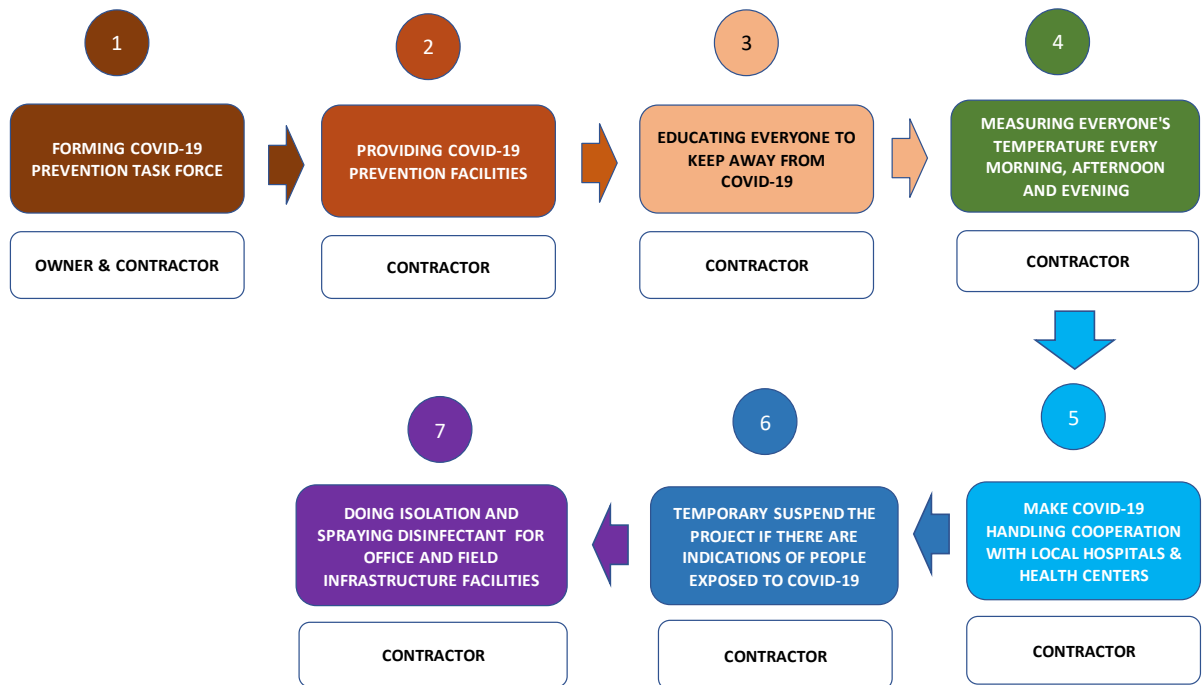
4. Implementation of COVID-19 Prevention in The Site

- a. Task Force to install the poster (flyers) both digital and physical about the appeal/COVID-19 prevention recommendations, such as handwashing, wearing masks, to be deployed or installed in strategic places on the Project site.
- b. The Joint Taskforce of the Medical officer shall provide explanation, recommendation, campaign, promotion of COVID-19 prevention technique in each morning (Safety morning talk).
- c. Task Force prohibits an ill person with a temperature indication of > 38 degrees Celsius (all managers, engineers, architects, employees/staff, foreman, worker and project guests) to come to the project location.
- d. The medical officer performs measuring the body temperature to all workers, and employees with the Security Staff and the security personnel every morning, afternoon and evening.
- e. If found managers, engineers, architects, employees, foremen and workers in the project site are exposed to the COVID-19 virus, the Medical Officer assisted by the Project Safety Officer conducts evacuation and disinfecting spraying at the site, facilities, handles and work equipment.

TECHNICAL SPESIFICATIONS

- f. Report to PPK if a positive worker and/or patient under surveillance (PDP) has been found and recommends temporary suspensions of activities.

COVID-19 HANDLING SCHEME IN CONSTRUCTION PROJECT



Source: Ministry Instruction (INMEN PUPR No. 02/IN/M/2020 tentang Protokol Pencegahan Penyebaran Corona Virus Disease 2019 (COVID-2019) dalam Penyelenggaraan Jasa Konstruksi)

For all workers, regardless of specific exposure risks, it is always a good practice to:

- Frequently wash hands with soap and water for at least 20 seconds. When soap and running water are unavailable, use an alcohol-based hand rub with at least 60% alcohol. Always wash hands that are visibly soiled.
- Avoid touching eyes, nose or mouth with unwashed hands.
- Practice good respiratory etiquette, including always wearing a mask.
- Avoid close contact with other people.
- Stay home if sick.
- Recognize personal risk factors.

TECHNICAL SPESIFICATIONS

2.13. CLEANING AND DEMOLITION

1. This work includes all cleaning and demolition work consisting of cleaning all trees, fallen wood, broken objects, shrubs, other plants, rubbish and all other unwanted materials, along with the removal of stumps and roots , stripping surface vegetation and topsoil and removing all residual materials derived from this work to provide a clean and clear surface before construction work begins.
2. The condition of existing roads, utility buildings, public services, trees, plants, etc. that are not designated for cleaning and demolition must be protected from defects and damage that may arise from carrying out construction activities.
3. Cleaning and demolition is carried out until the deadline of all work or as otherwise directed by the Engineer/EMPLOYER. This work will consist of demolition and disposing of everything above ground level unless the item is instructed by the Engineer/EMPLOYER to be left without being disturbed.
4. All trees felled in work factor within the existing Road Ownership Area will remain the property of the Employer and will be carefully stored and secured at the project location by the Contractor until moved by the Employer.
5. Measurement benchmarks, kilometer chainage, public service installations, and other objects as well as trees and plants that are appointed by the Board of EMPLOYER/Engineer Supervisors to be left behind, it must be protected from damage that can be caused by construction.
6. All materials and debris that are no longer used in construction work must be disposed with the approval of the Engineer/EMPLOYER. The contractor must make all necessary arrangements and bear all costs to obtain a proper disposal location.
7. Stump marks and other holes where the barrier has been removed must be backfilled and compacted to 90% from the maximum dry density according to AASHTO T99 and the area that has been cleaned must be left in a proper surface condition and neat conditions according to the direction of the Engineer/EMPLOYER.

TECHNICAL SPESIFICATIONS

CHAPTER 3

EXCAVATIONS, LANDFILLINGS, AND REVETMENTS WORK

3.1. SOIL EXCAVATION WORK

3.1.1. General Explanation

- a. This work will consist of excavation of soil, rubbish or rock or other materials.
- b. Excavation work includes excavation of complementary building foundations, LTP foundation, and others that require excavation work.

3.1.2. Tolerance Dimensional

- a. Finishing elevation, line and shape after excavation reach the excavation limit with a deviation of ± 10 cm from the plan elevation.
- b. The finishing surface of the excavated surface, which is open to surface water flow, must be smooth and flat enough, and have sufficient slope, to ensure a smooth surface drainage so there is no inundation.
- c. The finishing elevation of the waste excavation reaches the excavation limit with a deviation of ± 25 cm from the plan elevation.

3.1.3. Safety Excavation Work

- a. The Contractor must take full responsibility for ensuring the safety of the workforce carrying out the work.
- b. During excavation work, it must be maintained all the time the excavation slopes are capable of supporting side by side work.
- c. Heavy equipment for earth moving, compaction or other purposes will not be allowed to be located or operating closer than 1.5 m from the excavation.
- d. 'Cofferdam', end walls or other means to avoid water from excavation must be planned properly and strong enough to ensure that there will not be a sudden collapse, and be able to avoid floods that come quickly to the workplace.
- e. At all times while the workers or others are in the quarry, the Contractor must place a security supervisor.
- f. All open excavations must be fitted with enough barricades to prevent workers or others from falling inside.

TECHNICAL SPESIFICATIONS

3.1.4. Workplace Condition

All excavations must be maintained so that they are free of water and the Contractor must provide all necessary materials, equipment and labor for drying (pumping), diversion of waterways and construction of temporary channels, end walls and 'cofferdam'. The pump must be prepared at the work location at all times to ensure there is no disturbance in the continuity of the drying procedure.

3.1.5. Correction Inappropriate Occupational

Excavation works that do not meet the above tolerance criteria must be corrected by the Contractor, there is an area that has been over-excavated, or area that have excessive cracks or landslides must be replenished with a pile of selected materials or aggregate base layers or as directed by the Engineer/EMPLOYER.

3.1.6. Building Utility

- a. The Contractor must be responsible for obtaining any available information about the existence and location of the utility building in the landfill area and for obtaining and paying for any necessary permits or granting other rights to carry out the excavation required by the Contract.
- b. The Contractor must be responsible for the maintenance and protection of any functioning pipelines, cables, conduit or other pipelines and service lines or branch structures that may be found, and for repairing any damage caused by its operations.

3.1.7. Workplace Restoration and Temporary Disposal of Work

- a. All temporary structures such as 'cofferdam' or scores and plaster must be demolition by the Contractor after the completion of a permanent structure or other work for which excavation has been carried out, unless otherwise directed by the Engineer and EMPLOYER. The demolition must be done in such a way that it does not disturb or damage the completed structure or formation.
- b. Materials recovered from the temporary work remain the property of the Contractor or can, and if approved as appropriate by the Engineer and EMPLOYER, be put into permanent work and paid according to the Type of Payment concerned entered in Offer Schedule.
- c. Excavated materials should not be placed in a water channel but must be discarded immediately.

TECHNICAL SPESIFICATIONS

- d. All additional quarry holes, rock quarry areas or remaining quarry areas used by the Contractor must be left in a neat and orderly condition with firm sides and slopes.

3.1.8. Soil Excavation Monitoring Instrument

An inclinometer is used to measure the horizontal movement of a building's structure in order to know the behavior of horizontal movement data from a building, which is to determine the condition and safety of a civil engineering building such as dams, embankments, abutments, retaining walls.

3.1.8.1. Installation Stages

- a. Make a hole with the rotary drilling machine support, the diameter of the hole is adjusted to the diameter of the inclinometer pipe to be installed
- b. The position of the drilling machine and the drill bit must be made in such a way that the drill hole wall is straight and level
- c. Install the protective pipe to the depth estimated by the wall of the borehole collapse
- d. Estimate the depth of the borehole, so that the bottom of the inclinometer pipe is really stuck in a stable/hard soil layer
- e. Make sure the bottom of the hole meets the planned angle of inclination of 0-15 degrees with respect to the vertical line and depends on needs
- f. Cover the bottom of the inclinometer pipe with the tool that has been provided, so that the bottom of the pipe is not filled with grains of soil/rock
- g. Insert carefully into the drill hole of an inclinometer pipe with the bottom equipped with a cover
- h. If the water level in the borehole is high enough to make installation difficult, fill the water into the inclinometer pipe sufficiently to counteract the ground water lift force.
- i. Connect with the next inclinometer pipe, one end of which has been prepared with a connecting pipe in such a way that the pipe connection meets the requirements, that is the 2 pipes that are connected must not touch and have a distance of 100 mm
- j. The part of the pipe that is joined must be covered with waterproof tape to prevent the entry of soil particles or other material into the pipe
- k. If possible, connect the inclinometer pipe before inserting the inclinometer

TECHNICAL SPESIFICATIONS

pipe into the borehole, this depends on the length of the pipe installed and the completeness of the bore tool used

- l. Determine the position and direction of the four grooves in such a way that makes it easy in evaluation for example 2 facing grooves installed in the same direction and transverse of a building that is observed or adjusted to the direction of the wind
- m. Arrange and cut the upper pipe in such a way as to facilitate the withdrawal of the protective pipe from the borehole, and facilitate the installation of the protective plate
- n. Lift the protective pipe step by step and fill the gap between the pipe and the hole wall with materials that have the same properties as the type of soil/rock around the inclinometer pipe, namely:
 - Rock layers, filled with bentonite cement
 - Soil layer, filled with clay paste
 - Layers of boulder, filled with sand mixed with gravel
- o. Check and measure the position of the inclinometer pipe as desired (tilted or vertical), determine the desired location and position
- p. Measure the elevation of the top and bottom of the inclinometer pipe with a flat/theodolite measuring instrument
- q. Perform initial measurements, this data is very important as a comparison in conducting data analysis and evaluation
- r. Cover the upper inclinometer pipe with the lid provided and protect it with a protective plate that can be locked to avoid outside interference

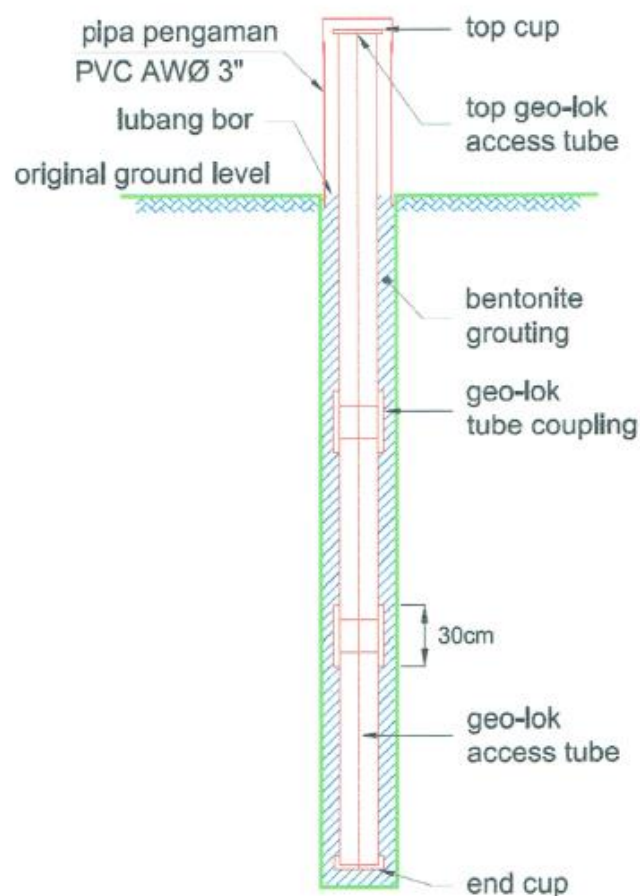
3.1.8.2. Monitoring Instrument

- a. Noting elevation of the inclinometer pipe and measuring 3 (three) readings to obtain a constant initial reading
- b. The reading is carried out with a readout unit, at least 1 (one) time each day, particularly when adding workload, namely during pilling
- c. The monitoring results consist of: horizontal movement reading data, embankment data, graphs of the relationship between horizontal movement of subsurface layers with depth, and horizontal deformation with time. Where graphs automatically exit the profile manager software program

TECHNICAL SPESIFICATIONS

The stages of measurement/reading of the inclinometer are as follows:

1. Make sure the Readout Inclinometer (PDA) is in good condition and has been charged before use
2. Determine the direction of A0
3. Insert the probe into the pipe to the bottom of the pipe
4. Then pull the probe per 0.5 m until the PDA gives the signal "ok"
5. Do it until the probe rises to the surface
6. Then turn the probe 180o then do the steps number 4 and 5
7. After completing the reading, download the reading results



**DETAIL PEMASANGAN
INCLINOMETER**

Figure 1. Inclinometer Installment Detail

TECHNICAL SPESIFICATIONS

3.2. LANDFILLING WORK

3.2.1. General

- a. Landfilling work includes work related to the pile on the surface of the landfill area with work that is carried out according to specifications, implementation drawings or the instructions of the Engineer and EMPLOYER.
- b. For all landfilling works, we must use good and clean material from plants, roots, wreckage, debris and all kinds of other impurities.
- c. Landfilling works consist of the works in accordance with the terms and conditions in the implementation drawings approved by EMPLOYER. The implementation drawing shows, among other things, longitudinal transverse profile pictures, slope and dimensions clearly.

3.2.2. Source of Material Use

- a. The material for the pile on site consists of materials suitable for the purpose approved by the Engineer and EMPLOYER.
- b. Ground for landfilling must be taken from outside the site, then the ground taken must be from the quarry and laboratory tests must be carried out every 1000 m³ of embankment including: compactor (standard proctor), the content of organic materials, plasticity, CBR laboratory and must obtain the approval of a Engineer and EMPLOYER (Factory Acceptance Test).
- c. Extra material or unused material must be disposed in accordance with the provisions that have been stated according to the instructions of the Engineer and EMPLOYER. Material is in a wet state, where dry can be used must be dried first/until it reaches its optimum moisture content and then used for piling.
- d. Pile material from original soil brought in by fulfilling the requirements for pile material, including:
 1. Not including clay
 2. Meet the plasticity requirements
 3. Clean of organic materials
 4. CBR laboratory immersion (SNI 1744: 2012) of at least 6%
 5. Before the landfilling work begins, EMPLOYER can order compaction of the cleaned surface to the required density according to the instructions of the Engineer and EMPLOYER.

TECHNICAL SPECIFICATIONS

3.3. SOIL COMPACTION

3.3.1. Overlay and Compaction

- a. If necessary, compaction work must be carried out in dry conditions in order to obtain the required compaction quality.
- b. Immediately after placement and overlaying the pile, each layer must be compacted thoroughly with suitable and suitable compaction equipment and approved by the Engineer and EMPLOYER until a density meets the specified requirements.
- c. The soil compaction will only be carried out if the moisture content of the materials is within the limit of 2% more than the optimum moisture content (wet of optimum). The optimum moisture content must be determined as the water content at which the maximum dry density is obtained if the soil is compacted according to AASHTO T-180.
- d. If a rock pile is required, it must be covered with a 200 mm thick layer of well-graded material containing stones no larger than 50 mm and able to fill all the gaps in the top of the rock pile. This cover must be built in accordance with the requirements for the landfill.
- e. Each piles layer must be compacted as determined, tested for density and received by the Engineer and EMPLOYER before the next layer is placed.
- f. The pile must be compacted starting from the outside edge and proceeding towards the pile axis in such a way that each part receives the same amount of compaction.
- g. Piles at locations that cannot be reached by ordinary compactors must be placed in a horizontal layer of loose material not more than 150 mm thick and completely compacted by using an approved mechanical tamper. Special care must be taken to ensure satisfactory compaction under and on the edge of the pipe to avoid cavities and to ensure that the pipe is fully supported.
- h. To carry out the overlay, the Contractor must protect from rain, solar heat which results in optimum changes in water content. If the overlay is exposed to rain, the Contractor must peel back the overlay.
- i. "Fill" Compacting Work
 - Compaction is carried out layer by layer with a certain thickness with the direction of the Construction Management Engineer/Technical Directors.
 - Compacted soil must reach a minimum of 95% of the maximum dry density that can be achieved in the state of optimum moisture content determined

TECHNICAL SPESIFICATIONS

- by modified AASTHO T-99 and reach a minimum field CBR value of 25%.
- During compaction the water content must be continuously controlled, before compaction the water content of the fill material must be the same as the optimum water content of the compaction modified proctor test results from the fill material sample.
 - If the water content of the pile/fill material is smaller than the optimum water content, then the pile of material must be given water so that it equals the optimum content. Conversely, if the water content of the pile/fill material is greater than the optimum water content, the fill material must be dried first or added to the drier pile material.
- j. Density testing with sand cone and CBR tests must be carried out for every 500 m² on each compacted pile layer in accordance with ASTM D-1556 / SNI 1743: 2008 and if the results of each test indicate that the density is less than the required density then the Contractor must improve the work .

3.3.2. Compacted Pile Protection

- a. The Contractor must maintain and protect the compacted pile from any influences that damage the quality of the pile.
- b. If the Engineer and EMPLOYER deem it necessary, the Engineer and EMPLOYER have the right to order additional testing on part or all of the pile that has been tested and accepted. If it is proven that the pile has decreased quality so that it does not meet this Technical Specification, the Contractor shall at its own expense repair the pile until it meets this Technical Specification and bear the test costs ordered Engineers and EMPLOYER.

3.3.3. Compaction Trial

- a. Before starting the work, the Contractor must send a landfilling sample to be used, and after approval by the Engineer and EMPLOYER, a laboratory test will be conducted to obtain the optimum moisture content and grinding standard with a vibrator roller to be used.
- b. The purpose of this experiment is to determine the optimum moisture content to be used and the relationship between the amount of grinding and the density that can be achieved by the sample material.
- c. The Contractor shall carry out the field density test in accordance with ASTM D 1556 (sand cone method) at the compaction site carried out. The location of this

TECHNICAL SPESIFICATIONS

test will be determined by the EMPLOYER. The next compaction layer cannot be carried out before the field density test is performed. All laboratory/test costs are the Contractor's responsibility.

- d. Density achieved for embankment construction is as follows: Each layer of soil must be compacted to a minimum of 95% of the maximum (dry) density used in ASTM D 1556 (sand cone method) / (SNI 1743: 2008) and field CBR tests of at least 25%.

3.3.4. Measurement

- a. The pile will be measured as the number of cubic meters of compacted materials received in full on the spot. The measured volume must be based on an approved cross-sectional image of the soil profile or excavation profile before a pile is placed and on the line, slope and height of the designated and approved final pile work. The method of calculating the volume of materials must be the method of the average end area, using a cross section of the work not more than 25 meters apart.
- b. Piles that are placed outside approved lines and cross sections, including any additional pile needed as a result of terracing work or binding of the pile on an existing slope or as a result of a decrease in foundation or replacement of materials that are less suitable including repair work that is unsatisfactory or less stable or failed will not be measured for payment
- c. If excavated materials are used for piles, these materials will be paid for as piles.
- d. The amount of pile measured will be paid for each cubic meter of pile. These costs include preparatory work, completion and placement of materials, the benefits of contracting services and all activities to achieve the best work results.

3.4. SELECTION OF SOIL PILE FOR THE ROAD

3.4.1. Soil Pile Standard

Standards and Regulations Applicable to the Soil Pile Criteria are:

- Indonesian National Standard (SNI)
- American Society of Testing and Martials (ASTM) standards.
- Standard and other similar Regulations

TECHNICAL SPESIFICATIONS

3.4.2. Structure / Subgrade Pile Materials

- a. Materials suitable for the structural pile that will be used in this specification include all materials in the ASTM test classification
- b. If the pile material used is different from what is stated, the contractor must first obtain approval from the assignor/Engineer
- c. Structure pile material can be obtained from the quarry location submitted by the contractor and is approved by the assignor or soil material from quarry at the work site that can be used and agreed by the assignor/Engineer as a pile of structure

3.4.3. Density of Structure / Subgrade Pilling

For piles from all areas to be made rigid pavement construction, the density of the pile structure must meet the following criteria:

- a. If the pile material is composed of non-cohesive material then:
 1. The top 30 cm minimum thickness must be compacted up to 100% maximum density and have a minimum CBR value of 6%
 2. The layers below must be compacted to 95% of maximum density
- b. If the pile material is composed of cohesive material, then:
 1. The minimum 30 cm thick layer must be compacted up to 95% maximum density and have a minimum CBR value of 6%
 2. The layers below must be compacted to 90% maximum density

For piles from all areas to be made flexible pavement construction, the density of the pile structure must meet the following criteria:

- a. If the pile material is composed of non-cohesive material, then:
 1. The first layer as thick as the top 60 cm must be compacted up to 98-100% maximum density and have a minimum CBR value of 6%
 2. The second layer with a minimum thickness of 50 cm must be compacted to 95% maximum density
 3. The third layer with a minimum thickness of 50 cm must be compacted to 90% maximum density
 4. The fourth layer with a minimum thickness of 50 cm must be compacted to 85% maximum density

TECHNICAL SPESIFICATIONS

- b. If the pile material is composed of cohesive material, then:
 - 1. The first layer as thick as the top 30 cm must be compacted up to 95% of the maximum density and have a minimum CBR value of 6%
 - 2. The second layer with a minimum thickness of 25 cm must be compacted to 90% maximum density
 - 3. The third layer with a minimum thickness of 25 cm must be compacted to 85% maximum density
 - 4. The fourth layer with a minimum thickness of 25 cm must be compacted to 80% of maximum density

For piles from all areas where pavement construction will not be constructed, the density of the pile structure must meet the following criteria:

- a. If the pile material is composed of non-cohesive material, then compaction must be carried out to a minimum of 95% maximum density
- b. If the pile material is composed of cohesive material, then compaction must be carried out at a minimum of up to 90% of the maximum density

The selected pile material that will be used when compaction is saturated or inevitable flooding must be sand or gravel or other clean grained material with a maximum Plasticity Index of 6%.

3.4.4. Pile Structure / Subgrade Monitoring

1. Settlement Plate

Settlement Plate (SP) is one of the geotechnical instruments that functions to monitor the settlement process on earthworks with sister preloading/piles of pre-load buildings. Settlement Plate functions to monitor settlement value/amount of land subsidence arising from the Preloading process. Land subsidence must be monitored to ensure that it reaches the planned condition (for example, the condition of consolidation has reached 90%).

- **Installation Stage**

- a. Insert the iron plate in such a way that the position of the galvanized pipe is perpendicular
- b. Landfilling the soil up to cover the entire surface of the iron plate and keeping it in proper possession

TECHNICAL SPESIFICATIONS

- c. Connecting pipes in accordance with the process of adding each pile layer
- **Monitoring Instrument**
 - a. Noting the initial settlement plate elevation is based on the initial data obtained at the time of installation
 - b. Measurement of 4 (four) readings to obtain elevation is the average value of the four readings
 - c. The reading is done at least 1 (one) time every day, particularly when adding workload, namely when pilling
 - d. The results of monitoring consist of: vertical movement reading data, pilling data and graphs of the relationship between vertical movement of the land and time.
- **Monitoring Limit Value**
 - a. If land subsidence occurs more than 100 mm per week, the stability of the pile is in the "hazard" category
 - b. If land subsidence occurs $30 < x < 60$ mm per week, the stability of the pile is in the "alert" category
 - c. If land subsidence occurs less than 30 mm per week, the stability of the pile is in the "safe" category

TECHNICAL SPESIFICATIONS

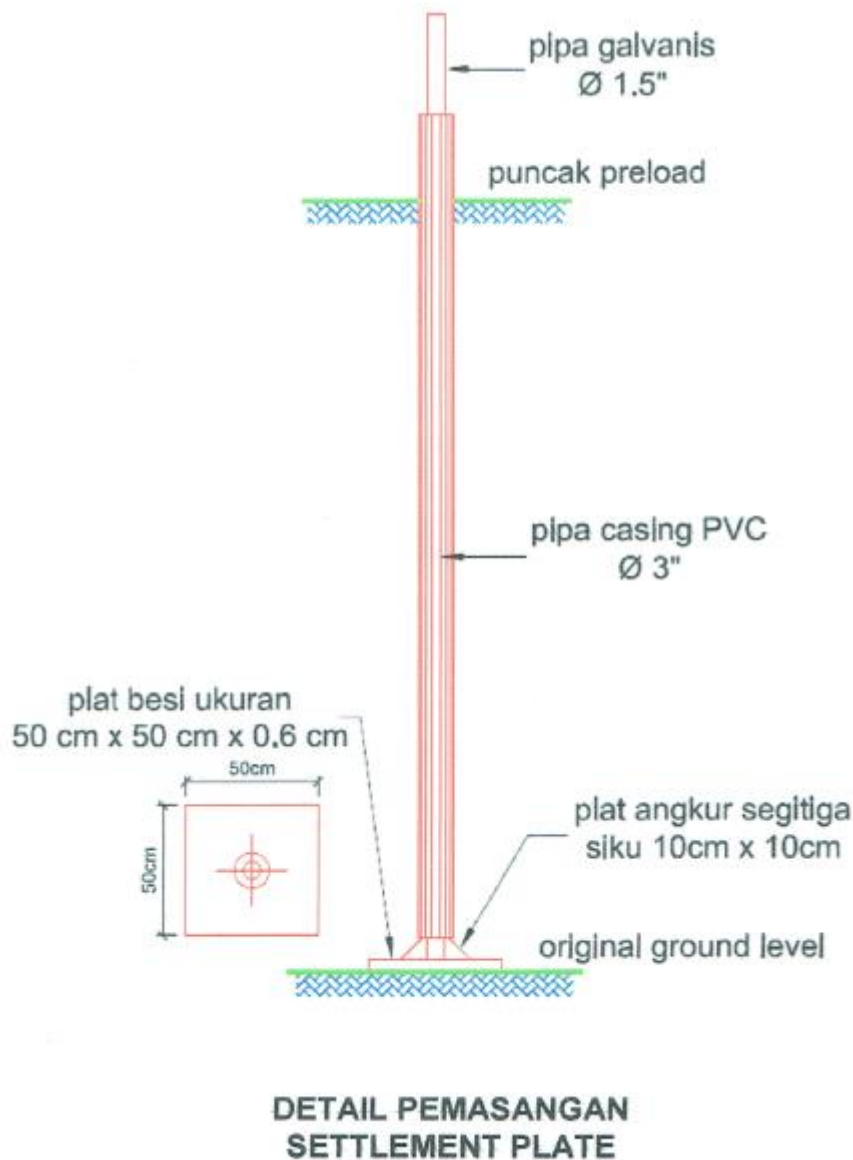


Figure 2. Settlement Plate Installment Detail

3.5. EXCAVATION DAN WASTE MOVEMENT

3.5.1. Explanation

These areas of work include the closure and structuring of existing landfills and sanitary landfills (new zone). This work includes excavation and movement of waste and other materials in it according to the height of the plan shown in the drawings or ordered by the Engineer and EMPLOYER.

The scope of activities on this work item includes both existing landfills and new landfills that arise during the implementation period.

TECHNICAL SPESIFICATIONS

All changes to these specifications must be consulted in writing to the Engineer and EMPLOYER must obtain prior approval from the Engineer and EMPLOYER to start work.

3.5.2. Survey

- a. At the agreed time to commence work, the Contractor under the supervision of a Construction Management Engineer and Technical Director, must inspect and carry out the survey with equipment approved at the work site.
- b. The elevations listed in the shop drawings must be recorded and signed by the Engineer and EMPLOYER.

3.5.3. Equipment

- a. The Contractor shall make a schedule for the use of the main equipment, and be approved by the Engineer and EMPLOYER
- b. The Contractor must propose work methods including daily work output, number, type and capacity of equipment
- c. If the use of other equipment is not permitted by Engineer and EMPLOYER, the Contractor must use equipment that has been proposed in the tender or which has been approved for use when the contract is signed. The Contractor must submit a work plan detailing the implementation of work in connection with the mobilization of equipment.
- d. Equipment used during implementation must be submitted to the work plan and approved by the Engineer and EMPLOYER prior to operation.

3.5.4. Tolerance Dimension

The excavation must be done in accordance with the size, height, and slope as shown in the drawings with the finishing slope, direction and formation after excavation should not vary from those specified more than 25 cm at each point.

3.5.5. Additional Depth Excavation

- a. If in carrying out the excavation of the Engineer and EMPLOYER feel it is necessary to deepen the excavation, the Engineer and EMPLOYER have the right to instruct the Contractor to increase the depth of the excavation.
- b. The cost of adding up to the excavation depth is only calculated, if the addition is ordered by a Engineer and EMPLOYER.

TECHNICAL SPESIFICATIONS

- c. The addition of the depth of excavation is measured in the manner determined by the Engineer and EMPLOYER adjusted to local conditions. Measurements are rounded down to 25 cm.
- d. If the addition of work in the form of adding depth requires additional time from the time schedule, the Contractor is permitted to extend the work schedule, for a logical additional time by sending a written request to the Engineer and EMPLOYER.

3.5.6. Excavation Depth Reduction

- a. The Engineer and EMPLOYER have the right to order the Contractor to stop the excavation before the depth of the plan if deemed necessary.
- b. The measurement of the reduction in work volume due to the reduction in excavation depth is the same as the calculation for the addition of excavation depth.

3.5.7. Reporting and Entry

- a. For each excavation work, before starting work the Contractor must submit a cross-section detailing showing the level of waste and original soil before the clearing and scraping operations are carried out to the Engineer and EMPLOYER.
- b. The Contractor must submit to the Engineer and EMPLOYER a detailed drawing of the entire structure of the proposed elevation of waste or ordered for use.
- c. After each excavation for waste has been completed, the Contractor must notify the Engineer and EMPLOYER, and/or other advanced materials not to be installed before they are approved by the Engineer and EMPLOYER.

3.6. WASTE COMPACTION

3.6.1. Explanation

- a. This work includes the deployment/leveling, reconstruction and compaction of waste and other materials therein which are approved by the Engineer and EMPLOYER for the pile material needed to make the pile according to the plan drawings.
- b. Compaction of waste is intended to obtain efficient land use conditions to meet required embankment ridges, and to get good stability of waste dumps prior to the Coversoil Works.
- c. All changes to these specifications must be consulted in writing to the Engineer

TECHNICAL SPESIFICATIONS

and EMPLOYER must get prior approval from the Engineer and EMPLOYER to start the work.

- d. Piles included in this section, namely the existing landfills and new landfills that arise during the implementation period.

3.6.2. Equipment

- a. The Contractor must submit work methods including daily work output, number, type and capacity of equipment to be operated by the Engineer and EMPLOYER.
- b. The selection of equipment must consider the field conditions and the environment.

3.6.3. Spread and Compaction

- a. The landfill and compaction activities are carried out by compacting waste using adequate compaction equipment. For this compaction work, the Contractor must be able to reach a minimum density of 600 kg / m³ or a minimum of 6 bulldozer tracks or a number of trails determined by compaction experiments. To support these activities required height stakes, solid boundaries / distribution areas that are used as a reference for compaction.
- b. Machine trajectories should take place in the perpendicular direction of the distribution plane. If necessary to increase the value of compacting, watering leachate effluent can be added to the pile to be compacted (leachate recirculation).
- c. In this overlay and compaction work the Contractor must carry out the phasing system or location division per zone by taking into account the working face of heavy equipment and weather conditions. For this reason the Contractor must submit his plan to the Engineer and EMPLOYER for approval of its implementation.
- d. To achieve the best compacting value on the sloping pile used heavy equipment

TECHNICAL SPESIFICATIONS

3.6.4. Compaction Trial

- a. Compaction trial is carried out in such a way that we can get the standard number of rolling/irritation required to achieve a minimum waste density of 600 kg/m³.
- b. Addition of leachate effluent or other material in compaction trial must obtain approval from the Engineer and EMPLOYER.
- c. Waste density testing can be done by making a test pit with a certain size in an area that has been done several times before the rationing for certain volume and then weighed to obtain weight. Waste density is the quotient between weight and volume of waste.
- d. If the appropriate waste density has not yet been obtained, then it will be grinding again with more number of irritations until it meets the specified density requirements.
- e. The Contractor is required to carry out a waste density test for every 5000 m² of solid area approved by the Engineer and EMPLOYER

3.6.5. Dimension Tolerance

- a. Slope and elevation that are completed after compaction must not be less or more than 50 mm from the specified or approved.
- b. If the height of the stockpile per slope is more than 6 m, reconturing must be carried out, so that the stability of the soil is maintained. Uncontoured slopes are cut and shaped to contour with a slope of 20 - 30° (about 1 vertical part with 3 to 2 horizontal parts).

3.6.6. Reference Standards

- a. The Contractor must complete all tests under the supervision of a Engineer and EMPLOYER and must submit a report within 1 (one) week after each test is carried out.
- b. This waste density testing standard refers to Ministerial Regulation of Public Works No. 3 of 2013 and SNI-19-3964-1994.

3.6.7. Measurement

Waste compacting will be measured as the number of cubic meters of compacted materials received in full on the spot. The measured volume must be based on approved cross-sectional drawings of the waste profile or excavation profile before a pile is placed and on the line, slope and height of the final embankment work

TECHNICAL SPESIFICATIONS

specified and approved by the Engineer and EMPLOYER. The method of calculating the volume of materials must be the method of the average end area, using a cross section of work not more than 25 meters apart, for that the use of heights and boundaries of solid fields and documentation of the initial elevation of the pile shall be available as a reference measurement.

3.7. LANDFILLING LIMESTONE WORK

3.7.1. General

- a. The landfilling limestone includes work in several areas, namely:
 - 1. Landfilling under the closing zone
 - 2. Landfilling on the new landfill zone
- b. Landfilling limestone must be clean of plants, roots, wreckage, debris and all kinds of other impurities.

3.7.2. Source of Material Use

- a. Limestone material for piles on site consists of materials suitable for the purpose approved by the Engineer and EMPLOYER.
- b. Limestone for the landfilling must be taken from outside the site, then the limestone taken must be from the quarry and CBR test must be done and must obtain the approval of the Engineer and EMPLOYER.
- c. Extra material or unused material must be disposed in accordance with the provisions that have been stated according to the instructions of the Engineer and EMPLOYER.
- d. Limestone pile material that is imported by fulfilling the requirements of pile material, including:
 - 1) CBR laboratory immersion (SNI 1744: 2012) of at least 6%
 - 2) Clean of organic materials

3.7.3. Compaction

- a. If necessary, compaction work must be carried out in dry conditions in order to obtain the required compaction quality.
- b. Immediately after placement and overlaying the pile, each layer must be compacted thoroughly with suitable and suitable compaction equipment and approved by the Engineer and EMPLOYER until a density meets the specified requirements.

TECHNICAL SPESIFICATIONS

- c. Each pile must be compacted as specified, tested for its density with the requirements of a field CBR (SNI 1738: 2012) of at least 25% and a minimum of 95% sandcone approved by the Engineer and EMPLOYER before the other material layers.
- d. The pile must be compacted starting from the outside edge and proceeding towards the pile axis in such a way that each part receives the same amount of compaction.
- e. Each pile must be checked for thickness every 2500 m2 approved by a Engineer and EMPLOYER.

3.7.4. Compacted Pile Protection

- a. Each pile must be checked a. The Contractor must maintain and protect the compacted pile from all influences which damage the quality of the pile. Its thickness is every 2500 m2 approved by the Engineer and EMPLOYER.
- b. If the Engineer and EMPLOYER deem it necessary, the Engineer and EMPLOYER have the right to order additional testing on part or all of the pile that has been tested and accepted. If it is proven that the pile has decreased quality so that it does not meet this Technical Specification, the Contractor shall at its own expense repair the pile until it meets this Technical Specification and bear the test costs ordered Engineer and EMPLOYER.

3.7.5. Overlay and Compaction

- a. The material for the landfilling is obtained from the type that has been approved by the Engineer and EMPLOYER will be overlaid with layers and then compacted. For this compaction work, the Contractor must carry out in such a way that the planned density can be achieved.
- b. In this overlay and compaction work the Contractor must carry out the phasing system or location division per zone. For this reason the Contractor must submit his plan to the Engineer and EMPLOYER for approval of its implementation.

3.7.6. Measurement

- a. The pile will be measured as the number of cubic meters of compacted materials received in full on the spot. The measured volume must be based on an approved cross-sectional drawings of the soil profile or excavation profile before a pile is placed and on the line, slope and height of the designated and approved final

TECHNICAL SPESIFICATIONS

pile work. The method of calculating the volume of materials must be the method of the average end area, using a cross section of the work not more than 25 meters apart.

- b. Piles placed outside approved lines and cross sections, including any additional pile needed as a result of terracing work or binding of the pile on an existing slope or as a result of a decline in foundation, will not be measured for payment, except:
 - Piles are needed to replace materials that are not suitable or soft or to replace rock or other hard materials.
 - Additional piles is needed to correct unsatisfactory or unstable work or fail in the event that the Contractor is not considered responsible.
- c. Small embankment that use ordinary piles stated as part of limestone work items will not be measured for payment as embankments under this chapter.
- d. If excavated materials are used for piles, these materials will be paid for as piles.
- e. The amount of pile measured will be paid for each cubic meter of pile. These costs include preparatory work, completion and placement of materials, the benefits of contracting services and all activities to achieve the best work results.

3.8. LANDFILLING FERTILE SOIL

3.8.1. General

- a. Earthwork includes work related to the accumulation of fertile soil on the landfill land cover surface with work carried out according to specifications, implementation drawings or directors' instructions.
- b. For all landfill work, it must use good, clean soil from plants, roots, wreckage, debris and all kinds of other impurities.

3.8.2. Source of Material Use

- a. The material for the pile on site consists of materials suitable for that purpose approved by the board of directors.
- b. Soil for landfilling must be taken from outside the site and laboratory tests must be carried out including: compactor (standard proctor), the content of organic materials, plasticity and must obtain the approval of the Engineers and EMPLOYER.
- c. Landfill material from native soil brought in by meeting the requirements of landfill material fertile land in accordance with land suitable for planting urban

TECHNICAL SPESIFICATIONS

forest plants

- d. The density that must be achieved in the field is 75 - 90% of the density of the standard laboratory proctor at the optimum moisture content used ASTM D 1556 test (sand cone method) / (SNI 1743: 2008).

3.8.3. Overlay and Compaction

- a. Material for the landfilling obtained from the type that has been approved by the Engineer will be spread and each area of 500 m² must be compacted to 75-90% of the dry (density) used ASTM D 1556 test (sand cone method) / (SNI 1743: 2008). For this compaction work, Contractor must carry out in such a way that the planned density can be achieved, taking into account the optimum moisture content of the pile material.
- b. In this overlay and compaction work the Contractor must carry it out with a phasing system or location division per zone. For this reason the Contractor must submit his plan to the Engineer and EMPLOYER to be approved for implementation.
- c. Each pile must be checked for thickness every 2500 m² approved by a Engineer and EMPLOYER.

3.8.4. Compaction Trial

- a. Before starting the actual compaction work, the Contractor must send a sample of fertile soil to be used, and after approval by the board of directors, a laboratory test will be conducted to obtain the optimum moisture content and grinding standards.
- b. The purpose of this experiment is to determine the optimum moisture content to be used and the relationship between the amount of grinding and the density that can be achieved by the sample material.

3.8.5. Fertile Soil Type

Soil that has good fertility is Latosol. Latosol soil has a rather thick to thick soil solum, starting from around 130 cm to more than 5 meters. The soil is red, brown, to yellowish. The texture of the soil in general is clay. Soil structure in general is crumb with loose consistency. It has a pH of 4.5 to 6.5. Having organic ingredients in general is only 5%. Contains moderate to high nutrient content. Nutrients contained in the soil can be seen from the color. The redder color of the soil, the fewer nutrients is

TECHNICAL SPESIFICATIONS

contained. Having the infiltration as rather quickly to rather slowly. Ground power is quite good, resistant to soil erosion. Density achieved for the construction of backfill is as follows: Each layer of land covering an area of 500 m² must be compacted to 75-90% of the density (dry).

TECHNICAL SPESIFICATIONS

CHAPTER 4

CIVIL WORKS

4.1. CONCRETE WORK

4.1.1. General

Concrete works must be carried out in accordance with the requirements stated in the Structural Concrete Requirements for Buildings, SNI 2847: 2013. The Contractor must carry out his work accurately and accurately according to the specifications of the working drawings and instructions from the Engineer / EMPLOYER. The Engineer / EMPLOYER has the right to inspect/supervise any work carried out by the Contractor. In the event of a construction failure, the Engineer / EMPLOYER does not release the Contractor from his responsibilities. All works that do not meet the description and conditions of execution (specifications) must be dismantled and replaced with the approval of the Engineer / EMPLOYER. All materials not approved by EMPLOYER must be removed from the work site at the Contractor's expense.

4.1.2. Reference Standards

Concrete works must be carried out according to the requirements stated in the regulations below:

- | | |
|---------------------|--|
| 1. SNI 15-2049-2004 | Portland Cement |
| 2. SNI 03-6429-2000 | Compressive Strength Concrete Cylinder Testing Method |
| 3. ASTM C 117 | Material testing standards that pass the 75 mm filter. Resistance to abrasion of small size coarse |
| 4. ASTM C 131 | Gradation test in aggregate |
| 5. ASTM A 136 | Provisions of additive material in concrete |
| 6. ASTM C 494 | Procedure for reinforced concrete structures design |
| 7. SNI 2847 2013 | Concrete mix design |
| 8. SNI 03-2834-2000 | Indonesian Industry Standard |
| 9. SII | |

4.1.3. Material

TECHNICAL SPESIFICATIONS

All materials must be of good quality and meet the requirements of Structural Concrete for Buildings, SNI 2847: 2013.. The Contractor must provide samples of materials that will be used to produce concrete, and have prior approval from EMPLOYER, and may not order/send before approval is given. The Engineer will keep approved samples as standard, with a view to checking/matching subsequent deliveries. The Contractor is not permitted to send materials with a large difference from the sample standard without the approval of the EMPLOYER/Engineer. All materials rejected by EMPLOYER/Engineer must be removed from the work site at the Contractor's expense.

4.1.3.1. Cement

a. The cement types used are:

- Portland Cement type I for all types of constructions.
- Portland Cement type V for concrete in LTP Ponds, leachate tanks and leachate collection, locking concrete in gas pipe connections and new sanitary landfill zone leachate pipes, culverts and settling basins.

All cement must comply the requirements specified in SNI 15-2049-2004 and the Indonesian Industrial Standard (SII 0013-81). The cement used must be approved by the Engineer / EMPLOYER and sent to the workplace with sealed and intact bags.

- b. If the EMPLOYER considers needs the Contractor sends a statement letter from the factory which is explaining the type, quality of the cement along with the manufacture's test certificate stating that it meets all the requirements specified by N.I.8. Clogged cement, sweeping or broken/torn bags are rejected for use.
- c. Cement must be stored in a warehouse/silo with adequate ventilation and does not leak, and placed on an elevated floor at least 30 cm from the ground. Cement bags are not allowed to be piled more than 2 (two) meters and each shipment is labeled with a date so that it can be used according to the delivery date.
- d. The Contractor must send reports from the cement tests in the laboratory to the EMPLOYER/Engineer on a regular basis. The laboratory designated for testing must first be approved by the EMPLOYER/Engineer.

4.1.3.2. Fine Aggregate (Sand)

TECHNICAL SPESIFICATIONS

- a. Fine aggregate for concrete works to be used in this project must comply with the requirements of INS or ASTM.
- b. Classification and gradation of fine aggregate as follows:

Sieve size (US standard sieve)	Pass, %
No. 4	100%
No. 8	92 - 100 %
No. 16	65 - 85 %
No. 30	35 - 55 %
No. 50	15 - 30 %
No. 100	0 - 12 %
No. 200	%

- c. Fine aggregate must not contain more than 5% sludge (determined to dry), and those which are defined as sludge are parts which can be through a 0.063 mm sieve or No. sieve. 200 if the test complies with ASTM C 117.
- d. Fine aggregate must be clean and free from all kinds of impurities both in the organic mud, soil, coral, salt and so on. Sea sand must not be used at all.
- e. The Contractor must submit a fine aggregate sample that will be used to obtain EMPLOYER/Engineer approval. Fine aggregate material must be stored in a clean, flat surface and prevented from contaminating and mixing with each other. The fine aggregate requirements above from paragraphs a into d also apply to ready mix concrete.

4.1.3.3. Coarse Aggregate (Gravel or Coral)

- a. Coarse aggregate for concrete works to be used in this project must comply with the requirements of INS or ASTM.
- b. Classification and gradation of coarse aggregate as follows:

TECHNICAL SPESIFICATIONS

Coarse Aggregate type A1 : (large)

Sieve size (US standard sieve)	Lolos, %
1 Inch	100%
3/4 Inch	90 - 98 %
1/2 Inch	30 - 45 %
3/8 Inch	0 - 10 %
No. 4	0 - 5 %

Coarse Aggregate type A2 : (medium)

Sieve size (US standard sieve)	Lolos, %
1/2 Inch	100%
3/8 Inch	90 - 98 %
No. 4	30 - 45 %
No. 8	0 - 10 %

- c. The aggregate does not contain sludge in excess of 1% (determined by dry weight) which is defined as mud are parts that can pass through a 0.063 mm sieve or sieve no. 200 if tested according to ASTM C 117. If the mud content exceeds 1%, the coarse aggregate must be washed.
- d. Coarse aggregate must consist of hard grains and not gritty. Coarse aggregate containing flat grains can only be used if the flattened grains do not exceed 20% of the total weight of the aggregate. What is meant by flat aggregate items is the ratio between width and thickness greater than 3 (three). Coarse aggregate items must be eternal, meaning that they are not broken or destroyed by weather influences, such as the sun and rain.
- e. The Contractor must submit a sample of coarse aggregate that will be used to obtain EMPLOYER/Engineer' approval. Tests that must be carried out on the example above are:
 - Test with the machine according to ASTM C 131 Resistance to abrasion of small size coarse
 - Gradation test in accordance with ASTM A 136
 - Gradation test for sludge content in accordance with ASTM C 117
 - Other tests if deemed necessary and all become the responsibility of the Contractor

TECHNICAL SPESIFICATIONS

- f. The aggregate must be stored in an inseparable place on the surface of the soil that is clean, dense and dry and must be prevented from fouling and mixing
- g. The above gross aggregate requirements from paragraphs a-g also apply for ready mix concrete.

4.1.3.4. Reinforcement Steel

a. Material

The reinforcement steel used is a minimum must comply with PBI-1971. The quality, size and type above are as follows:

Quality	Characteristic which gives stable strain 0,2 (kg/cm ²)
BJTP 24	2.400
BJTD 40	3.900

Concrete wire: The reinforcing steel wire must be made from soft steel with a diameter of at least 1 mm that has been flattened first, and not zinc plated.

b. Diameter tolerance

The size of the steel reinforcement used must comply the following diameter tolerances:

No	Diameter (d) (mm)	Tolerance (mm)	Roundness deviation (%)
1	6	± 0.3	Maximum 70 from tolerance limit
2	8 ≤ d ≤ 14	± 0.4	
3	16 ≤ d ≤ 25	± 0.5	
4	28 ≤ d ≤ 34	± 0.6	
5	d > 34	± 0.8	

Note

1. Roundness deviation is the difference between the maximum and minimum diameters of the measurement results in the same container of concrete reinforcing steel
2. For threaded concrete reinforcement steel, d = inner diameter

Source: SNI 07-2052-2002

TECHNICAL SPESIFICATIONS

c. Diameter replacement

- Replacement of other diameters, only allowed with the written approval from the EMPLOYER/Engineer.
- If the replacement is approved, the required cross-sectional area must not be less than what is stated in the drawing or calculation.
- Costs incurred by replacing the reinforcement to the drawings insofar is not drawing errors, it is the responsibility of the Contractor.

d. Placing reinforcement

Reinforcement must be placed carefully in a position as planned, and must be maintained the distance between reinforcement with formwork to get a thick concrete decking that is sufficient.

Here is a table of minimum concrete decking conditions for various structural conditions:

Concrete Condition	Thickness of Concrete Decking
The concrete is casted above and always get connection with the ground	min 75 mm
Concrete related to soil or weather	min 50 mm
Concrete that is not related to weather or soil	
- Column	40 mm
- Beam	40 mm
- Wall	30 mm
- Plates	20 mm
Concrete that is directly related to the waste in the LTP	min 50 mm

e. Implementation

- Steel and wire as mentioned above must be free from dirt, rust, paint, and other materials that will reduce the adhesion to concrete.
- Bending will straighten the steel reinforcement must be done in a cold state and cut and bent in accordance with the drawings work.
- All reinforcement must be installed in the right position so that they do not change places or shift before and during casting. Minimum reinforcement decking according to the concrete decking is in the table point d.

TECHNICAL SPESIFICATIONS

- Reinforced steel splice lengths must be in accordance with the planning guidelines for reinforced concrete structures SNI 2847 2013.
- Reinforcement steel must be removed from the field immediately within 24 hours after a written order from the EMPLOYER/Engineer.
- Binding of reinforcement must be fastened with wire ties, so it is not displaced during casting operations.
- Welding of reinforcement steel will not be permitted unless specified in the drawings or specifically authorized by written EMPLOYER/Engineer. If the Engineer approves the welding of the connection, then in this case is a fully penetrating tip-filled welding that meets the requirements of AWS D2.0. Cooling of welding objects with water is not permitted.
- Connection of reinforcement with diameter greater or equal to 20 mm for both columns and beams, each length of 6 m alternating intervals is done in accordance with the SNI 2847 reinforced concrete structure manuals.

f. Storage

Storage of concrete iron is intended to prevent the occurrence of rust, by placing it on a board or wooden block so that it is not directly on the ground, for long time storage, concrete steel must be stored under the roof.

g. Test and certificate

- To get a guarantee on the quality or quality of reinforcing steel in accordance with technical specifications, the Contractor must submit an official certificate from the laboratory when ordering reinforcing steel.
- For every shipment of 100 tons of reinforcing steel, a minimum of 3 samples must be periodically conducted for each diameter of the steel bar. Sampling of reinforcing steel will be determined by the EMPLOYER/Engineer.
- All tests mentioned above, must be carried out in the Laboratory recommended by the EMPLOYER/Engineer and at a minimum in accordance with other standards/equipment that are equivalent.
- All testing costs are borne by the Contractor.

TECHNICAL SPESIFICATIONS

4.1.3.5. Additional Mixture Material

- a. The use of concrete mixtures is only licensed by the EMPLOYER/Engineer and must comply with ASTM C 494 Chemical Admixtures for Concrete.
- b. Concrete mixtures are used only for quality K-350 and K-225 concrete and according to ASTM C 494.
- c. In order to protect the building from seepage, then buildings that accommodate leachate and its processed products are added integral waterproofing.

4.1.3.6. Water

Water for the manufacture and maintenance of concrete must not contain oil, acids, alkalis, salts, organic materials and other materials that damage concrete or steel reinforcement.

4.1.4. Concrete Quality

The quality of concrete used are K-125, K-175 and K-250 to ensure the stability of concrete quality, it is recommended to use ready mixed concrete.

- Concrete with quality K - 125

Covering concrete work floors, appropriate with work drawings

- Concrete with quality K - 175

Includes locking concrete on a new sanitary landfill zone embankment to lock the GCL, according to the working drawings and drainage channels.

- Concrete with quality K - 250

Includes locking concrete in the connection of gas pipes and leachate pipes in sanitary landfill zones, footplate foundations, structure column and beam LTP, guard posts, offices, weigh station, MRF, workshops and others.

For quality concrete K-225 or below, if it does not use ready mix, then it must be adjusted to the job mix that has been approved by the EMPLOYER/Engineer.

4.1.5. Concrete Mix Design

- a. Five weeks before the concrete casting work begins, the Contractor must make a design procedure and preliminary test at his own expense to obtain the quality as required. The mixture must use a weight ratio between cement, sand, gravel, and water.

TECHNICAL SPESIFICATIONS

- b. Mixed design should follow the requirements of SNI-03-2834-2000 and evaluate the strength of its characteristics.
- c. If for some reason the source or quality of the cement and/or aggregate is replaced, a new mixture must be sought so that it still meets the requirements.
- d. In the event that ready mix concrete is used, all requirements in the AASHTO designation ready mix concrete standard H. 157-74 must be fulfilled.

4.1.6. Concrete Making and Equipment

- a. The Contractor is entirely responsible for making a concrete mixture that is good/unformed and meets the specified requirements. To meet these requirements, the Contractor must provide a good concrete mixer and is approved by the EMPLOYER/Engineer.
- b. Arrangements for transportation, weighing and mixing of materials must be with the approval from the EMPLOYER/Engineer.
- c. Mixing concrete by not using a weight ratio (scales) is not allowed.
- d. The mixer must be completely empty before collecting/receiving material for further mixing, it must be cleaned and washed if the mixer is not used for longer than 30 minutes and at the end of each work. The mixer must also be cleaned and emptied first, if the concrete to be made is of different quality.
- e. Re-mixing of partially fallen/hardened concrete is not permitted. Likewise, the addition of water to a ready mix of concrete (from the mixer) with the aim of facilitating workmanship and so on is not permitted.

4.1.7. Concrete Trial

- a. The Contractor must provide the necessary equipment and place to carry out the following experiments:
 - Slump test
 - Steel cast for making concrete cylinders or cubes
- b. The required slump value is 12 cm + 2.
- c. By its own expense the Contractor must make, maintain and transport all samples to the laboratory determined/approved by the EMPLOYER/Engineer for the implementation of the compression test at 7 days, 14 days and 28 days.

Concrete Age	Total of Sample
7 days	3

TECHNICAL SPESIFICATIONS

14 days	3
28 days	3

- d. Concrete before reaching maximum compressive strength is tested at the age of 7 days, 14 days and 28 days. The following table compressive strength comparison according to age concrete.

Age Concrete	Comparison of compressive strength
7 days	0.70
14 days	0.88
28 days	1.00

- e. Each cylinder/cube of the test must be clean and permanently marked with the code number and the day of manufacture, together with the mark of the part of the work where the sample was taken. The system of measurement and marking of the cube will be determined by the Engineer / EMPLOYER.
- f. The Contractor must provide material for the manufacture of samples from all tests required in this section in the specifications. The Contractor must regularly submit all test results to the EMPLOYER/Engineer. All costs related to testing must be covered by the Contractor.

4.1.8. Casting

a. Material

- For finishing exposed concrete must be made of plywood with a thickness of 12 mm and can be used for 2 times of concrete casting. This plywood was given the reinforcement of 5/7 cm rafters to maintain the stability of the formwork.
- For closed concrete reference, finishing must be made of thick Class II timber as needed and can be used for 2 times of concrete casting, this timber should be supported by 5/7 cm rafters to maintain the stability of the formwork.
- For formwork strengthening (mold), if needed the Engineer/EMPLOYER can ask the Contractor to calculate the strength of the formwork and to be approved by the EMPLOYER/Engineer.
- In addition to the above types must be with the EMPLOYE/Engineer

TECHNICAL SPESIFICATIONS

b. Construction

- Formworks must not leak and rigid enough to prevent shiting or displacing the buffer. The surface formwork is smooth and flat, not to be sagged or concave. Formwork joints must be arranged to be straight and level in horizontal and vertical directions
- Anti deflection buffer (cambres) must be made as well as possible and able to support as needed, without any damage or overstress or shifting the place in the construction area that is burdened.
- The structure of the supporting poles must be placed in such a position, so that this construction is really strong and rigid to support its own weight and the loads that are on it during implementation
- Except for the different details in the drawing, formwork for all beams and floor plates is carried out following the anti-flexing upward. All beams or/and floor plates are 0.2% span width in the center of the span. All cantilever beams and floor plates 0.4% of the span, counted from the free end.

c. Bolts

The tie rod bolts needed for bonding in the concrete must be arranged so that when the formwork is demolition, then all the reinforcing irons will be 4 cm from the concrete surface. Binding wires are not permitted on exposed concrete which will be directly related to natural conditions, which can cause uneven colors. All formwork must be made in such a way that it can use nails without damaging the concrete.

d. Cleaning

All formwork must be cleaned before use. The work must be done in such a way that there will not be any possibility of porous concrete, damage/defects and others in the concrete. As soon as the concrete is cast in several parts of the formwork, the inside must be cleaned of all other materials, including water. For each part of formwork, structural parts must be examined by the EMPLOYER/Engineer before concrete is cast in that part. Particularly for reference columns and concrete walls or high beams, at the bottom edge must be made openings or two sides to remove dirt that may be present at the bottom of the column/wall. These openings may be closed after being examined and

TECHNICAL SPESIFICATIONS

approved by the EMPLOYER/Engineer.

e. Coating

Before installation of reinforced concrete formwork used for exposed concrete must be coated with formwork oil that does not leave marks on the concrete. Formwork for ordinary concrete (which needs to be plastered again) must be thoroughly soaked in water as a substitute for oil before the concrete is casted.

f. Formwork Dismantling

Buildings should not experience changes in shape, damage or overloading with plans to dismantling formwork from concrete. The responsibility for safety when dismantling each part of the formwork or support rests with the Contractor.

g. Minimum time for formwork dismantling

The minimum time from the completion of concrete casting to the dismantling of formwork from the structural parts is determined from the cylindrical/cube trial specimens which provide the minimum compressive strength as follows:

Structure Portion	Minimum time for demolition formwork (days)
- Side beams and wall	1
- Floor plate	21
- Beam brace	21

Source: SNI 03-1974-1990

TECHNICAL SPESIFICATIONS

4.1.9. Concrete Compressive Strength

All concrete used in the work must comply the required compressive strength.

Compressive Strength of Concrete Characteristics is obtained by the following formula:

$$f_{ck} = f_{cm} - k.S$$

$$f_{cm} = \frac{\sum f_{ci}}{n}$$

$$S = \sqrt{\frac{\sum (f_{ci} - f_{cm})^2}{n - 1}}$$

f_{ck} = concrete compressive strength characteristics

f_{cm} = average compressive strength of concrete

f_{ci} = value of the test results

n = number of results

S = Standard deviation

k = 1,645 for confidence level 95%

Notes :

f_{ck} , f_{cm} , f_{ci} symbols is used to cylinder test 150 mm - 300 mm while for cube test 150 x 150 x 150 mm can be use the symbols σ_{bk} , σ_{bm} , and σ_i as the replacement of the f_{ck} , f_{cm} , dan f_{ci} .

Concrete quality and implementation quality are considered to meet the requirements, if the following conditions are met:

1. There must not be more than 5% of the minimum number (20 or 30) of the results of consecutive test specimens occurring less than f_c' or σ'_{bk} .
2. If after all casting has been completed for each concrete quality a minimum amount of specimens can be collected, then the results of consecutive specimens must meet $f_{ck} \geq (f_{cm} - 1,645.S)$ or $\sigma_{bk} \geq (\sigma_{bm} - 1,645 S)$
3. If the test specimen collected is less than the minimum amount that has been determined, then the standard deviation value (S) must be increased by the modification factor given in the Table

TECHNICAL SPESIFICATIONS

For Total of Test Result Minimum 20		For Total of Test Result Minimum 30	
Total of Test Result	Modification Factor	Total of Test Result	Modification Factor
-	-	10	1,36
-	-	11	1,31
-	-	12	1,27
-	-	13	1,24
-	-	14	1,21
-	-	15	1,18
-	-	16	1,16
-	-	17	1,14
8	1,37	18	1,12
9	1,29	19	1,11
10	1,23	20	1,09
11	1,19	21	1,08
12	1,15	22	1,07
13	1,12	23	1,06
14	1,10	24	1,05
15	1,07	25	1,04
16	1,06	26	1,03
17	1,04	27	1,02
18	1,03	28	1,02
19	1,01	29	1,01
20	1	30	1

4. If after the completion of the entire concrete casting for each concrete quality there are less than the minimum number of test specimens, if not evaluated by means of other statistical mathematical propositions, no single grade value of the 4 results of examination of objects may not be evaluated consecutive test, fcm, 4 occurs less than $(f_c' + 0.82.S_r)$, where S_r = standard deviation of the plan.
5. The difference between the highest and lowest values among 4 consecutive test specimens must not be greater than $4.3.S_r$.

TECHNICAL SPESIFICATIONS

4.1.10. Rejection of Concrete Work

- a. EMPLOYER/Engineer have the right to reject work that does not meet the requirements. The Contractor must replace or repair/demolition concrete work that does not meet the conditions at his own expense.
- b. If the compressive strength test of the cylinder/cube test group fails to meet the above requirements, the Engineer / EMPLOYER will reject all concrete works from the test results that do not meet.

4.1.11. Casting Implementation

4.1.11.1. Concrete Transport and Casting

- a. Concrete casting should not begin before EMPLOYER and Engineer check and approve casts, formwork, reinforcement, armature and others, where concrete will be poured/casted. The place where the concrete will be poured must be free from all kinds of dirt, debris, pieces, wood, water and so on.
- b. Water (puddles) must be discharged from the place/room to be filled/casted concrete. Water flowing into the excavation must be controlled/disposed of in a manner approved by the EMPLOYER/Engineer.
- c. The contents of the mixer released in a continuous operation must be transported without causing degradation. Concrete must be transported in carts that are clean and waterproof. The method used must be approved by the EMPLOYER/Engineer.
- d. The tools and places used for the transport of concrete must be cleaned and washed if the work stops for longer than 30 minutes and at the end of each work. All concrete mixes at the work site must be placed/casted and compacted in place within 40 minutes after pouring water into the mixer.
- e. Concrete in general should not be dropped freely/poured from a height greater than 1.5 m. casting must be carried out by avoiding degradation and guarantee continuous casting. Concrete must be placed in layers no more than 60 cm thick and compacted according to the provisions below without degradation. Casting of a unit or part of the work must be carried out with a continuous operation or until a construction joint is reached.
- f. Concrete, mold or reinforcement must not be disturbed for at least 24 hours after casting, except with the permission the EMPLOYER/Engineer. All casting must be carried out during the day and concrete casting from a part

TECHNICAL SPESIFICATIONS

of the work should not be started if it cannot be completed during the day, except with the permission of the Engineer / EMPLOYER may be done at night. This permit may not be granted if the lighting system prepared by the Contractor has not yet been approved by the Engineer / EMPLOYER.

- g. When necessary, the Contractor is permitted to use a concrete pump, wheelbarrows to transport the mix to the place to be casted. Transporting concrete is not permitted with buckets.
- h. In the case of walls, concrete columns or parts considered high, they should not be casted from above, but must be from the side through an opening at an agreed height. Bulk drains for casting should not be used, except close distances and only with the approval of the EMPLOYER/Engineer. If this is agreed by the EMPLOYER/Engineer, then the channel must be made of metal or smoothed material, so that the concrete mixture can flow smoothly, while the slope of the channel / gutter is not steeper than the ratio of 1 (one) upright and 2 (two) horizontal.
- i. Implementation joint should be placed so that they do not reduce the strength of construction much. If the implementation broadcasts are not shown in the plan drawings, the locations must be approved by the EMPLOYER/Engineer.
- j. Storage sites for joint than those stated in the drawings must be approved by the EMPLOYER/Engineer.
- k. Placement of water (connection casting) on the wall that holds the water, must be installed water stop of the type that was approved in advance by the EMPLOYER/Engineer.

4.1.11.2. Concrete Compaction

- a. Concrete must be compacted completely with mechanical vibrators done by people who are experienced and have been trained for the job. The finished concrete work must be a mass that is free of degradation holes or honey combing.
- b. The vibrator used must be of the rotary out of balance type with a frequency of not less than 6,000 cycles per minute. care must be taken that compaction/vibration of all concrete parts does not cause degradation of the material due to over vibration. Vibration should not be used on reinforcement, especially reinforcement that has entered the concrete that begins to harden.

TECHNICAL SPESIFICATIONS

- c. The number of vibrators used must be adjusted to the volume and speed of the casting. The Contractor must also provide at least 1 additional vibrator/backup to replace the damaged at the time being used.

4.1.11.3. The Protections towards the Natural Weather

a. Hot Weather

If necessary, a series of wind restraint, shade, fog spraying, splashing water, splash with water or cover with wet covers on parts that have already been casted, and such protective measures must be taken immediately after casting and the finishing work is completed.

b. Rainy Season

- It is not permitted to cast during heavy rain, and newly casted concrete must be protected from rain. The connection must be protected as described in this specification.
- Before the next casting is done, all concrete which is affected by rain/rainwater flow must be inspected, repaired and cleaned first of concrete mixed with/eroded by rain water. Subsequent casting must first obtain permission from the Engineer / EMPLOYER.

4.1.12. Treatment

- a. New concrete must be protected from heavy rain, flow and from damage caused by tools. All concrete should always be wet, for at least 7 days, by pouring water into a perforated pipe or other means that make the surface area of the concrete always wet.
- b. Wood formwork is left to remain so that the concrete remains wet during maintenance to prevent cracking at joints and drying concrete too fast. Water used for maintenance must be clean and completely free of chemical elements which can cause damage or discoloration in the concrete.

4.1.13. Defects on the

Although the results of the cylinder/cube test are satisfactory, the assignor has the authority to refuse defective concrete construction as follows.

- a. Very porous concrete construction.
- b. Concrete construction does not fit the planned shape or position is not as shown in the drawings.

TECHNICAL SPESIFICATIONS

- c. Concrete construction that is not as perpendicular or flat as planned.
- d. Concrete construction containing wood or other objects.

4.2. STEEL WORK

4.2.1. General

This section covers the procurement of materials, personnel, equipment and fittings as well as the installation of all steel roof trusswork as shown in the figure.

This work includes everything needed for the implementation of steel construction on the roof in full accordance with the drawings and technical requirements.

4.2.2. Reference Standards

Steel construction requirements and technical terms in general form one unit in this technical requirements book. Unless otherwise specified in the technical requirements book all steelworks must comply with the following standards:

- a. Specifications for Structural Steel Buildings, SNI 1729: 2015
- b. American Society for Testing Material (ASTM)
- c. Indonesian Industrial Standards (SII).

Contractor must carry out this work with high accuracy and suitability according to these technical requirements, plan drawings and instructions required by Construction Management.

4.2.3. Material

All materials used must be new and approved by the EMPLOYER/Engineer. The EMPLOYER/Engineer have the right to request testing of these materials and the Implementer must be responsible for all costs incurred for it. Steel structure must have BJ 37 quality ($f_y = 240 \text{ MPa}$, $f_u = 370 \text{ MPa}$).

The welding used is electric welding with FE-70 quality or equivalent to $f_u = 490 \text{ MPa}$ (in accordance with JIS). All steel used must be of the shape, size and thickness and be free of rust, deformity due to impact, bending, or twisting, weighing according to design.

All steel materials must be from suppliers that can be accounted for with certificates from the factory. If deemed necessary, the implementer must submit

TECHNICAL SPESIFICATIONS

the required test results related to this steel construction with a shipping invoice. The material for the coating is paint, with the color determined later.

4.2.4. Fabrication

Manufacturing must be carried out in a workshop which meets the requirements protected from the effects of weather. Implementers must conduct workshops in the field and be approved by the EMPLOYER/Engineer.

a. Welding

This welding work must meet the requirements of JIS or AISC. Welding must be carried out by experienced experts and with high accuracy. The Contractor must submit a certificate of expertise from each of its welders in accordance with the regulations.

The weld sizes listed in the drawings are effective measurements. The electrode bars used are the type of Mild steel Arca Welding Electrode and must meet the requirements of JIS or AISC/AWS. The electrode rod must be stored in a place that can guarantee the properties of the electrode while in storage.

Welding must ensure equal distribution of the electrode fluid. As much welding work as possible in the field must be quite good and very careful, it should not be done when it is wet or rainy.

Welding stops must be at specified locations and must be guaranteed that welded profiles will not rotate or swell after the connection has cooled. After welding is complete, the remnants of the welding crust must be cleaned properly. Welds that show defects must be cut and welded again at the Contractor's expense.

Before the welding work begins, the Contractor is obliged to submit work procedures for welding methods to be carried out, both in the workshop and to be done in the field. This proposal must be examined and approved by Engineer before this welding work can begin.

b. Welding Work Preparation

The surface area to be welded must be flat, clean and free of cracks or other

TECHNICAL SPESIFICATIONS

defects that can reduce the quality of welding. Also the surface must be free of dirt, paint, asphalt, oil and rust.

Before the welding work begins, there must be a guarantee that the fields to be joined to the welding must not move until the welding job is finished.

The parts to be welded should be flat and if there is to be upright welding then welding must start from the bottom then upward.

The end of a blunt welding must be guaranteed that the connection is carried out in full. For this reason, joints should be used at the end of the joint so that welding can be carried out in full.

c. Structural Steel Installation Work

Before the erection begins, the Contractor must re-examine the position of the steel armature and notify the EMPLOYER/Engineer about the method and order of implementation/erection. Special attention must be paid to the installation of the armature for the column where the armature must be precise and accurate to prevent mismatch in erection. For this reason, it must be maintained so that during the casting period, the armature does not shift, for example by welding on reinforcing concrete columns.

All equipment and steigers needed for installation of steel construction must be provided by the Contractor in good condition in the field, although it is not specifically shown in drawings or technical requirements must be provided. The Contractor is responsible for the safety of work in the field. For this the Contractor must provide a safety belt, helmet, gloves, fire extinguisher, etc.

4.2.5. Bolt Installation

High tension bolts must be installed with two bolt rings, one under the bolt head and one under the nut. It should be noted that the bolt ring is mounted with the concave facing out.

The installation and tightening of the bolt must be arranged so that it is always tight and cannot begin before the connection is checked and approved by the Engineer. The nut that must be tightened is only the nut against the plane which is rather perpendicular to the axle hole. The bottom of the bolt head must not deviate from the plane perpendicular to the axle axle more than 3.5 degrees. Use of tapered bolt

TECHNICAL SPESIFICATIONS

rings can be done if needed. The bolt protrudes from the nut not less than 1.5 mm and not more than 4.5 mm.

4.2.6. Bolt Tightening

Steel bolts can be tightened by hand or with machine-driven keys. The wrench must be of the type approved and which can indicate the required torque is achieved. The wrench must be checked frequently and must be adjusted to reach the required voltage or torque.

4.3. LIGHTWEIGHT STEEL ROOF WORK

4.3.1. General Requirements

- c. This work will consist of making and installing roof structures in the form of a truss that has been coated with a stainless coating. Trapezoidal and rectangular triangular trunk arrangement consisting of:
 - Top chord
 - Bottom chord
 - The web. The entire frame is connected using a self drilling screw with an adequate amount.
 - Batten frame is directly installed above the main roof truss structure with a distance in accordance with the size of the tile distance.
- d. Light steel roof truss works include:
 - Building span measurements before fabrication
 - The work of making structure is done in a permanent workshop (Fabrication)
 - Work of mounting the entire roof truss covering the truss structure, wall beams (top plate/ plate nut), battens, overhang fissures, wind ties and bracing (stiffener ties)
 - Bunch installation

4.3.2. Material Requirements

Lightweight steel roof truss structure materials are:

- a. High Quality Steel G 550
- b. Minimum Melt Strength of 550 Mpa
- c. Maximum Voltage 550 Mpa
- d. Modulus of Elasticity 200.000 Mpa
- e. Modulus of Shear 80.000 Mpa

TECHNICAL SPESIFICATIONS

- f. Material structure of lightweight steel roof truss must be coated with protection against corrosion attacks, following the requirements of anti-rust coating material:
- Galvanized Coating
 - Hot-dip zinc type
 - Z22 class
 - Coating thickness 220 gr/m²
 - Composition 95% zinc, 5% mixture material

4.3.3. Pre-Construction Requirements

- a. The Contractor is required to provide product exposure prior to carrying out the installation of a lightweight steel roof truss.
- b. The Contractor is required to submit a complete drawings work with details and responsible for all measurements listed in the drawings work. In this case includes the dimensions of the profile, the length of the profile and the number of connectors at each gusset point.
- c. Material changes/details for any reason must be submitted to an Engineer for written approval.
- d. The main elements of the truss are fabricated in a permanent workshop using JIG machine tools that guarantee the accuracy of the assembly results (fabrication)

4.3.4. Implementation Requirements

- a. Preparation and installation of truss and other related materials, must be carried out in accordance with the drawings and designs that have been calculated with the special application of light steel calculations in accordance with the calculation standards referring to the competent regulatory standards.
- b. All details and connectors must be installed according to drawings work.
- c. The assembly of the truss must be done in a permanent workshop using a raft machine (jig) and the installation of the screw is carried out with a screw driver equipped with torque control.
- d. The Contractor must prepare all cantilever structures with a waterpas level for the easel mount in accordance with the design of the roof truss system.
- e. The Contractor must ensure the strength and durability of all structures used for pedestal horses. In this regard, the Engineer or expert has the right to request information about the reactions of the truss.

TECHNICAL SPESIFICATIONS

- f. The Contractor is willing to provide a minimum of 8 (eight) tiles that will be used as roofing cover, so that the provider of mild steel construction can install battens with the exact distance possible, and the supply of these tiles must be available when the horses arrive at the project site.

4.4. ROAD WORK

4.4.1. Pavement Road

4.4.1.1. Sub Grade Preparation

Sub grade preparation conducted after excavation/filling level as per design. The equipment to be use are motor grader, vibro compactor and water tank.



Figure 3. Leveling by Motor Grader

After the work is done testing for compaction of the sub grade refers to AASHTO T180 standard (at least 95% γ_D max) or field CBR Test interval 100 m length.

4.4.1.2. Sub Base Course Work

Sub Base Course work is done after sub grade preparation work is done and comply with quality control requirement. Based on road engineering calculation thickness of sub base course layer is minimum 150 mm.

TECHNICAL SPESIFICATIONS

Procedure of Sub Base Course Work :

- 1) Mixing sub base course using wheel loader
- 2) Delivery material of sub base course material using dump truck.
- 3) Execution of work

Material of sub base course spreading by Motor Grader and compacting by Vibro Compactor. If the moisture content below OMC (Optimum Moisturing Content) the material need watering by Water Tank Truck and compacting again.

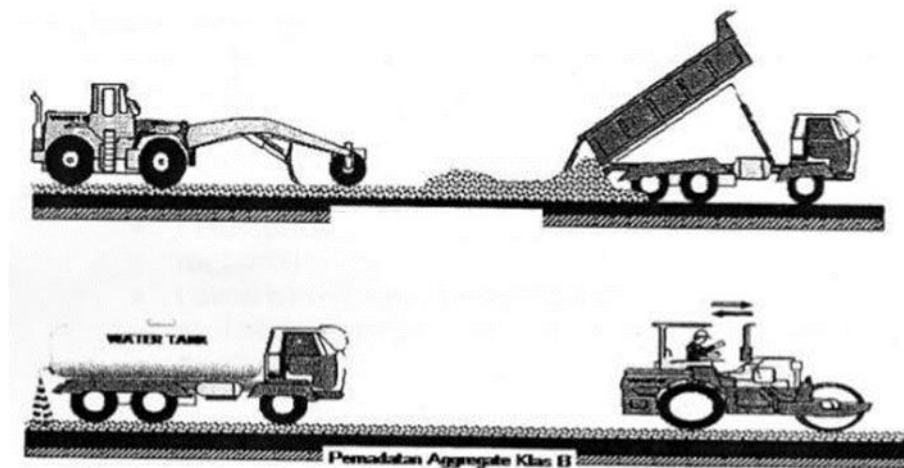


Figure 4. Laying and Compaction

After the work is done testing for compaction of the sub base course refers to AASHTO T180 standard (at least 95% γ_D max) and field CBR Test every 100 m square.

4.4.1.3. Base Course Work

Base Course work is done after sub base course work is done and comply with quality control requirement. Based on road engineering calculation thickness of base course layer is minimum 150 mm.

Procedure of Base Course Work :

- 1) Mixing base course using wheel loader
- 2) Delivery material of base course material using dump truck.
- 3) Execution of work

TECHNICAL SPESIFICATIONS

Material of base course spreading by Motor Grader and compacting by Vibro Compactor. If the moisture content below OMC (Optimum Moisturing Content) the material need watering by Water Tank Truck and compacting again.

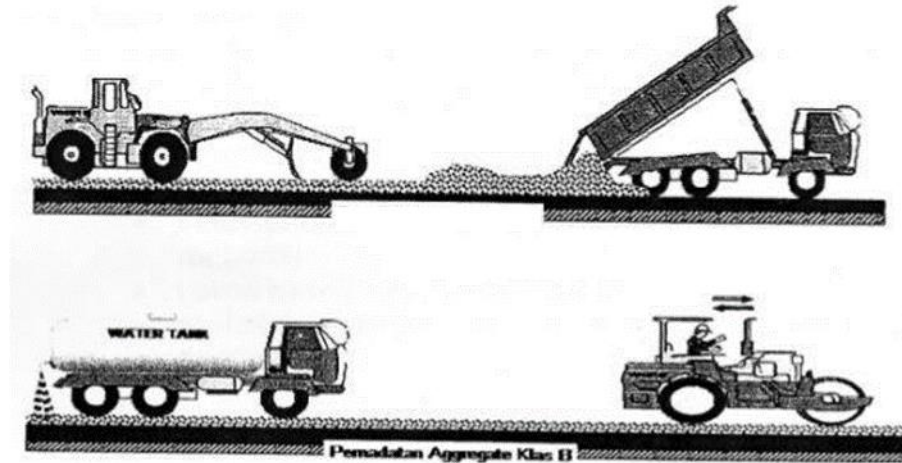


Figure 5. Laying and Compaction

After the work is done testing for compaction of the base course (base A) refers to AASHTO T180 standard (at least 95% γ_D max) and field CBR Test every 500 m square.

4.4.1.4. Prime Coat

The function of prime coat is used as an adhesive and absorption layer between Base Course with construction on top of Surface Course. Before spraying the asphalt is heated to the Asphalt Distributor tank and mixed with Kerosene after the asphalt reaches the set temperature according to specifications. After that Prime coat is sprayed onto Base Course, with thickness of 0.3 to 0.9 liters / square meter. To find out about the prime coat application, a paper test will be carried out.

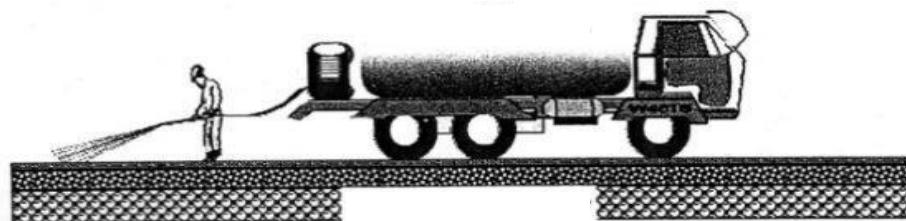


Figure 6. Spraying Prime Coat

TECHNICAL SPESIFICATIONS

4.4.1.5. Asphalt Concrete (Surface Course)

Asphalt Concrete material is spread out by Asphalt Finisher and before main work executed conducted at the site, the necessary trial test such as number of passing and temperature checking to find out optimum performance.

After all is fulfilled, Asphalt Concrete is laid on the surface of Base Course Material which has been sprayed by Prime Coat and after curing time minimum 4 hour.

The width, thickness (thk. 4 - 5 cm) and length of the overlay are according to the specifications. Compaction is carried out in 2 stages. The first compaction will be done by Tandem Roller and continue by Pneumatic Tire Roller. Number of compaction passing of Asphalt Concrete overlay according to compaction trial.

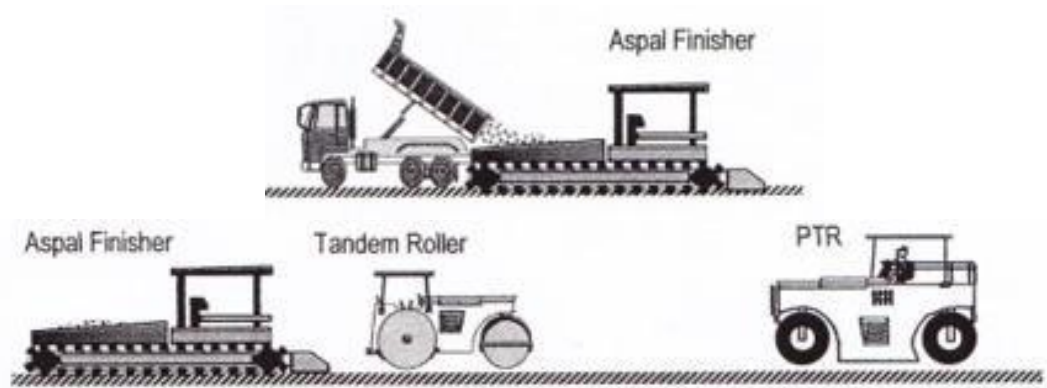


Figure 7. Laying & Compaction Asphalt Concrete

After the work is done testing for compaction of the Asphalt Concrete layer refers to AASHTO T96 and AASHTO T182.

4.5. CHANNEL WORK

4.5.1. General

All measures of drainage must follow the plan drawings. If it turns out that there are deficiencies in the drawing, the Contractor must seek the approval of the Construction Management Engineer and the EMPLOYER to determine it.

TECHNICAL SPESIFICATIONS

4.5.2. Scope of Work

Scopes of work on the drainage appropriate based on the drawings are:

- a. Drainage channels with 570x300x400 mm trapezium dimension with construction of stone masonry.
- b. Culvert with dimensions of 600x400 mm with K-250 reinforced concrete construction.
- c. Settling Basin of 1500x1500x1500 mm dimension with K 250 reinforced concrete construction.

4.5.3. Preparatory Work

Before carrying out construction work, preparatory work needs to be carried out consisting of:

- a. Location survey and initial measurement.
- b. Access entrance settings to construction location.
- c. Material and equipment layout settings.
- d. Equipment mobilization.

4.5.4. Execution Work

All work must be carried out according to technical and safety standards in accordance with applicable regulations.

TECHNICAL SPESIFICATIONS

CHAPTER 5

LEACHATE COLLECTION SYSTEM (LCS) AND LEACHATE TREATMENT PLANT (LTP)

5.1. SCOPE OF WORK

5.1.1. General

Leachate Collection System for both landfills consists of leachate collection and distribution systems and leachate treatment systems. The two systems can be said to be interconnected, as shown in the working drawings. Leachate collection system consists of a pipeline sub system, namely:

- Secondary leachate collection pipe: capture and collect leachate in the catchment area to primary leachate supplier.
- Primary leachate collection pipe: channel the leachate collected to the leachate treatment unit, this pipeline can also function as a leachate collection.
- The open channel from the leachate collection pipe to the sump pit.

Optimization of the existing leachate treatment plant (LTP) utilizes 1 (one) existing east side LTP system which consists of processing sub-systems, namely:

- Sump Pit
- Anaerobic Pond;
- Facultative Pond;
- Maturation Pond;
- Wetland Pond; and
- Indicator Pond.

5.1.2. Standard

All work must be carried out properly and with full expertise in accordance with technical specifications and planning drawings. Implementation must comply with all standards for relevant matters that apply in Indonesia.

TECHNICAL SPESIFICATIONS

5.2. WORK FOR LEACHATE COLLECTION AND DISTRIBUTOR SYSTEM LANDFILL AREA

5.2.1. General Requirements

Leachate pipeline works should follow the requirements listed in the 1974 Indonesian Plumbing Guidelines, as well as the requirements set by the authorities. The material quality must be good and have been tested by an authorized institution.

The drawings for the pipe installation plan are outline, the location of the installation requirements and the pipe installation lane must be adjusted to the situation on the field.

After the pipeline work is completed, all parts of this work must be tested. All deficiencies and leaks must be fixed immediately so that the entire system works properly.

Before the product/goods are sent to the work location, the Provider must provide a Factory Acceptance Test in order to check and test the quality of the material/product.

5.2.2. Pipeline Technical Requirements

- a. Unless otherwise specified by the Engineer and EMPLOYER, the leachate pipes used in this work are half perforated HDPE pipe type, except the leachate pipe which directly connects with the LTP inlet is a non-perforated HDPE pipe.
- b. Unless otherwise specified by the Engineer and EMPLOYER, the pipe diameters used are:
 - Secondary pipe for new zone Kawatuna Landfill = diameter of 12"
 - Primary pipe for new zone Kawatuna Landfill = diameter of 16"
 - Secondary pipe for new zone Kabonga Landfill = diameter of 6"
 - Primary pipe for new zone Kabonga Landfill = diameter of 12"
- c. Minimum pressure nominal for leachate pipa is PN 10.
- d. All pipes and fittings-accessories that are used must follow the standards that apply to the waste water pipe.
- e. Coupling (pipe connection) used is a type of connection with welding generally used in HDPE pipes.
- f. Each pipe and accessories used must clearly contain information about:

TECHNICAL SPESIFICATIONS

- Type of pipe
 - Diameter of pipe (mm)
 - Pipe strength value
 - Production number, date and other signs
 - Angle (degree) of the fitting
- g. Perforation in the capture/collection pipe is carried out appropriate with the drawings with a tool that will not damage the strength of the pipe.
- h. Product of RUCIKA or equivalent.

5.2.3. Scope of Pipeline Work

Plumbing installation work hereinafter referred to as pipeline includes:

- Measurement work;
- Benchmark work;
- Excavation work;
- Landfilling work; and
- Pipeline work.

a. Measurement work

What is meant by measurement work in this case is lengthwise direction measurement and pipeline work. This work is fully supervised and/or together with Engineer and EMPLOYER.

b. Work plan

Based on these measurements, the Contractor must prepare a work plan for pipeline that contains:

- Surface elevation
- Excavation base elevation
- Elevation laying pipe
- Surface elevation after completion of landfilling and / or road construction
- Location and / or position of straight pipeline, bend piping, trust blocks and others in accordance with the conditions on the field or on the instructions of the Engineer and EMPLOYER.

TECHNICAL SPESIFICATIONS

5.2.4. The Things Need to be Considered

- a. At the time of pipe installation must be really concerned about the position of the pipe so that it is really straight and on the correct peil and the base of the pipe must be flat, there should be no stones (debris) or hard objects that allow damage to the pipe in the future day.
- b. When connecting pipes must be carried out dry and clean, there should be no water at all and cleanliness must be checked in the pipe.
- c. Cutting of pipes if absolutely necessary can be done by the Contractor with the approval of the Engineer and EMPLOYER and must be done and must be carried out with the appropriate tools for the pipes used.
- d. At the meeting between the leachate and the gas capture pipe, there is a locking concrete from K-250 concrete, which functions to maintain the position of the pipe.

5.2.5. Pipe Testing

- a. The pipeline testing must be carried out in the presence of the EMPLOYER/Engineer in the future if it has been received / meets the requirements for an official report.
- b. In principle, testing is done by part of the maximum pipe length of 100 m.
- c. The cost of the test and the tools needed are the responsibility of the Contractor.
- d. If the test is not successful, the Contractor must look for the reasons, then fix it, if necessary demolition and repairs are the responsibility of the Contractor.

5.2.6. Changing the Diretions of Laying Pipe

Changes in the direction of pipe placement (curve/bends) must be carried out with the help of appropriate bend/elbow connector, as well as for branching it must be by tee or tee-cross (as needed). Bending or changing the shape of a pipe in any way is not permitted (mechanically or by heating).

5.2.7. Gravel's Work

In this work, a 50-70 mm choice of gravel stone is spread over an area of new landfill zone with a height of 40 cm, with a function for filtration of leachate water before entering the leachate pipe.

TECHNICAL SPESIFICATIONS

5.3. REHABILITATION WORK OF EXISTING LEACHATE TREATMENT PLANT (LTP)

5.3.1. General

Work carried out in rehabilitation existing LTP other than work in processing ponds includes:

- a. Demolition work of the existing LTP area.
- b. New LTP construction work with K-250 quality.
- c. Leachate solar cell pump and pump house.

5.3.2. Sump Pit

This sump pit construction work follows the stages of civil works in general, with some equipment or additional units namely:

- a. Installation of a bar screen on the open channel before entering the combined sump pit with a 60° mounting angle.
- b. Installation of 1 unit 80 x 80 cm manhole.

5.3.3. Anaerobic Pond

Rehabilitation work in anaerobic pond for leachate includes the following works:

- a. Anaerobic pond works, with K-250 concrete grades, K-125 lean concrete grades.
- b. Work of maintenance bridge in the middle of the pond equipped with a fence.
- c. Fencing, around the anaerobic pond except on the side wall directly adjacent to the facultative pond.

5.3.4. Facultative Pond

- a. Facultative pond works, with K-250 concrete grades, K-125 lean concrete grades.
- b. Work of maintenance bridge in the middle of the pond equipped with a fence.
- c. Fencing, around the anaerobic pond except on the side wall directly adjacent to the anaerobic pond.

5.3.5. Maturation Pond

Maturation pond work for leachate includes the following works:

- a. Maturation pond works, with K-250 concrete grades, K-125 lean concrete grades.
- b. Work of maintenance bridge in the middle of the pond.

TECHNICAL SPESIFICATIONS

5.3.6. Wetland Pond

The optimization work in the Wetland pond for leachate treatment includes the following works:

- a. Wetland pond works, with K-250 concrete grades, K-125 lean concrete grades.
- b. Work of 6 units of water gate for maintenance in the middle of the pond.
- c. Pond media works,
 - Procurement and installation of gravel layers. A layer of fine gravel (12-20 mm diameter) as thick as 20 cm and a rough gravel (diameter 20-40 mm) as thick as 30 cm.
 - Planting water plants designating wetland such as *Akar Wangi* and its kind that is according to the type of plants contained in the design note.

TECHNICAL SPESIFICATIONS

CHAPTER 6

COVER SOIL WORK

6.1. LANDFILLING FERTILE SOIL

6.1.1. General

- a. Earthwork includes work related to the accumulation of fertile soil on the surface of the ground cover of the area covered by work carried out according to specifications, according to the implementation drawings or the instructions of the Engineer and EMPLOYER.
- b. For all landfilling work must use good and clean soil from plants, roots, wreckage, debris and all kinds of other impurities.

6.1.2. Source of Material Use

- a. The material for the pile on site consists of materials suitable for those needs which are approved by the Engineer and EMPLOYER.
- b. The soil for landfilling must be taken from outside the site and laboratory tests must be carried out including: compactor (standard proctor), organic matter content, plasticity and must be approved by Engineer and EMPLOYER.
- c. Landfilling material from native soil brought in by fulfill the requirements of landfilling material fertile soil in accordance with soil suitable for planting urban forest plants.
- d. Density must be achieved in the field of at least 75-90% of the density of the standard laboratory proctor at optimum moisture content.

6.1.3. Overlay and Compaction

- a. Densities achieved for embankment construction are as follows: Soil layers of each area of 500 m² must be compacted to 75-90% of the dry (dry) density used by ASTM D 1556 (sand cone method) / (SNI 1743: 2008) test.
- b. In this overlay and compaction work, the Contractor must carry out the phasing system or location division per zone. For this reason, the Contractor must submit his plan to the Engineer and EMPLOYER for approval of its implementation.

TECHNICAL SPECIFICATIONS

6.1.4. Compaction Trial

- a. Before starting the actual compaction work, the Contractor must send samples of fertile soil to be used, and after approval by the EMPLOYER a test will be held in the laboratory to obtain the optimum moisture content and grinding standards
- b. The purpose of this experiment is to determine the optimum moisture content to be used and the relationship between the amount of grinding and the density that can be achieved by the sample material.
- c. The density achieved for embankment construction is as follows: Each layer of land covering an area of 500 m² must be compacted to a minimum of 75-95% of the maximum (dry) density used in the ASTM D 1556 test (sand cone method)/(SNI 1743: 2008).

6.1.5. Measurement

- a. The pile will be measured as the number of cubic meters of compacted materials received in full on the spot. The measured volume must be based on an approved cross-sectional drawings of the soil profile or excavation profile before a pile is placed and on the line, slope and height of the designated and approved final pile work. The method of calculating the volume of materials must use the method of the average end area, using a cross section of the work not more than 25 meters apart.
- b. Pile that are placed outside approved lines and cross sections, including any additional pile needed as a result of alienated work or binding of the pile on an existing slope or as a result of a decline in foundation, it will not be measured for payment, except:
 - Piles are needed to replace the materials that are unsuitable or soft or to replace rock or other hard materials.
 - Additional pile is needed to correct unsatisfactory or unstable work or failure in the event that the Contractor is not considered responsible.
- c. Small embankments that use ordinary piles stated as part of the earthworks will not be measured for payments as piles under this chapter.
- d. Piles used outside of the contract boundary of the pile construction or bury materials that do not meet the requirements or unused will not be included in the pile measurement.

TECHNICAL SPESIFICATIONS

- e. If excavated materials are used for piles, these materials will be paid for as piles.

6.2. PROCUREMENT AND INSTALLATION OF GEOSYNTHETIC CLAY LINER (GCL) WORK

6.2.1. General

Geosynthetic Clay Liner is a water-retaining material consisting of bentonite layer or other material that has very low permeability, where Geosynthetic clay liners are combined with Geosynthetic and geomembrane which are mechanically joined together by being hit by a needle board, stitched or using chemicals. This Geosynthetic Clay Liner will be used as a base layer in the landfill area by meeting the requirements of technical specifications, namely to prevent leakage at the landfill area so as to maintain the stability of the landfill subgrade and not pollute the surrounding environment. The contractor is required to show the material samples accompanied by the material technical specifications to the Engineer and EMPLOYER for inspection and approval.

6.2.2. Storage and Installation

- a. Geosynthetic Clay Liners sent to the field must be stored and protected from things that can damage the Geosynthetic and from the influence of direct sunlight (for a long period of time).
- b. Geosynthetic Clay Liners are installed in accordance with recommendations/instructions issued by the factory, and must be installed at the location as stated in the design drawings.
- c. The surface of the land where the Geosynthetic will be set, must be dry and clean from destructive objects such as mud, rocks, tree roots, tree trunks, etc. that can cause damage to the Geosynthetic (GCL). Land under the Geosynthetic location will be set uniform density or with the agreement of the Engineer and EMPLOYER.
- d. The material storage location should be close to the work location to minimize transportation and handling. Liner material must be stored in a place with a smooth surface and free from rocks or other objects that can damage the material.
- e. It is not recommended to try to roll out the material during periods of heavy wind, rain, or other conditions that prevent the successful welding of Geosynthetic Clay Liners.

TECHNICAL SPESIFICATIONS

- f. Geosynthetic panels (GCL) must be inspected immediately after deployment and if any damage or factory defects are found as soon as possible to be repaired.
- g. Connection of Geosynthetic clay liners must be done in the right way to anticipate leaks that occur, and also must be examined of the connection. Installation in Geosynthetic Clay Liner must have an overlay of at least 1 m between one Geosynthetic Clay Liner.
- h. Geosynthetic Clay Liner installation in embankment area. The embankment area must be wrapped with GCL which is intended in order to the stability of the embankment is maintained when there will be pore protection from under the embankment or from the side of the embankment and it is protected from rain so that the stability of the embankment will be maintained.

6.2.3. Specification Requirement

The Geosynthetic Clay Liner used must meet all the requirements as specified. In below are the requirements for Geosynthetic Clay Liner specifications from Naue GmbH & Co. KG, Germany that will be used in the landfill area:

TECHNICAL SPESIFICATIONS

Table 8. Material Geosynthetic Clay Liner Specifications

Property	Test method*	Unit	Values
Geotextile layers:			
Polypropylene nonwoven:			
Mass per unit area	EN ISO 9864	g/m ²	220
Polypropylene woven:			
Mass per unit area	EN ISO 9864	g/m ²	110
Bentonite layer (sodium bentonite powder):			
Mass per unit area	EN 14196 (ρ_{CLAY})	g/m ²	3,000
Swell index	ASTM D5890	ml/2g	24
Fluid Loss	ASTM D5891	ml	≤ 18
Water content	DIN 18121 / ISO 11465 (5hrs, 105 °C)	%	approx. 10
Polyethylene coating:			
Mass per unit area	EN ISO 9864	g/m ²	≥ 200
Bentofix X2 NSP 3300:			
Mass per unit area	EN 14196 (ρ_{GBR-C})	g/m ²	approx. 3,580
Thickness	EN ISO 9863-1	mm	6.0
Max. tensile strength, md/cmd**	EN ISO 10319 / ASTM D6768	kN/m	12.0 / 12.0
Elongation at break, md/cmd**	EN ISO 10319 / ASTM D6768	%	10.0 / 6.0
Peel strength (nonwoven vs.woven/coating)	ASTM D6496	N/10 cm***	≥ 60
		N/m	≥ 360
Static puncture strength	EN ISO 12236 / ASTM D6241	N	2,000
Permeability	EN 14150 (10 m water head, coating only)	m ³ /m ² /day	3 x 10 ⁻⁶
Permeability / Hydraulic Conductivity (calculated by testing according to EN 14150)	EN 14150 (10 m water head, coating only)	m/s	≤ 10 ⁻¹⁴
Index Flux (q ₁₀)	EN 16416 / ASTM D5887 (GBR-C only)	(m ³ /m ²)/s	1 x 10 ⁻⁸
Roll dimensions:			
width x length, / diameter (e.g.)	-	m x m / m	4.85 x 50 / Ø 0.65

* = based on; **md = machine direction, cmd = cross machine direction; ***max. peak

TECHNICAL SPESIFICATIONS

CHAPTER 7

SUPPORTING FACILITIES AND ARCHITECTURAL WORK

7.1. GENERAL

Supporting facilities work referred to in this section are buildings with broad provisions including the following:

1. Management Office : 128,00 m²
2. Mechanical Workshop : 120,00 m²
3. Guardhouse : 18,00 m²
4. Material Recovery Facility : 225,00 m²

7.2. INSTALLATION WORK

a. Scope of Work

1. Building foundation of river stone with a mixture of 1 Portland cement (PC) : 3 sand.
2. Underneath the pillars / columns the buffer is mounted on the foundation.
3. Pair of red bricks with a mixture of 1 PC : 5 sand is installed in the places stated in the drawings.
4. Install of *trasram* (watertight) of mixed bricks 1 PC : 3 sand is used in places according to the drawings.
5. Install of red bricks with an area of more than 10-12 m² must be interspersed with practical columns.
6. Bricks must be immersed before being installed until the bubbles run out (saturated water) and are not allowed to use bricks that have not been soaked in the water. Bricks must be good quality and not cracked.

b. Material Requirements

All 5x10x20 cm Red Bricks for installation work on the wall must comply with the standard terms and conditions which are intact. All cement mix for work must comply with the terms and conditions stated for Portland cement.

Sand for admixture used for all construction works, which are required according to these specifications must be provided by the Contractor according

TECHNICAL SPESIFICATIONS

to the terms and appropriates with the terms and conditions of the material specifications for sand.

Water used for admixture is free from sludge, organic materials, alkali, salts and other impurities and must be tested and approved by the Engineer and EMPLOYER.

c. Implementation Requirements

1. The mixture is mixed in a certain place that is clean from dirt, has a flat and hard base, does not absorb water which previously had to have the approval of the EMPLOYER/Engineer.
2. If it is not determined otherwise, mixing and stirring may be done by hand (using a hoe and so on) until a uniform mixture of colors is shown.
3. The mixture used is as stated in the drawing or approved by the Engineer and EMPLOYER
4. The methods and equipment for transport and stir will be such that they will not delay the use of the stir.
5. Bricks should not be installed during heavy rain or long enough to wash away a stir. The mixture which has been melted by rain must be removed first and replaced before it hardens completely.
6. A brick must be installed properly and the face part is flat, the pile of brick-filled mortar must fill each other with blanks and bind with each other, vertical straight lines and a good surface, except if indicated otherwise from the drawings or as directed by the EMPLOYER/Engineer.

7.3. FINISHING WALL WORK

7.3.1. Plastering Wall Work

a. Scope of Work

1. Included in the wall plastering work is the supply of labor, materials, equipment including auxiliary equipment and transportation equipment needed to carry out the plastering work, so that good quality work results can be achieved.
2. Plastering wall work is done on the surface of the inner and outer walls and all the details mentioned/shown in the drawings.

TECHNICAL SPESIFICATIONS

b. Material Requirements

1. Portland cement must fulfill SNI 15-2049-2004 Portland cement requirements.
2. Sand must meet material requirements for sand or fine aggregate.
3. The use of a mortar mixture.
 - Admixture 1 pc: 3 sand used for dense plastering
 - Admixture 1 pc: 5 sand, used for all other wall plastering.
 - The entire surface of the plastering is finished from PC material.

c. Implementation Requirements

1. Plastering is carried out according to the specialization standard of the material used in accordance with the instructions and approval of the Engineer and EMPLOYER, and the written requirements in the description and terms of this work.
2. Plastering work can be carried out when concrete field work or masonry wall pairs have been approved by Engineer and EMPLOYER. Works are in accordance with technical specifications.
3. In carrying out this work, it must follow all the instructions in the architectural drawings, particularly in the detailed drawings and cutout drawings regarding the thickness/height/peil size and shape of the profile.
4. The stirring mixture of the stirred adhesive is a mixture in volume and meets the following requirements:
 - For watertight, concrete, masonry brick walls related to outside air and all masonry bricks at ground level to a height of 30 cm from the floor for bathrooms, WC/toilets and other wet area used to stir plaster 1 pc : 3 sand.
 - For other fields required 1 PC plastering : 5 sand.
 - Smooth plastering (*acian*) used homogeneous mixture, *acian* can be done after plastering is 8 days old (dry completely).
 - All types of stirring adhesive must be prepared so that it is always in good condition and has not dried. Efforts should be made to allow the time interval for mixing the adhesive with the installation not to exceed 30 minutes, particularly for the watertight mixture.

TECHNICAL SPESIFICATIONS

5. Plastering of walls is only permitted after installation of electrical and plumbing installations for the entire building.
6. For concrete before plastered on the surface must be cleaned of the remnants of formwork and then chipped first and all holes used in formwork binder or form tie must be covered with plaster.
7. For the field of brick masonry walls and reinforced concrete that will be finished with paint used smooth plastering (above the plaster surface).
8. For walls embedded in the ground must be plastered using watertight type.
9. All areas that will receive materials (finishing) on the surface are given horizontal lines or chipping to give a better bond to the finishing materials, except for those who receive paint.
10. Head plastering installations are made at a distance of 1 M, mounted upright and using plywood pieces of 9 mm to benchmark plane flatness.
11. The thickness of the plastering must reach the surface thickness of the wall/column stated in the drawing, or according to the peels requested by the drawing. The minimum plastering thickness of 2.5 cm, if the thickness exceeds 2.5 cm must be provided with chicken wire to assist and strengthen the stickiness of the plaster on the part of work permitted by Engineer and EMPLOYER.
12. For each surface of different types of material that meet in a flat plane, must be given *naat* (water rope) with a width of 0.7 cm in depth 0.5 cm, except if there are other instructions in the drawings.
13. For a flat surface, it must have a curved or convex tolerance of the field not exceeding 5 mm for each distance of 2 m. If it exceeds, the Contractor is obliged to repair it by Contractor's expense.
14. Plastering humidity must be maintained so that understanding takes place naturally not too suddenly, by wetting the plastering field whenever it appears dry and protecting it from direct sunlight with a covering material that can prevent rapid evaporation of water.
15. If cracks occur as a result of improper drying, the plastering must be dismantled and repaired until acceptable to the Engineer and EMPLOYER at the expense of the Contractor. For 7 (seven) days after the reading is complete the Contractor must always flush by the water, until it is saturated at least 2 times every day.
16. As long as the brick/concrete wall installation is not finished, the

TECHNICAL SPESIFICATIONS

Contractor shall maintain and guard it against damage and contamination of other materials. Any damage that occurs is the responsibility of the Contractor and must be repaired.

17. Surface finishing work is not justified before plastering is more than 2 (two) weeks.

7.3.2. Ceramic Wall Work

a. Scope of Work

1. This work includes the supply of labor, materials, equipment and assistive devices needed in the execution of this work to get good results.
2. This ceramic wall work includes all the details mentioned/shown in the drawings or according to the instructions of the Engineer and EMPLOYER.

b. Material Requirement

1. Material:

Ceramic wall:

- Thickness : Minimum 5 mm
- Bahan Perekat : Admixture 1 PC : 3 sand
- Colour/Texture : Determined later
- Size : Minimum 20 x 25 cm or bigger

2. The materials used before installation must be submitted to obtain approval from the Engineer and EMPLOYER.
3. Material which is not on the list but is needed for completion/replacement of work in this section, it must be new, the best quality of its type and must be approved.

c. Implementation Requirements

1. On the surface of the concrete wall/existing installation, ceramics can be directly placed using 1 PC: 3 sand adhesive.
2. Ceramics installed are those that have been completed properly, the color, motifs of each ceramic must be the same, not cracked, chipped or other defects.
3. Cutting ceramics must use special cutting tools for that, according to the manufacturer's instructions.
4. Before ceramics are installed, ceramics must first be soaked in water until

TECHNICAL SPESIFICATIONS

saturated.

5. Ceramic patterns must pay attention to size/location and all equipment that will be installed in hanging cabinets and others that are listed in the drawings.
6. The height of the peil edge over the ceramic is adjusted to the drawings.
7. The initial installation of tiles on the wall and where the remaining size must be determined, it must be discussed in advance with the Engineer and EMPLOYER before the installation work begins.
8. The area of the ceramic wall must be completely flat, the broadcast lines must be completely straight. Broadcast the horizontal direction on the walls with different height peil floors must be a straight line.
9. Ceramics must be arranged according to straight lines of 4-5 mm each intersection of the broadcast must form two perpendicular lines. Ceramic broadcasts are filled with filler material so that they form a half circle as stated in the material requirements and the color will be determined later.
10. Cleaning the surface of the tile from the remains of mortar can only be done by using cleaning fluid for ceramics.
11. Ceramic gap/“Naad-naad” in the installation of ceramics must be filled with supergrout material.

7.3.3. Aluminum Frame Gypsum Partition Work

a. Scope of Work

1. This work includes the supply of labor, materials, equipment and assistive devices needed in the implementation of this work to get good results.
2. It includes the entire work of the aluminum frame gypsum board partition wall as shown in the detailed drawings.

b. Material Requirements

1. Frame Material

- From an aluminum framing system approved by a Engineer and EMPLOYER.
- Size/width 7 cm, shape according to shop drawings approved by Engineer and EMPLOYER.
- The aluminum framing color profile is 14 micron anozed color. The color is determined later.
- Minimum material thickness is 1.80 mm.

TECHNICAL SPESIFICATIONS

- Permissible deformation limit values are 2 mm.
- Materials processed by the factory must be carefully selected in advance according to the shape tolerance measures of thickness, clarity, curvature and the required supply.
- Requirements for the material used must meet the conditions/requirements of the factory concerned.

2. Coating Material

- From the gypsum board product approved by the EMPLOYER, the material thickness is 15 mm as shown in the detailed drawings. Installation on the outside/inside is finished.

3. Accessories

- Armature, screws, plates, bolts if any must be galvanized.
- For the main frame/armature, a 2 mm thickness galvanized steel plate is used.
- Other supplementary materials must comply with the requirements and in accordance with the size of the panel and the panel frame material installed.

4. Finishing Material

- Finishing gypsum board from vinyl/wall paper products approved by the EMPLOYER.

c. Implementation Requirements

1. Before carrying out the work, the Contractor is required to examine existing drawings and conditions in the field (size and holes), including studying the shape, lay-out/placement pattern, installation method, mechanism and details according to the drawing.
2. Contractor is required to make shop drawings according to size/shape. mechanism of work that has been determined by Engineer and EMPLOYER.
3. If desired, the Contractor is required to make a mock-up before work begins and installed.
4. Before installation, piling other materials in the workplace must be placed in a room/place with good air circulation, not exposed to direct weather and protected from damage and moisture.
5. It must be taken to ensure that all connections in the installation of "klos", bolts, armature and other reinforcement are needed so that the strength

TECHNICAL SPESIFICATIONS

is guaranteed by observing/maintaining neatness, particularly for areas where there may not be holes or defects from the adjustment.

6. The design and production of the partition system must be approved by Engineer and EMPLOYER.
7. Installation of partitions must not deviate from the terms of the plan drawing.
8. All frames must be mounted right angledness, upright, flat according to the peil in the drawing and straight (not exceeding the permissible slope tolerance limits of each material used.
9. Pay attention to all connections with other materials, the angles of meeting with other fields. Where there is no clarity in the drawings, the Contractor shall ask this matter to the Engineer and EMPLOYER.
10. After installation, the Contractor is obliged to provide protection against collisions and other objects and damage due to negligence of work, all damage arising is the responsibility of the Contractor until the work is completed.

7.4. FLOOR FINISHING WORK

7.4.1. Concrete Rebate Work

a. Scope of Work

1. The scope of work includes the provision of labor, materials, equipment and assistive devices needed in the implementation of this work so that good work results can be obtained.
2. The work of this concrete rebate includes all the details mentioned/shown in the drawings as a finishing floor mat.

b. Material Requirements

1. Portland cement must fulfill SNI 15-2049-2004 Portland cement requirements.
2. Sand must meet material requirements for sand or fine aggregate.
3. Gravel must meet material requirements for coral or coarse aggregate.
4. The materials used, before the examples must submit to the Engineer and EMPLOYER for approval.

c. Implementation Requirements

1. For direct installation upper ground, the soil to be installed with concrete

TECHNICAL SPESIFICATIONS

rebates must be compacted to get a flat surface so that maximum soil carrying capacity is obtained, compaction is carried out using tools.

2. The landfilling sand required under floor must be clean and free of alkalis, acids and other organic materials which can reduce the quality of the installation. Landfilling sand layer thickness required at least 10 cm or according to the drawings, doused by the water and compacted so that the maximum density is obtained.
3. For the working floor on a concrete plate (level floor), the concrete plate is given a layer of plaster (sceed) mixture of 1 PC: 3 sand 2 cm thick evenly, taking into account the slope of the floor, particularly in wet and hard areas.

7.4.2. Ceramic Floor Work

a. Scope of Work

1. This work includes the provision of labor, materials, equipment and other supporting tools for the purposes of carrying out good quality work.
2. This pair of ceramic floor tiles is installed in all the details mentioned/shown in the drawings, along with plint and nosing stairs.

b. Material Requirements

- a. Thickness : Minimum 5 mm
- b. Adhesive : Admixture 1 PC : 3 sand
- c. Color/Texture : Determined later
- d. Size : 30 x 30 cm or 40 x 40 cm or bigger for the main room 20 x 20 cm or bigger for toilet

Portland cement must fulfill SNI 15-2049-2004 Portland cement requirements. Sand must meet material requirements for sand or fine aggregate. The materials used before being installed must first be submitted to the EMPLOYER.

c. Implementation Requirements

1. Before starting work Contractors are required to make a shop drawing on ceramic patterns
2. Ceramics installed must be in good condition, not cracked, deformed and stained.

TECHNICAL SPESIFICATIONS

3. Mix pairs/ranks with a mixture of 1 PC: 3 masonry sand and add the adhesive material as required or it can also use pure PC *acian* and add the adhesive material.
4. Ceramic material must be absorbed before being installed in clean water (does not contain alkaline acids) until it is saturated.
5. The results of ceramic floor installation must be a completely flat surface area, not bumpy, with attention to the slope in wet and hard areas.
6. The pattern, direction and initial installation of the ceramic floor must be in accordance with the detailed drawings or according to the instructions of the Engineer and EMPLOYER. Pay attention to the installation hole and drainage/control tub before work begins.
7. The distance between the ceramic mounting units with each other (joints), must be the same width, a maximum of 3 mm, which forms parallel and straight lines of equal width and depth, for intersecting construction joint must form a right angleness the intersect with each other.
8. Joints are filled with good quality joint fillers, from materials as required above. Adjusted with installed ceramics.
9. Cutting ceramic tiles units must use special ceramic cutters according to factory requirements.
10. Ceramics that have been installed must be cleaned of all kinds of stains on the surface of the ceramics, until it is completely clean.
11. Ceramics that have been installed must be avoided from touching/loading for 3x24 hours and protected from possible defects resulting from other work.
12. Ceramic Plint is angled against the floor, taking into account the quality of the angled with the same floor and the same thickness.

7.5. FRAME, DOOR AND WINDOW WORK

7.5.1. Aluminum Frame Work

a. Scope of Work

1. Provide labor, materials, equipment and other tools to carry out work so that good and perfect work results can be achieved.
2. This work includes all doors, window sills, bovenlicht frames as stated/shown in the drawings and shop drawings from the Contractor.

TECHNICAL SPESIFICATIONS

b. Material Requirements

1. Aluminum frame used :

- Material : Made from aluminum framing system.
- Profile Form : Appropriate with shop drawings approved by Engineer and EMPLOYER. For window sills made with a frameless system.
- Profile Color : Determined later (color sample is submitted by the Contractor)
- Profil Width : use the width of the material as shown in the drawings.
- Coloring : Colour Anodized 18 micron, thickness minimal 1-2 mm.
- Deformation Value : Allowed for maximal 2 mm.
- Thick : minimal 1.0 mm

2. Requirements for the material used must meet the description and requirements of the aluminum work and meet the requirements of the factory concerned.

3. Aluminum frame construction is carried out as shown in the detailed drawing including its shape and size.

4. Materials to be fabricated must be selected first in accordance with the shape tolerances of size, thickness, curvature, curvature and coloring required.

5. The work of cutting, punch and drill, with the machine must proper so that obtained the frame for windows, walls and doors to have the following size tolerances:

- For height and width of 1 mm
- For diagonal 2 mm.

6. Accessories.

Galvanized stainless steel embedded head screws, vinyl weather strips, aluminum fastener latches should be covered with caulking and sealants, anchors for aluminum frames made of thick steel plates 2 - 3 mm, with a zinc coating of no less than (13) microns so that it can shift.

7. Finishing Material

Treatment for window and door sills surfaces that are in contact with alkaline materials such as concrete, stirring or plaster and other materials

TECHNICAL SPESIFICATIONS

must be given a clear finish layer or anti corrosive treatment with insulating varnishes such as asphaltic varnish or other insulation materials.

c. Implementation Requirements

1. Before starting the implementation, the Contractor is required to examine the drawings and conditions in the field (hole size and peil) and make a finished sample for all connection details and aluminum profiles related to the construction system of other materials.
2. The priority of the fabrication process, must be ready before the work begins, by making a complete shop drawing first with the instructions of the Engineer and EMPLOYER including floor plan, location, brand, quality, shape, size.
3. All frames both for walls, windows and doors are carefully fabricated in accordance with the size and field conditions so that the results can be accounted for.
4. Cutting aluminum should be kept away from iron material to avoid sticking iron dust on its surface. It is based on working it in a safe place carefully without causing damage to its surface.
5. Welding is justified using non-activated gas (argon) from the inside so that the connection is not visible to the eye.
6. The end of the frame must be joined firmly and thoroughly with screws, rivets, staps and must match. Welding must be neat to obtain quality and shape in accordance with the drawings.
7. The anchors for the aluminum frame are made of steel thickness of 2-3 mm and placed at intervals of 600 mm.
8. It is required that the aluminum frame is equipped with the following possibilities:
 - It can be a frame for glass walls.
 - It is suitable with sliding windows, rotating windows, etc.
 - The frame system can accommodate frameless glass doors.
 - For the system partition, it must be able to be installed without turned off completely which damages both the floor and ceiling.
 - Having accessories that can support the above possibilities.
9. For hardware fittings and reinforcing materials where aluminum frames will come in contact with iron, copper or other metal surfaces in question must

TECHNICAL SPESIFICATIONS

- be given a layer of chormium to avoid corrosion contact.
10. Tolerance of mounting aluminum frame on one side of the wall is 10-25 mm which is then filled with lightweight concrete/grout.
 11. Particularly for aluminum sliding window work to be considered before the frame is installed. Surface area of horizontal walls (wall holes) attached to the lower and upper threshold must be waterpassed.
 12. To obtain impermeability to air leakage, particularly in conditioned spaces, a mohair should be placed and, if necessary, synthetic rubber or materials from synthetic resins.
 13. Around the edge of the frame that is visible bordering the wall to be sealant so that it is waterproof and soEmployerroof.
 14. The bottom edge of the exterior sill threshold should be equipped with flashing for rainwater containment.

7.5.2. Aluminum Frame Doors and Windows Work

a. Scope of Work

1. Provide labor, materials, equipment and other tools to carry out work so that good and perfect work results can be achieved.
2. This work involves making door leaves and glass panes as shown in the drawings.

b. Material Requirement

1. Frame Material

- From aluminum framing system material approved by Engineer and EMPLOYER. The type used for the outer glass frame is the frameless type.
- The shape and size of the profile is adjusted to the shop drawing approved by the Engineer and EMPLOYER.
- Anodized color aluminum framing color profiles (Examples of colors submitted by the Contractor for approval by Engineer and EMPLOYER).
- Allowable deformation limit value is 2 mm.
- Materials that are processed by the manufacturer must be processed carefully in accordance with the shape of tolerance, size, thickness, right angleness, curvature, coloring required.
- Requirements for the material used must meet the description and

TECHNICAL SPESIFICATIONS

requirements of the aluminum work and meet the requirements of the factory concerned.

2. Glass Clamp

1. Used glass clamps of good quality rubber material and meets the requirements specified by the factory, installation requires only 1 (one) connection and must be watertight and structural seal.

3. Glass panel material for doors, windows, partitions.

- Materials for interior glass use float glass (clear sheet glass).
- All glass materials used must be free of stains and defects, free of sulfides or other patches.
- Thick glass in accordance with the drawing plan.

c. Implementation Requirements

1. Before carrying out the work, the Contractor is required to examine existing drawings and conditions in the field (size and holes), including studying the shape, pattern, layout/placement, installation method, mechanism and details according to the drawing.
2. Before installation, materials are placed in a room/place with good air circulation, not exposed to direct weather and protected from damage and moisture.
3. It must be taken to ensure that all elbow joints for aluminum frames and other reinforcement are needed to ensure their strength by observing/maintaining neatness, particularly for areas where there should be no visible defects in the tuning.
4. All sizes must fit the drawings and be the size of the finished.
5. Door Leaf.
 - If needed, galvanized screws must be used without leaving visible marks on the surface.
 - For glass panel door after installation must be flat and not bumpy also not twisted.

7.5.3. Teak Plywood Door Frame of Work

a. Scope of Work

1. Provide labor, materials, equipment and other assistive devices to carry out the work so that good and perfect work results can be achieved.
2. This work involves making teak door plywood as stated/shown in the

TECHNICAL SPESIFICATIONS

drawings.

b. Material Requirement

1. Wood Frame Material

- The wood used must be quite old, straight, dry with a flat surface, free from defects such as cracks, eye blades and other defects.
- For the wooden frame used is wood of good quality, durability of class I and class I - II of the size of the door leaf shown in the drawings is the finished size.
- The inner doors with plywood and plastic laminated teak construction are adjusted in size with detailed drawings and not allowed to use joints, it must be intact for 1 face unless otherwise specified in the drawing.
- Minimum door frame thickness is 3.20 cm.

2. Adhesive Material

- For adhesives used good quality wood glue.
- All surfaces of wooden frames must be smoothly flat, straight and angled.

3. Door leaf panel material

Doors with teak plywood/plastic laminated construction using materials:

- Plastic laminated thickness of 1 (one) mm.
- Teak plywood thickness of 4 mm.
- Plywood thickness of 4 mm.
- All surfaces of wooden frames must be smoothly flat, straight and angled.

4. Finishing Material

Finishing for teak plywood surfaces from good quality wood paint

TECHNICAL SPESIFICATIONS

c. Implementation Requirements

1. Before carrying out work, the Contractor is required to examine drawings, shapes, patterns, placement, installation methods, mechanisms and details.
2. Before installation, storage of door materials at work must be placed in a room/place with good air circulation, not exposed to direct weather and protected from damage and moisture.
3. It must be taken to ensure that all elbow/corner joints for wooden frames and other reinforcement are needed so that strength is ensured by observing/maintaining neatness, particularly for the area where no holes or defects should be found.
4. All wood looks has to be shaved smooth, flat, straight and elbows with one another, and in the field is ready for adjustment/installation.
5. All sizes must match the drawings and be a finished size.
6. Door leaf:
 - Plywood/plastic laminated teak door mounted on a wooden frame is by glue, without nailing. If necessary, must use galvaized screws, leaving no visible marks on the surface. Particularly for formica that is glued to the surface of the plywood (4 mm) that has been installed on the door frame, this process must be carried out with a press at the work shop.
 - On the teak plywood door leaf, it must be installed flat, not bumpy and perfectly bonded.
 - Plywood teak surface should not be putty.

7.6. GLASS AND MIRROR WORK

a. Scope of Work

1. Provide labor, materials, equipment and other tools to carry out work so that good quality and perfect work results can be achieved.
2. Glass and mirror work includes all the details mentioned/shown in the drawings detail.

TECHNICAL SPESIFICATIONS

b. Material Requirements

1. Glass is an object made and flat glass material which generally has the same thickness, has translucent properties, can be obtained from processes of translucent pull, can be obtained from processes of pulling, rolling and floating (Float glass) and laminated if is shown in the drawings.
2. Width and length tolerance
Length and width should not exceed tolerances as specified by the manufacturer.
3. Right Angle
Rectangular shaped sheet glass must have angles and even flat cut edges, the maximum permissiveness tolerance allowed is 1.5 mm per meter.
4. Defects
 - Permitted clear sheet defects must comply with manufacturer's requirements.
 - The glass used must be free of bubbles (spaces that contain gas contained in the glass).
 - Glass used must be free of chemical compositions which can disturb the view.
 - Glass must be free of cracks (broken lines in the glass either partially or completely thick).
 - Glass must be free from edge assemblages (protrusions on the long and wide sides outward /inward).
 - Must be free from the string from the wave yarn means a defect arising line that translucent, the wave is a glass surface that changes and disturbs the view.
 - Must be free from spots, clouds and scratches.
 - Free of arches (bent sheet of glass).
 - The quality of the sheet glass used is AA quality.
 - The thickness of the sheet glass used must not exceed the tolerance specified by the manufacturer. For glass thickness of 5 mm, about 0.3 mm.
5. Glass Material
 - Glass and mirror materials, must comply with SII 0189/78.
 - Materials for interior glass using:
 - Clear sheet glass (Float Glass) or laminated (Laminated Glass).

TECHNICAL SPESIFICATIONS

- Materials for interior glass using:
- Color thick float glass according to the drawings.
- Bahan untuk cermin menggunakan :
- Clear Float Glass, thickness of 5 mm.

The surface must be free of stains and defects, free of sulfides or other blotches.

6. The rest of the glass that is visible or not visible due to cutting, must be grinded / smoothed.

c. Implementation Requirements

1. All work is carried out by following the drawing instructions, descriptions and terms of the work in this book.
2. This work requires expertise and accuracy.
3. Material that has been installed must be protected from damage and impact, and marked for easy recognition, signs should not use lime. Signs must be made from pieces of paper glued together using *aci* glue.
4. Glass cutting must be neat and straight, required to use special glass cutting tools.
5. The cutting of the glass must be adjusted to the frame size, a minimum of 10 mm goes into the glass groove on the frame.
6. The final glass cleaner must use a soft cotton cloth using glass cleaner.
7. The relationship of glass or glass with other materials without passing the frame must be filled with transparent color silicone glue. The installation method and preparation for installation must follow the instructions issued by the factory.
8. Mirror and glass must be installed neatly, the edges should be straight and flat, cracks and broken are not allowed on the sealant / edge, free from all stains and scratches.
9. Mirror cutting must be neat and straight, required to use special glass cutting tools.

TECHNICAL SPESIFICATIONS

7.7. KEY AND HANGER TOOLS WORK

a. Scope of Work

1. This work includes the provision of labor, materials, equipment and doors/shutters and other assistive devices to carry out the work until the achievement of good and perfect work results.
2. Installation of hanging and locking devices include all mounting on wooden doors, aluminum doors and aluminum shutters as intended/required in the detailed drawings.

b. Door and Window Equipment

Details of the type used are seen in the drawings.

c. Implementation Requirement

1. The top hinge is mounted ± 28 cm (as) from the top surface of the door. Lower hinges are installed ± 32 cm (as) from the surface under the door. The middle hinge is installed halfway between the two hinges.
2. For the toilet door, the upper and lower hinges are installed ± 28 cm from the door surface, the middle hinge is placed in the middle between the two hinges.
3. The door pull is mounted 90 cm (s) from the floor surface.
4. The lockcase, handle and backplate installation and door closer must be neat, straight and in accordance with the position determined by the EMPLOYER/Engineer. If this is not achieved, the Contractor shall repair without additional costs.
5. Door stopper mounted on the floor, its location is arranged so that the door and lock do not hit the wall when the door is open.
6. Door holder at the base of the door is installed 6 cm from the edge of the door. The installation must be good so that when pressed down, the rubber holder will press on the floor in the desired position. Door holders are installed only on doors that do not use door closer.
7. All key devices must work properly, for this reason testing must be done roughly and smoothly.
8. Key identification must be installed according to the door.
9. The Contractor is required to make a shop drawing (detailed drawing of the implementation) which clearly includes all required data.

TECHNICAL SPESIFICATIONS

10. Shop drawing before implementation must be approved in advance by the Engineer and EMPLOYER.

7.8. CEILING WORK

7.8.1. Gypsum Board Ceiling Work

- a. This includes the provision of gypsum board ceiling materials and construction of the hangers, preparation of the site and installation in the places listed in the drawings for this purpose.
- b. Ceilings Frame
Except in other written drawings, the ceiling frame is made of hollow iron bars 40.60.2 mm for the main frame and 20.40.2 mm for others.
- c. Gypsum Board Sheet Installation
Gypsum board ceiling covering material used is a minimum thickness of 9 mm gypsum board.

7.8.2. GRC Ceiling

- a. GRC ceiling with a thickness of 4 mm, installed in the places specified in the planning drawing, the size according to the planning drawing.
- b. Except in other written drawings, the ceiling frame is made of hollow iron bars 40.60.2 mm for the main frame and 20.40.2 mm for others.
- c. Painting uses the same material for interior painting as explained in the painting specifications, except for transparent finishing; do transparent finishing as required by the maker of finishing materials.

7.9. FRAME COVER WORK

7.9.1. Wooden Cover Frame

- a. Scope of Work
 1. Included in this roofing work is the provision of manpower of equipment and other auxiliary materials used in this work to achieve quality and perfect work in operational use.
 2. This roof truss and roof installation work is as stated/shown in the detailed drawings, descriptions and requirements in this book.

TECHNICAL SPESIFICATIONS

b. Material Requirement

Types of wood used

1. Wooden class I-II Durable class I, quality A, unless otherwise stated in the Technical specifications and stated in the drawings.
2. It must be the best quality wood of each type with a size according to the drawings.
3. Avoided wood defects, among others in the form of white wood, cracked, eye wood, crossed wet and weathered.
4. The requirements for the wood moisture used must meet Guideline for Writing Scientific Papers (*PPKI*) requirements.
5. All wood installed/used is approved by the EMPLOYER/Engineer.
6. All wood material must be preserved with a preservative painting system.

c. Implementation Requirements

1. Before starting the implementation of the Contractor is required to examine the drawings of the condition of the field as-is building to get the provision of installation in the field.
2. The Contractor must be ready before the work begins by making a shop drawing scope that has been approved by the Engineer/EMPLOYER. The work includes a frame drawing and their details.
3. Before the frames are lifted mounted above the wall, the frames are first grounded and adjusted to the distances in order to the results can be accounted for.
4. The joining of wood is justified if the span of wood exceeds the standard length of the wood (4 m), the connection must be strong with a clamped iron plate with a thickness of 10 mm with a bolt of 12 mm diameter and 4 points for each connection.
5. Each stage of roof truss installation must obtain the approval from the EMPLOYER/Engineer.
6. The installed roof truss must be flat and strong, it is not permissible for any deflection or swaying if it is loaded.
7. Installation of tile or gable must be really neat and flat, not cracked, and water seepage does not occur when it rains.
8. Installation of asbestos must be with anti-rust (galvanized) couplers and a rubber seal that is resistant to heat and rain is installed on its head.

TECHNICAL SPESIFICATIONS

9. If cutting is needed on tile or asbestos, it must be done by cutting the machine, the cutting results must be neat and good.

7.10. ROOF COVER WORK

7.10.1. Zincalume/Metal Roof Cover

a. Scope of Work

1. Included in the work of this roof coverings is the supply of manpower of equipment and other auxiliary materials used in this work to achieve quality and perfect work in operational use.
2. This roof truss and roof installation work is as stated/shown in the detailed drawings, descriptions and requirements in this book.

b. Material Requirement

- a. Kinds : Spandek Zincalume
- b. Type : By order
- c. Colour : Determined later.
- d. Type : ADH - 7500

Zincalume Aluminum must be good quality, smooth, regular shape not bent or twisted. The shape, size and color used must be the same and uniform. The Contractor is obliged to provide a sample of material for approval with a written statement regarding the material specifications, detailed shape, size and instructions for installation.

For Zincalume cover required is galvanized nails, the size used is in accordance with those issued by the zincalume manufacturer.

c. Implementation Requirements

1. The roof must be installed according to expertise and in such a way that it is really neatly arranged in all directions and the interlocking must be compatible and tight.
2. For the size and distance of the battens to be adjusted to the size and weight of the tile used or in accordance with the requirements issued by the factory/in accordance with the working drawings.
3. In the gable part must use a special type of zincalume according to factory standards and also must use the same product with other roof coverings in

TECHNICAL SPESIFICATIONS

terms of quality or color.

4. If there is work of lightning protection, it must be considered the lane and how to pull the cable and how to install clamps.

7.11. PAINTING WORK

a. Scope of Work

1. Preparation of the surface to be painted.
2. Painting the surface with materials that have been determined.
3. Painting all surfaces and areas in the drawing but not specifically mentioned, with colors and materials in accordance with the instructions of the Engineer and EMPLOYER.

b. Examples and Material for Treatment

1. The Contractor must prepare examples of painting of each color and type of paint on transparent areas measuring 30 x 30 cm². In these fields must be listed with the type of color, paint formula, number of layers and types of layers (from primers to the final coat).
2. All areas of the sample must be shown to the EMPLOYER/Engineer. If the examples have been agreed in writing by the EMPLOYER/Engineer, then the Contractor will proceed with making the mock-up as stated above.

c. Wall Painting Work

1. Included in the work of wall painting is painting all building plastering and/or other parts specified in the drawing.
2. For the external walls of buildings used special paint containing weather shield. The brand and color will be determined later.
3. For walls in buildings used Acrylic Emulsion type paint. The brand and color will be determined later.
4. To get the texture on the interior wall painting determined by the finish textured spray paint, use colorflex semi gloss Texture. This texture paste based on acrylic emulsion is sprayed with a compressor sprayer.
5. For textured emulsion spray paint, on the outer wall 1 PC: 5 sand plastered with fine sifted sand, sprayed with a spray machine on 1 PC: 5 flat sand plaster. After dry and hard, then spray with an alkali resistance sealer and emulsion paint. The painting layer for the outer wall is 3 (three) layers with

TECHNICAL SPESIFICATIONS

the same thickness of each layer.

6. The inner wall painting layer consists of 1 (one) layer of alkali resistance sealer followed by 3 (three) layers of acrylic emulsion with the thickness of paint as follows:
 - Layer I dilute (additional 20% water)
 - Layer II viscous
 - Layer III dilute.
7. For types of colors, the Contractor is required to use cans with the same mixing number (batch number).
8. After the painting work is finished, the wall area is a whole, flat, smooth area, there are no streaked parts and the wall area is guarded against fouling.
9. Product of DULUX or equivalent

d. Ceiling Paint Work

1. Included in the ceiling paint work are multiplex plywood ceilings, concrete plates or other parts specified in the drawing.
2. The brand and color will be determined later after conducting a painting experiment.
3. Furthermore, all methods/procedures are the same as the wall painting in the previous article except that no alkaline resistance sealer coating is used in this ceiling painting.
4. For textured spray paint work, colourflex semigloss Texture finish is used.
5. Multiplex joints must be provided with a flexible sealant in order they do not appear as cracks after being painted.
6. Product of DULUX or equivalent

e. Wood Paint Work

1. Included in wood paint work are multiplex panel doors, and/or other parts specified in the drawing.
2. The paint used is Synthetic anamel type, the brand and color will be determined later after conducting a painting experiment.
3. The area to be painted is given a 1 layer of red wooden manie, then it is covered with wooden plamur until the holes/pores are completely filled. The area to be painted is given a 1 layer of red wooden manie, then it is

TECHNICAL SPESIFICATIONS

- covered with wooden planks until the holes/pores are completely filled.
4. After 7 (seven) days, the plamur field is sanded with fine iron and cleaned from dust and then painted at least 3 (three) times using a brush.
 5. After the painting is complete, the paint area is formed, intact, flat, there are no spots or air bubbles and the paint area is guarded against fouling.
 6. Product of DULUX or equivalent
- f. Melamic Finishing Work
1. Included in this work are all areas of woodwork seen in the building including sills, panels, trims, wooden railings, interior and furniture work, points, and other parts specified in the drawings.
 2. All wood surfaces that want to be dynamically cleaned from oil dust and dirt that may be attached there.
 3. After thoroughly clean, rubbed with wood sandpaper, so that the entire surface of the wood is flat and smooth, no longer there is uneven wood fiber on the surface of the wood.
 4. If the entire surface of the wood is smooth, the pores of the wood must be covered with sufficient melamic wood filler, then rubbed with a cloth until smooth and flat.
 5. The surface of the wood that has been coated with the wood filler, smoothed with fine Duco sandpaper, then the dust of the former sandpaper is cleaned.
 6. Making wood filler is done by mixing the sanding sealer with the handener and added with enough talk, the wood filler is applied with a bag until the pores are closed completely with fine Duco sandpaper for each layer.
 7. Sanding Sealer Plastophic Sanding Sealer or equivalent as a base paint mixed with hardener and diluted with thinner. The mixture ratio is 10 parts Sanding Sealer + 1 part hardener + thinner to taste. It takes 2-3 layers of base paint, each layer must be perfectly sanded so that a smooth, flat surface is obtained.
 8. The final paint is used Plastofix Clear Semiglass by applying layer 1 evenly and completely and perfect sandpaper then apply layer 2 and the last layer 3 is finished layer without needing to be sanded. The color will be determined later.

TECHNICAL SPESIFICATIONS

g. Steel Paint Work

1. Included in this work is painting all parts of the iron fence along with its doors, metal gutters and other iron work specified in the drawings.
2. Paint work is done after the area to be painted, finished with fine sand and free of dust, oil and others.
3. As an anti-rust base coat, it is used as a base paint 1 time. Welding joints and sharp edges are given a "touch up" with two layers.
4. After drying after 8 hours, and sanded again then sprayed 1 layer. After 15 hours of drying, the final layer is sprayed with 3 layers.
5. Painting is done by using a spray with a 3-layer compressor.
6. After painting is complete, the paint must be smooth, intact, glossy, no bubbles and guarded against contaminants.
7. Product of DULUX or equivalent

h. Timber Coating (Menie) Work

1. Included in this work is the painting of all multiplex plywood surfaces to be painted, sky frames, door frames and/or other parts specified in the drawing.
2. Before the menie work is carried out, the rough wood field must be sanded with rough wood sandpaper and continued with fine wood sandpaper until the surface of the plane is smooth and flat.
3. Menie work is done by using a brush, done layer by layer, so that the wooden field is completely covered with a layer of menie.

7.12. SANITARY WORK

a. Scope of Work

1. Included in the installation of this sanitary work is the provision of labor, materials, equipment and other assistive devices used in this work to achieve quality and perfect work results in its use/operation.
2. This installation sanitary work as stated/shown in the shop drawing and technical specifications.

TECHNICAL SPESIFICATIONS

b. Material Requirements

1. All materials must meet the size, standard and easily available on the market.
2. All equipment is in complete condition in accordance with what has been provided by the manufacturer for each selected type.
3. The goods used are from products that have been approved by Engineer and EMPLOYER.

c. Implementation Requirements

1. All materials before installation must be presented to the Engineer and EMPLOYER as well as factory requirements / conditions for approval. Unapproved material must be replaced without any additional cost by the Contractor.
2. If it is necessary to exchange/replace material, the replacement must be approved by a Engineer and EMPLOYER.
3. Before installation begins, the Contractor must examine existing drawings and conditions in the field, including studying the shape, pattern, placement, installation, sparings, installation methods and details according to the drawings.
4. If there are any abnormalities in this matter between drawings, specifications and so on, the Contractor must immediately report it to the Engineer and EMPLOYER.
5. The Contractor is not allowed to start work somewhere if there is an abnormality/difference in the place before it is resolved.
6. During the implementation must always be held testing/inspection to perfection work results and functions.
7. The Contractor is obliged to repair/repeat/replace if there is damage that occurs during the implementation period and the warranty period, at the Contractor's expense, as long as the damage is not caused by the Owner's actions.

TECHNICAL SPESIFICATIONS

d. Sanitary Ware

1. Sink Work

- Sinks and equipment installed are those that have been selected whether there are no chipped, cracked or other defects and have been approved by the EMPLOYER.
- The height and construction of the installation must be adjusted to the drawings and instructions and producers in the brochure. The installation must be good, neat, waterpassed and cleaned of all dirt and stains and the connection of the plumbing installation should not be any leaks.
- Product of KIA, or equivalent

2. Water Closet Work

- Water closet and their accessories installed are those that have been selected properly, there are no chipped, cracked or other defects and have been approved by the Engineer and EMPLOYER.
- Water closet must be installed with a sturdy location and height according to the drawings, waterpass. All stains must be cleaned, pipe connections must not be leaks.
- Product of INA, or equivalent

3. Bathroom Equipment

- In the toilet where shown in the drawings for the ablution place, wall faucet fixtures are installed.
- The equipments must be in good condition without any defects and has been approved by the Engineer and EMPLOYER. The layout of the installation is adjusted according to the drawings and the method of installation follows the manufacturer's instructions as explained in the relevant brochures.

4. Faucet Work

- The size is adjusted to the needs of each according to the drawing plumbing and brochures sanitary tools. Wall faucets are used with long necks and have a ring holder that must be attached to the wall. Faucets installed in the yard must have a sink thread in the serving room and

TECHNICAL SPESIFICATIONS

the kitchen is connected with a goose neck pipe (extension).

- Stop faucets used are made of brass with a diameter and placement according to the drawings.
- Faucets must be installed in clean water pipes with strong, angled, placement must be in accordance with the drawings.
- Product of TOTO or equivalent

5. Floor Drain Clean Out

- The floor drain and clean out used has a hole diameter of 2" with hinged covers, and installed in places according to the plan.
- Floor drains that are installed have been selected well without defects.
- In places where the floor drain will be installed, the floor covering must be perforated neatly, using a small chisel with the shape and size according to the size of the floor drain.
- After the floor drain and clean out are installed, the couple must clean the waterpass, clean it from cement stains and no leakage.

7.13. PLUMBING WORK

7.13.1. Clean Water Installation

a. Scope of Work

1. Included in the installation of clean water work is the supply of labor, materials, equipment and other assistive devices used in this work to achieve quality and perfect work results in their use/operation.
2. The installation of clean water works as stated/indicated in the shop drawing and technical specifications.

b. Material Requirements

1. Pipe with a diameter of 3/4" to 1", both the main pipe and branch pipe, including those that go to fixtures using PVC. Product of RUCIKA or equivalent.
2. Fittings must be made from the same material as the pipe.

TECHNICAL SPESIFICATIONS

c. Implementation Requirements

1. Upright pipe

The vertical pipe leading to the fixture must be planted inside the wall / floor. The Contractor must make the grooves and holes needed on the wall according to the pipe requirements.

After the pipe is installed, clamped and tested must be closed again in order to not visible from the outside. The method of re-closure must be as before and a neat finish so that no visible marks from the bed.

2. Horizontal Pipe

For pipes in top of the roof and under the floor, the pipes must be installed with a support or a hanger. The distance between the pipe and the hanging wall can be adjusted to the field conditions.

3. Thread Connection

Thread connection between pipes and fittings is done for pipes with diameters up to 40 mm (1½"). The depth of the threads in the pipe must be made in such a way that the fitting can enter the pipe with 3 threads of hand turning. All thread connections must use henep seal and zinkwite with a mixture of oil.

All pieces of pipe is using a pipe cutter with a knife wheel. Each end of the inner material pipe must be cleaned of traces of cutting with a reamer. All pipes must be clean of used joints.

4. Glue Joints

Connection between pipes with PVC fittings using glue that is suitable for the type of pipe and according to the manufacturer's recommendations Pipes must fit completely into the fittings and this can be done with a special press. Pipe cutting must be perpendicular to the pipe.

5. Sleeves

Sleeves for pipes must be installed properly each time they penetrate the concrete. Sleeves for walls are made of cast iron or steel pipes. For the desired watertight, it must be equipped with wings/flanges/water stop. For pipes that penetrate the construction of buildings that have a watertight layer (water proofing) must be of the flushing sleeves type. The cavity between the pipe and sleeves must be watertight with a rubber seal or caulk.

TECHNICAL SPESIFICATIONS

7.13.2. Wastewater Installation

a. Scope of Work

1. Included in the installation of wastewater installation work is the supply of labor, materials, equipment and other assistive devices used in this work to achieve quality and perfect work results in their use/operation.
2. This wastewater installation work is as stated/indicated in the shop drawing and technical specifications.

b. Material Requirements

1. Pipes with a diameter of 2.5" to 6", both the main pipe and branch pipe, including those heading for fixtures using PVC.
2. From the end of the pipe in the building to the septic tank using Type AW PVC pipe.
3. Floor drain and clean out from stainless steel.
4. Rainwater filters/roof drain made of cast iron or glass fiber which has a convex body shape that functions as a sediment bowl.
5. Product of RUCIKA or equivalent

c. Implementation Requirements

1. Horizontal Pipe

Pipe installed with tilt (slope) 1 - 2%. Placement of the pipe must be endeavored to be in a hidden place both in the wall and in the space under the floor. Any branching or joining that changes direction must use a 45° angle fitting (for example, Y branch and so on) type of long radius.

2. Underground Pipe

Pipes are installed and implanted below ground/road surface with a minimum thickness of 80 cm, from the top of the pipe to the ground/floor. Before the pipe is implanted at the bottom of the quarry, it must first be filled with 10 cm thick solid sand. Furthermore, after the pipe is placed, around and above the pipe then filled with soil until solid. Construction of the surface of the ground/floor of the former excavation must be returned to normal

3. Pipe Implantation

The base of the trench must be leveled and compacted. For each pipe connection a 50 mm deep excavation must be made. The depth of pipe

TECHNICAL SPESIFICATIONS

placement is adjusted to the slope of 1-2% from the starting point of the septic tank to the infiltration well. For pipe placement that crosses the road of vehicles with a depth of less than 80 cm, the top of the pipe must be protected with reinforced concrete plates with a thickness of 10 cm, the concrete plate is not resting on the pipe.

4. Septic Tank Overflow Pipe

Pipes are installed and buried under the ground surface/road with a slope of 1-2% from the starting point of the septic tank to the infiltration well. For pipe placement that crosses the road of vehicles with a depth of less than 80 cm, at the top of the pipe must be protected reinforced concrete plates with a thickness of 10 cm, the concrete plate does not rest on the pipe.

TECHNICAL SPESIFICATIONS

CHAPTER 8

GAS PIPE WORK

8.1. SCOPE OF WORK

Gas generated from the degradation process in the landfill must be controlled so that it does not disturb the environment by minimizing the spread of gas laterally from the landfill site. It is not permitted to drain the gas into the open air, but combustion must be carried out at each end of the gas pipe installed periodically. The installation of gas pipes in this work is carried out in the new sanitary landfill zone in both sites and the closing zone (only at Kawatuna Landfill). Gas pipes installed have a horizontal distance between at least 30 meters. In closing zone the gas must be evacuated out by creating a vertical gas capture system that can be carried out with the following stages:

1. For Kawatuna Landfill, make a well by conducting vertical drilling as far as possible to a minimum depth of 2 m below the surface of compacted waste through solid perforated and non-perforated (12") High Density Polyethylene (HDPE) pipes which is protected by the presence of casing made of iron plate with a diameter of 800 mm with a thickness of at least 0.8 mm which contains 50/70 mm gravel which serves as a protective and insulating layer of waste against the gas exhaust pipe and installed along the specified gas exhaust pipe area.
2. For closed zone at Kawatuna Landfill, non-perforated HDPE solid (8") gas pipes are installed starting from the 50 cm thick limestone layer to the top level.
3. For Kabonga Landfill, make a well by conducting vertical drilling as far as possible to a minimum depth of 2 m below the surface of compacted waste through solid perforated and non-perforated (6") HDPE pipes which is protected by the presence of casing made of iron plate with a diameter of 800 mm with a thickness of at least 0.8 mm which contains 50/70 mm gravel which serves as a protective and insulating layer of waste against the gas exhaust pipe and installed along the specified gas exhaust pipe area
4. The gas is then piped above ground level to a minimum elevation of 2 m above the surface area of zone.

TECHNICAL SPESIFICATIONS

After the pipeline work is completed, all parts of this work must be tested. All deficiencies and leaks must be corrected immediately so that the entire system works properly, unless otherwise specified by the Engineer and EMPLOYER.

8.1.1. Procurement and Installation of Perforated and Non-Perforated Solid (8" and 12") HDPE Pipes for Kawatuna Landfill

In the work of perforated and non-perforated solid (12") HDPE pipes, it is intended as a gas collection pipe. In closing zones, the gas pipeline is installed vertically from a minimum depth of 2 m from the surface of compacted waste to the top level of fertile soil protected by the installation of a 800 mm diameter gas pipe casing with a plate thickness of at least 0.8 mm to the planned height.

For the new sanitary landfill zone the installation of gas pipes uses a solid HDPE pipe (12") perforated, connected with leachate pipes according to the placement of the planned point and protected by the installation of 800 mm gas pipe casing with a minimum plate thickness 0.8 mm to the planned height.

Minimum pressure nominal for gas pipe is PN 16, Product of RUCIKA or equivalent. Before the product/goods are sent to the work location, the Provider must provide a Factory Acceptance Test in order to inspect and test the quality of the material/product, with a total of 7 assessment teams consisting of a minimum of Contractor, Engineer and EMPLOYER.

8.1.2. Procurement and Installation of Perforated and Non-Perforated Solid (6") HDPE Pipes for Kabonga Landfill

For the new sanitary landfill zone the installation of gas pipes uses a solid HDPE pipe (6") perforated, connected with leachate pipes according to the placement of the planned point and protected by the installation of 800 mm gas pipe casing with a minimum plate thickness 0.8 mm to the planned height.

Minimum pressure nominal for gas pipe is PN 16, Product of RUCIKA or equivalent. Before the product/goods are sent to the work location, the Provider must provide a Factory Acceptance Test in order to inspect and test the quality of the material/product, with a total of 7 assessment teams consisting of a minimum of Contractor, Engineer and EMPLOYER.

TECHNICAL SPESIFICATIONS

8.1.3. Gravel 50-70 mm for Gas Capture

In the gas capture pipe work, 50-70 mm gravel stones are filled into each casing made of 800 mm diameter metal plate with a minimum thickness of 0.8 mm, around a perforated solid (12") HDPE pipe with an outer diameter of 315 mm for gas capture with the height or volume specified in the drawings.

8.1.4. Manufacture of gas pipe Casing dia 800 mm Plat thickness of at least 0.8 mm

Casing made of iron plate with a thickness of at least 0.8 mm was installed to protect the gas catching pipe against the waste layer, along the specified exhaust pipe.

8.1.5. Box Joint K-250 Work

Box joint work is placed at each connection at the bottom of the landfill (new zone) between the leachate pipe and the gas pipe, the concrete construction used is the K-250 standard.

TECHNICAL SPECIFICATIONS

CHAPTER 9

BUFFER ZONE AND PERIMETER FENCE WORK

9.1. BUFFER ZONE WORK

The work of the buffer zone includes the work of planting grass and trees.

Table 9. Softscape Detail Work

No.	Work	Specification/dimension
1.	Trees Planting	
	- Japanese knotweed	Species: <i>Pseudosasa japonica</i> T (cm): minimal 300, 1 polybag 3-5 trees Ø (cm): minimal 5
	- Manohara	Species: - T (cm): minimal 300 Ø (cm): minimal 5

Table 10. Planting Implementation

No.	Work	Specification/dimension
1.	Cover Soil Planting	(1) The ground surface to be planted with cover soil plants is smoothed and leveled.
		(2) If the soil condition is acidic, it is necessary to calcify the surface layer evenly, while if the soil is alkaline, sulfur is given which is then left for a week.
		(3) After liming, the soil is fertilized and stirred evenly.
		(4) Cover soil plants are planted with a spacing of 10 cm x 10 cm x 10 cm equilateral triangle pattern.
		(5) After one block of planting is finished, immediately water it evenly until the soil is wet (slightly submerged). During the adaptation period (one month), the plants are watered twice, there are in the morning and evening.
		(6) To avoid high evaporation and dry risk in plants in the early post-planting period, plants can be shaded using "Paranet" until the plants have released new leaves.

TECHNICAL SPESIFICATIONS

No.	Work	Specification/dimension
		(7) Fertilization is done every week for 3-6 months with urea and NPK fertilizer.
2.	Trees Planting	(1) Digging tree planting holes. The location of the planting hole according to the planting plan. The dimensions of the tree planting hole are length, width and height: 60 cm x 60 cm x 60cm. The dimensions of the bush planting hole are 20 cm x 20 cm x 20 cm.
		(2) If the soil condition is acidic, it is necessary to do liming, while if the soil is alkaline, sulfur is given to the dug and mixed evenly, and left for a week.
		(3) After liming, the mound is given manure and is stirred evenly
		(4) Insert a portion of the soil into a hole of 10 cm thickness.
		(5) The tree (balling / polybag) is placed perpendicular to the hole by opening the root wrapper or the polybag first.
		(6) Insert the remaining mound into the hole and tighten it until has filled all the empty parts.
		(7) Attach a tree stand (stagger) with three bamboo trunks in a triangle position to support the tree. Material from bamboo diameter 5-7 cm and length 2-2.5 m.
		(8) Watering the hole until it is flooded.
		(9) Solution of root and shoot stimulant substances (Vit B1 or Atonic) is recommended to be given after planting trees and watering.
		(10) Fertilizing is first done in the second week and repeated every 2 weeks for 3-6 months using urea and NPK fertilizer.
4.	NOTES	(1) For trees which are imported from seeding, the root is in the form of a tap. Therefore, it is necessary to be balling along with pruning tap roots so that when planted at the root site, it will turn into fibers. (2) For trees imported through root cuttings cultivation already in the form of fibers, only need to balling (the roots should not be damaged)

TECHNICAL SPESIFICATIONS

No.	Work	Specification/dimension
		(3) It is advisable for plants that has been moved from the nursery to the site to be quarantined by the way the plants are given strong paranet and watering. It is intended that plants are not stressed when moved recently.

9.2. PLANTING WORKS

9.2.1. General Requirements

1. Work on plants must be carried out by Experts / Sub-Executors of Experienced Work in accordance with their fields.
2. Work must be completed properly, with the approval of a Engineer, with a maintenance period according to these technical specifications and the plant can live in a fertile life.
3. The main Contractor is fully responsible for the work results of the plant concerned.
4. Types of plants to be planted are trees, grasses and shrubs as an additional element of greening in the landscape location and can also beautify the environment.
5. The scope of work up to the maintenance period includes:
 - a. Soil processing;
 - b. Planting appropriates with the spacing;
 - c. Provision of water (good irrigation);
 - d. Use the right dose of fertilizer;
 - e. Eradication of disease pests that may attack plants.

9.2.2. Preparation and Implementation Requirements

1. The quality and size of the plants used come from nursery stock that has been checked for the availability of these plants on the market in order to not change in plant type because it is not available, and does not show indications that the plant will dry up and die.
2. Plants are used in a size that is suitable to the size ready for planting, ready to be moved and the root ball of the plant is still in a wrapped condition or in a container / polybag of plants when the plant is stored or not yet planted.

TECHNICAL SPESIFICATIONS

3. Plant quality is characterized according to the type or variety of the plant itself. Plants from good nurseries that have been inspected and approved by the Engineer.
4. Dimensions of plant size are as they stand in their natural position. It is not allowed to equalize plant height by raising or lowering the root ball in the plant hole.
5. Provide a special area in the form of a Temporary Nursery to be used as a quarantine area for all newly arrived plants. In this nursery provided a shaded area using Paranet as a temporary shade for new plants. Usually new plants will experience stress due to the shipping process and require adaptation to new environmental conditions.
6. During the Temporary Nursery, Watering the plants must be intensified and supplemented with root and leaf growth enhancer substances such as B1 and Atonic solutions.
7. Quarantine / adaptation period can range from 1 week to 2 weeks depending on conditions and stress levels of the plant. It is recommended that plants be prepared 2-3 weeks before the planting schedule at the project site, particularly for shrubs and ground cover.

9.3. MAINTENANCE AND TREATMENT OF PLANTS

9.3.1. Maintenance Period

All plants are guaranteed to remain alive and fertile after the maintenance period and after the submission of FHO Works. Plant replacement/embroidery should be included in the maintenance guarantee period. This embroidery is the replacement of dead or diseased plants of the same type and size in the same position. If a plant dies/damaged during the maintenance period, the contractor is obliged to replace it with a new plant with the same specifications.

9.3.2. Initial Maintenance

Inspection of the planting results for the final submission when closing the maintenance period will be carried out by the Engineer and EMPLOYER. All replacement costs are borne by the Contractor, which has been included in the calculation of maintenance costs.

TECHNICAL SPESIFICATIONS

9.3.3. Procedures for Post-Planting Maintenance

1. Watering

Watering is done to keep the plant from drying out.

The frequency of watering is done 2 times a day, there are in the morning and evening.

2. Weeding and Tillage

Weeding is done for loose soil and cleaning of plants/weeds around the plant.

3. Pruning on Post-planting maintenance is done

- a. For trees and bushes/shrubs by trimming broken leaves or twigs, dead/dry, in order the plant growth is not disturbed.
- b. To maintain plant health if there are leaves, or twigs affected by disease after pruning must be removed immediately in order to not spread to other plant parts

4. Pruning on routine maintenance is done

- a. To control plant growth that is irregular and disturbs the environment/vision of road users.
- b. To maintain plant health if there are leaves, or twigs that are affected by disease, fungus or other parasites, it needs to be pruned immediately in order to not extend to other plant parts.
- c. To remove branches/twigs that are old/damaged and dead.
- d. To maintain the shape or dimensions and size of the plant.
- e. To reduce evaporation in the long dry season so that the plant does not die from drought (done at the end of the rainy season).
- f. To reduce the number of foliage so that the branches do not break during the rainy season.
- g. To maintain plant growth properly, pruning times need to be set appropriately, there are:
 - after the blooming/fruiting season
 - at the end of the rainy season
 - to make an ideal form of grass or tree/plant as planned pruning must be done when the plants are leafy.

TECHNICAL SPESIFICATIONS

5. Fertilizing.

Fertilization treatment is distinguished based on the type of plant, namely:

a. Trees

It is using the NPK Fertilizer. The frequency of administration per 2 weeks for 3 months, then per 1 month

b. Grass

Urea or ZA Fertilizers are used

9.3.4. Maintenance Schedule

1. Post-Plant Maintenance

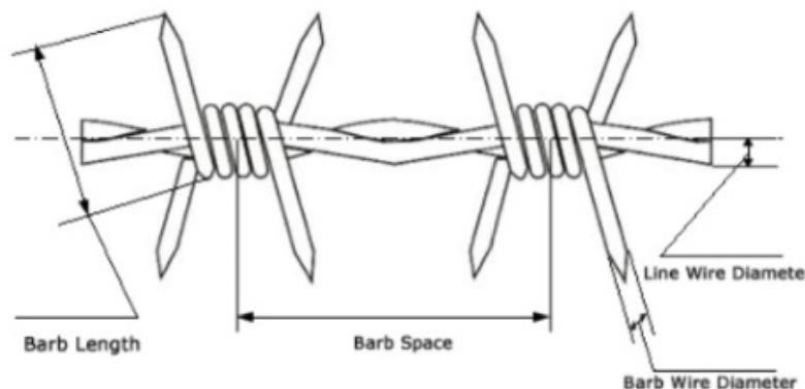
Post-planting maintenance is carried out since the completion of planting the road landscape plants and takes place during the maintenance period of the work. This maintenance is carried out during the growing period and doing intensively by taking into account the type of plant. Each type of plant has a different treatment and to provide convenience.

2. Routine Maintenance

Routine maintenance on the landscape is carried out both on old plants that already exist or is a continuation of activities after post-planting maintenance.

9.4. PERIMETER FENCE WORK

The work of perimeter fence for Kabonga Landfill is planned to use with concrete panel as seen in the design drawing and for Kawatuna Landfill is planned to use with barbed wire like the specifications below.



TECHNICAL SPESIFICATIONS

TYPE	MATERIAL	WIRE GAUGE (BWG)	BARB DISTANCE (CM)	BARB LENGTH (CM)
Single Twisted Barbed Wire	Galvanized	minimum 12BWG x 12BWG	7,5 - 15	1,5 - 3

TECHNICAL SPESIFICATIONS

CHAPTER 10

MECHANICAL AND ELECTRICAL WORK

10.1. ELECTRICAL WORK

10.1.1. General

1. Implementation of this electrical installation work must be carried out by an electricity technician who has a class III/C recognition letter (PAS) from the local Electrical State Company (PLN) Distribution and has an electrical installation SIPP issued by the local government, hereinafter referred to as a Contractor.
2. Standard

In the execution of work, in addition to these technical specifications, the following standards / references apply:

 - a. General Regulations on Electrical Installation (PUIL) in 2000 or the latest.
 - b. Indonesian National Standard (SNI), Indonesian Electric Standard (SLI), Indonesian Industrial Standard (SII), PLN Standard (SPLN) and standards or regulations issued by the Government of Indonesia or the local area.
 - c. Regulations of the manufacturer of the equipment used.
 - d. If there are no standards/regulations that have been issued by the Indonesian or local governments, then standards issued by the Association of German Electrical Engineers (VDE), JIS, British Standard Associates, International Electrotechnical Commission (IEC) and others can be used.
3. Water and electricity for work must be provided by the Contractor. It includes installation, costs and re-demolition. Engineer and EMPLOYER are not responsible / reimburse the costs incurred by the Contractor.
4. Work Drawings
 - a. These plans and specifications drawings are a complementary and mutually binding unit.
 - b. Installation plan drawings show the general layout, but in the process must pay attention to project conditions, architectural drawings and structures must use as a reference.

TECHNICAL SPESIFICATIONS

- c. Before work begins, the Contractor must submit work drawings and details (shop-drawings) which must be submitted to the Engineer and EMPLOYER for approval. Every submission of work drawings, means that the Contractor has studied and coordinated with other fields of work.

5. Material and Equipment

Before installation work begins, the Contractor must submit a list and samples of materials and equipment to be installed to the Engineer and EMPLOYER.

6. Sub Contractor

- a. As long as it does not conflict with applicable regulations, the Contractor can use assistants as Sub-Contractors.
- b. The appointment of a Sub-Contractor must be submitted and obtained prior approval from the Engineer and EMPLOYER.
- c. Responsibility remains with the Main Contractor.

7. Supervision

- a. The Contractor takes full responsibility for all his work.
- b. The Contractor is obliged to place experts to manage and supervise every part of the work, so that a good and timely quality of work is obtained.
- c. These experts must always be at the work location / site and be able to make decisions for the smooth running of work.

8. Work Adjustment

- a. The plan drawings and technical specifications are a complementary entity.
- b. The plan drawings and technical specifications of other work area must be checked and adjusted / coordinated. All work must be planned carefully so that interference with other parts can be eliminated / minimized. The Contractor must report all parts of the building construction that will be used for installation work.
- c. This work must be carried out at the right time and in the right conditions, in order to not impede other work. If there are difficulties that can hinder the pace of work, it must be reported immediately to the Engineer and EMPLOYER to be resolved immediately.
- d. If there must be a change, in order to the change is still in certain limits,

TECHNICAL SPESIFICATIONS

so that the field of work is still appropriate with the implementation of this work.

9. Testing

- a. Before being handed over, all the results of the installation work must have tested with good results, safe, ready to use, reliable and received an Operation Eligible Certificate (SLO) from State Electricity Company (PLN).
- b. The Contractor is responsible for the procurement of equipment and personnel for the tests to be performed.
- c. The test must be witnessed and approved by the Engineer and EMPLOYER. The notification of the test implementation to the Engineer and EMPLOYER is no later than 4 (four) days in advance.
- d. Engineer and EMPLOYER have the right to give orders to the Contractor to carry out testing (in whole or in part of the work) at any time, if the estimated results of the work can already be tested or doubted / needed.
- e. Tests that must be carried out:
 - Testing of conductor insulation and installation
 - Grounding testing
 - Polarity testing
 - 3 x 24 hour operation test
- f. Requirements for test results
 - Conducting insulation resistance testing gives results min. 1 m Ohm.
 - Installation insulation testing gives min. 1 kilo Ohm / Volt.
 - Grounding test gives good / safe results, so the voltage does not exceed 50 Volts.
 - Polarity must be correct, so that security in operation & maintenance can be guaranteed.
 - Testing operations must give good results for 3 x 24 hours.
 - If there are bad or doubtful test results, the Contractor must immediately correct and then conduct the re-test.
 - If the test still gets bad results after 3 times repaired, then the Contractor is obliged to disassemble the results of his work and start

TECHNICAL SPESIFICATIONS

the work from the beginning, until good results are obtained. All costs are the responsibility of the Contractor.

10. As Built Drawing/Manual/Certificate

After the work is completed, the Contractor is required to submit to the Engineer and EMPLOYER in the form of: installation drawings appropriate with the implementation, manual instructions, permit letters and / or official information and certificates from the agencies related to the work.

10.1.2. Electrical Installation

10.1.2.1. Scope of Work

Procurement, installation and arrangement of materials and equipment mentioned in this technical specification, including:

1. A complete lighting system in the building, including wiring, flash points, switches and all power outlets/sockets.
2. A complete lighting system outside the building (street lighting) including wiring, flashpoints, fittings and street lighting poles.
3. Feeder cables for lighting panels and power panels and main distribution panels.
4. Complete lighting panel, power panel and main distribution panel.
5. Procurement, installation and arrangement of auxiliary materials and auxiliary equipment, both those mentioned in the technical specifications and those not mentioned, but technically/generally necessary to obtain a system that is safe, perfect, ready to use and reliable.
6. Carry out inspections, tests and endorsements of all installed electrical installation systems, by authorized agencies.

10.1.2.2. Equipment and Material

1. Main Distribution Panel
 - a. Domestic assembly.
 - b. The panel module model is perfectly placed, paired on the wall, open at the bottom and the door has a master key. Indoor-type pair type.
 - c. Indoor-type pair type.
 - d. Using a minimum steel plate 3 mm with an iron frame, compact and strong coated with anti-rust, so that it can withstand corrosion, stress, electrical

TECHNICAL SPESIFICATIONS

and mechanical during short circuit, between the plate / wall with the frame electrically into a unity.

- e. Equipped with grille for ventilation and exhouse vent.
- f. Laying of components is managed, protected, easy to operate and maintain. Terminals for incoming or outgoing cables and control cables are arranged so that they do not interfere with panel components.
- g. Meters and indicators appropriate with the drawings.
- h. Consists of 5 switchgear with a minimum size according to the drawings.
- i. All steel / iron parts are painted with heat-resistant gray paint.
- j. The number and type of panel components are shown in the drawings.

2. Lighting Panel

- a. Domestic assembly.
- b. The panel module model is perfectly earthed, paired on a pragma mini wall/mounting.
- c. 1 row 4 to 18 modules.
- d. Types of pairs in the panel location adjusted in the drawings.
- e. Laying of components arranged / arranged properly, protected, easy to operate and maintain.
- f. Terminals for incoming or outgoing cables and control cables are arranged so that they do not interfere with panel components.
- g. 1 row: wicket door opens 90° upwards
- h. Rated current of the enclosure, 4 modules 50 A
- i. Insulating, self-extinguishing material
- j. Colour: white RAL 9003.
- k. Compliance with standards, IEC 439.3 (EN 60-439-3) IMQ approved as in IEC 23-3 (Italy).
- l. Degree of protection, as in IEC 529: IP40 (protection against solids and liquids), as in EN 50-102: IK07 (protection against mechanical impacts), class 2 protection against indirect contact.
- m. Fire and excessive heat withstand capacity: 650°C/30 s as in IEC 695-2-1 (masonry flush mounting only).

TECHNICAL SPESIFICATIONS

3. Panel Component

a. Circuit Breaker

Circuit Breaker must meet the following minimum conditions:

- voltage rating 660 VAC
- Breaking capacity at the mainstream 50 kA and branch currents 10 kA.
- over current adjustment
- Equipped with overload safety, short circuit current and under voltage release.
- SNI 04-0225-2000 regarding General Requirements for Electrical Installation 2000
- Product of SCHNEIDER, ABB or equivalent.

b. Miniature Circuit Breaker

MCB must meet the following minimum requirements:

- voltage rating 240/415 VAC
- breaking capacity 10 kA
- equipped with overload safety and short circuit current
- SNI 04-0225-2000 regarding General Requirements for Electrical Installation 2000
- Product of SCHNEIDER, ABB or equivalent.

c. Ampermeter dan Voltmeter

Ammeters and voltmeters must meet the following minimum conditions:

- type to be installed on the panel
- accuracy 1,5 %
- maximum power 2 VA
- the voltmeter has a 7 position selector switch
- Product of ANALOG or equivalent.

d. Power Factor Meter

PFM must meet the following minimum requirements:

- type to be installed on panel
- accuracy 1,5 %
- capacity 0,4 cap - 0,4 ind
- Product of SCHNEIDER, MG or equivalent.

e. Frequency Meter

TECHNICAL SPESIFICATIONS

The minimum frequency meter must meet the following conditions:

- type to be installed on panel
- accuracy 0,3 %
- range 45 Hz ~ 55 Hz
- Product of SCHENEIDER, MG or equivalent.

f. KWH meter

KWH meter must meet the following minimum requirements:

- type to be installed on panel
- 3 phases with 6 pointer numbers
- Product of SCHENEIDER, MG or equivalent.

g. Current Transformator

The minimum current transformer must meet the following conditions:

- dry type current transformer
- accuracy 0,3 %
- ratio appropriates with the drawings
- Product of SCHENEIDER, MG or equivalent.

h. Indicator Light

- type to be installed on panel
- 3 colours (R red, S yellow, T blue)
- Product of TELEMCHANIQUE, FUJI or equivalent.

i. Time Switch

The minimum Time Switch must meet the following conditions:

- voltage rating 240 VAC
- small power consumption (± 2 VA)
- roaming time 24 hours
- Product of SCHENEIDER, THEBEN or equivalent.

j. Contactor

The contractor must meet the following minimum conditions:

- coil voltage rating 240 VAC
- power consumption (hold) max. 7 VA
- contact ability as needed.
- Product of SCHENEIDER, TELEMCHANIQUE or equivalent.

All panel components must be suitable for use in tropical areas and as far as possible from one factory.

TECHNICAL SPESIFICATIONS

4. Low Voltage Cable

- a. For low voltage installations, NYFGBY, NYY, NYM, NYA types are used with a working voltage of 0.6 / 1 kV.
- b. Usage location, cable size and number of cores are adjusted accordingly.
- c. It is not allowed to change the type, size and number of cable cores.
- d. Indonesian National Standard (SNI) 04-0225-2000 concerning General Requirements for Electrical Installation 2000
- e. Product of METAL CABLE, SUPREME, KABELINDO, JEMBO or equivalent.

5. Protective Pipes/Conduits

- a. For cable protectors embedded in walls use high impact PVC pipes with a minimum inner diameter of 2 x the outer diameter of the cable.
- b. For cable protectors that are not embedded in the wall (above the ceiling) and it is not located on the rack / tray uses high impact fire resistant PVC pipes with a minimum inner diameter of 2 x the outer diameter of the cable.
- c. For cable protectors that are not embedded in the wall and visible / seen (except basement) is used compact mini trunking or duct cable.
- d. Must be equipped with appropriate auxiliary equipment and be installed in the correct manner.

6. Cable Tray

- a. Cable tray made of galvanized coated steel with a thickness of 1.2 mm min plate, the size according to the drawings.
- b. Hangers are made of strip plates or round iron, the distance between the hangers max. 2 meters or adjusted to the technical requirements. Hangers must be neat and strong so that if there is loading it will not change shape.
- c. Cable tray and hanger must be painted stainless, if necessary the final color will be determined by Engineers and EMPLOYER.

TECHNICAL SPESIFICATIONS

7. The lamp

a. Flourescent lamp

- The fluorescent tube used by the cool day light with wattage according to the instructions in the drawings.
- Using electronic ballasts, so no capacitors & starters are needed.
- Ballasts must have low power losses, are durable, not noisy, cause no interruption to TV / Radio and high PF.
- Shape the lamp housing according to the instructions in the drawings.
- Parts of the lamp housing that are made of iron plates must be galvanized, must have a minimum thickness of 0.7 mm, be painted white colour and have a terminal grounding.
- Lamp product of PHILIPS, OSRAM or equivalent.

b. Incandescent lamp

- White or clear (non-colored) light bulbs with wattage according to the drawings.
- Whether equipped with a light house or an open one, use porcelain fittings or heat-resistant plastics as appropriate.
- The shape of the lamp housing is appropriate with the instructions in the figure, the part of the lamp housing made from aluminum must be coated with dyes (anodized), while those made of iron plates must be galvanized and painted heat-resistant, the color of the lampholder is determined later.
- The lamp housing is equipped with a grounding terminal.
- Lamp product of PHILIPS, OSRAM or equivalent.

c. Swithces and Sockets

- Switches (plate switches)
 - Made of white heat-resistant plastic, flush mounting.
 - Equipped with a steel box with the thick min. 35 mm.
 - Contact ability switch min. 6 Amps/250 Volts.
- Sockets
 - Made of white heat-resistant plastic, flush mounting.
 - Menggunakan baud pengikat, bukan jenis claw-fix.

TECHNICAL SPESIFICATIONS

- Equipped with thick steel box min. 35 mm.
- The ability to power socket min. 10 Amps / 250 Volts and has a grounding terminal.
- For power sockets (1 phase) it is also equipped with a switch, indicator lights and plugs containing fuses.
- Particularly for power socket wiring compact mini trunking (see above).
- Special Sockets (3 phase)
 - Made of heat-resistant plastic, surface mounting.
 - The ability of the socket is adjusted to the needs of min. 16 Amps at 380 Volts / 3 phase.
 - It has 5 poles for a 3 phase system with neutral and grounding.
 - Equipped with a suitable plug (*stekker*).

d. Installation Equipment

- The intended installation equipment is material (material or equipment) to complete the installation in order to obtain results that meet the requirements, are safe, reliable and easy to maintain.
- All cable clamps used must be factory made.
- All cable connections must be done in a junction box / doos, the cable color must be the same.
- The junction box / doos used must be big enough and closed.

10.1.2.3. Implementation

1. Panel

- a. Panel location as shown in the drawings and adapted to local conditions, if there is difficulty in that location, it is able to ask for guidance from Engineers and EMPLOYER.
- b. For panels that are embedded (inbouw) the cables from or to the terminal panel must be protected with PVC pipes that are embedded in the wall as strong and neat order. Whereas for panels that are attached to the wall (outbound), the cables from / to the terminal panel must go through a cable ladder (tray).
- c. The cable connection to the terminal must use the appropriate cable lug. Installation of cable lug can use press-pliers for sizes up to 16 mm² and

TECHNICAL SPESIFICATIONS

hydraulic crimping tools for sizes up to 400 mm². This connection must be good and will not cause dangerous electrical indication.

- d. Height of the panel mounted on the wall at least 1.60 m from the floor.

2. Withdrawal of Underground Cable

- a. Implantation cables must meet applicable regulations and requirements indicated in technical specifications.
- b. Wires should not be twisted and are labeled with lead indicating direction at every distance of 1 m.
- c. It is not permissible to make an order before a Engineer and EMPLOYER checks and approves the laying of the cable.
- d. Cables that penetrate walls or floors must use sleeve pipes, these pipes are at least PVC.
- e. Cable connection is avoided whenever possible, except when circumstances are not possible. The connection can be carried out after obtaining permission from the Engineer and EMPLOYER, using cable mof/casting resin. Above the connection is placed a concrete stake that reads "MOF CABLE".
- f. The cable must not be deflected with a radius of less than 15 x its diameter. Above the turn is placed a concrete stake that reads "LAND CABLE" and turn direction.
- g. Product of 3M or equivalent.

3. Grounding

- a. The grounding system must meet applicable regulations and the requirements shown in the drawings/specifications.
- b. All panels and equipment must be grounded. Conducting grounding on panels using BCC with min size of 6 mm² and max. 50 mm², the connection to the panel must use a cable lug. The depth of grounding must be at least 6 m and the tip of the grounding electrode must reach ground water level, in order to achieve a low soil resistance price (max. 1 ohm).
- c. The measurement of ground resistance is carried out by the Contractor after obtaining approval from the Engineer and EMPLOYER.

TECHNICAL SPESIFICATIONS

4. Lighting Installation

- a. The certain location of the lamps and sockets is adjusted to the local drawings and conditions, if there is difficulty in determining the location, it can ask for instructions from the Engineer and EMPLOYER.
- b. Generally the height of switches and sockets from the floor is at least 1.5 m, except at certain locations (for example: pump room, kitchen etc.).
- c. All non-embedded cable pulls must use a cable tray. These cables must be laid regularly and do not overlap.
- d. Installation of protective pipes/conduits inside columns and concrete plates must be carried out before casting. The protective pipe is equipped with fishing lines and guarded so it cannot be break or leak.
- e. Installation of protective pipes/conduits inside brick walls must be done before plastered/overlaid walls.
- f. It is not allowed to clamp the cable to the ceiling frame. If the cable tray distance to the lighting point is far enough, a protective pipe/PVC pipe must be used and clamped on a concrete plate above.
- g. Cable connection and branching are only allowed in junction boxes/doors.
- h. All lamp fittings must be hung according to the instructions in the drawings, if not shown in the drawing, it can be used a 3 mm galvanized wire as a hanger.

5. Electricity Power Installation

- a. The certain location of the equipment or machinery is adjusted to the local drawings and conditions, if there is difficulty in determining the location, it can ask for instructions from the Engineer and EMPLOYER.
- b. The Contractor shall install the cable up to the equipment, unless stated otherwise in the drawings.
- c. Cable pulls through the trench must be arranged properly/neatly so that they do not overlap and twist.
- d. Cable pulls that do not pass through the trench or that go through the wall (outbound) must be protected with protective pipes. So that the protective pipes do not sway and are neatly organized, they must be equipped with clamps and other anchoring equipment.

TECHNICAL SPESIFICATIONS

- e. At every turn of the protective pipe which is greater than 1" must use a flexible pipe, the bend must be with a radius of min. 15 x the diameter of the cable inside.
- f. The cable above must be placed on the cable tray and the color of the cable must be adjusted to the phase.

6. Installation of Street Lighting

- a. The location of the lights such as the instructions in the drawings and adapted to local conditions, if there are difficulties in determining the location can be guided by Engineer and EMPLOYER.
- b. Street Lights
 - Types of lights for outdoor area
 - Aluminum reflector which is able to provide a good lighting system
 - Easy installation and maintenance
 - Lamp type and wattage according to the drawings
 - The level of light can be adjusted as needed;
 - 3-day system autonomy in continuous bad weather conditions (rain, thick clouds, hurricane ETC);
 - The age of using solar panels up to 25 years;
 - The lifespan of LED public street lighting lamps is up to 50,000 hours with the efficacy of 100 lm/watt
 - The lighting component consists of a 400 Wp Solar panel, a 400AH 12v battery; deep Cycle VRLA and BCR Controller PWM 30 A, 12 / 24V and tested according to national/international standards;
 - Stand on reinforced concrete foundation with a mixture of K.175, the size of the foundation according to the drawings.
 - Lamp product of PHILIPS, OSRAM or equivalent.
- c. Light poles
 - Poles must be able to withstand dead loads including lamps, lamphouses and wind loads up to 100 km/h;
 - Using a plate thickness of at least 2 mm;
 - Poles include anti-climbing bracket/base plate trellis and bolt anchors;
 - Pole Height matches with the drawings

TECHNICAL SPESIFICATIONS

10.1.3. Pump

10.1.3.1. Pump Controller

- a. Controlling and monitoring
- b. Control inputs for dry running protection, remote control etc.
- c. Protected against reverse polarity, overload and overtemperature
- d. Integrated MPPT (Maximum Power Point Tracking)
- e. Battery operation: Integrated low voltage disconnect
 - Efficiency max : 98 %
 - Ambient temp : 40-50 °C
 - Enclosure class : IP68

10.1.3.2. Motor

- a. Maintenance-free brushless DC motor
- b. Water filled
- c. Premium materials, stainless steel: AISI 304/316
- d. No electronics in the motor
 - Efficiency : max. 92 %
 - Motor speed : 600-3.300 rpm
 - Insulation class : F
 - Enclosure class : IP68
 - Submersion : max. 150 m

10.1.3.3. Pump

- a. Impeller & Impeller Station : High quality cast iron (GG25)
- b. Impeller : stainless steel AISI 304
- c. Pump Shaft : Stainless steel
- d. Axle Seal : Galant packing or mechanical seal
- e. Motor Casing : High quality cast iron or aluminum alloy
- f. Water temperature : max .50 °C
- g. Product of EBARA, GRUNDFOS or equivalent.

10.1.3.4. PhotoVoltaic Panels

- a. Power Output Tolerance : $\pm 3\%$
- b. Module Efficiency : 16.68%
- c. Cell Type : Polycrystalline

TECHNICAL SPESIFICATIONS

- d. Front : Tempered Glass
- e. Frame : Anodized Aluminum

10.1.3.5. Investigation and Testing

1. General

All machinery and equipment must be investigated and tested at the factory before being shipped. After installation of the machines is complete, the Contractor must retest in the field/installation location.

All tests must be approved by the construction management Engineer and technical director. The contractor must be responsible for the results of tests at the plant or at the installation location and must be able to demonstrate the function of each equipment to the construction management Engineer and technical directors. The calibration certificate for the instrument/measuring instruments used in this test must have the approval from the construction management Engineer and technical director.

If there is a defect during testing at the factory and the location, the Contractor must replace the defective component with a new one and retest. The contractor must submit the test results at the plant or on site to the construction management Engineer and technical directors. All labor, test and calibration equipment, equipment/measuring instruments used in testing (at the factory/on location) as well as test costs are the responsibility or must be provided by the Contractor.

2. Factory Tests for Pumps and Solar Cell Equipment

All pumps must be tested according to Standard Operating Procedures.

- a. All pumps are driven by electric motors.
- b. The testing procedure must be approved by the construction management Engineer and technical director
- c. All pumps and solar cell equipment must be tested in 4 or more working conditions, there are:
 - No load capacity.
 - Maximal capacity.
 - Minimum allowable capacity.

TECHNICAL SPESIFICATIONS

- d. The characteristic from each pumps must include:
 - Water flow capacity.
 - Head.
 - Efficiency.
 - Electricity absorbed
- e. All electric motors must be tested before shipping, while the electric motor testing procedures at the factory must comply with the standards in force in the original country (electric motors' producers).

Factory testing certificates regarding the performance and natural electric motors must be submitted to the construction management Engineer and technical directors. All electric motors that work automatically must be tested for functionality. The contractor must test the insulation resistance of the motor.

Table 11. Pump Head and Capacity

NO.	ITEM	SPECIFICATION					
		Capacity (l/s)	Head (m)	Power (kW)	Type	Unit	Remarks
Kawatuna Landfill							
1	Sump Pit Pump (for Zone 3)	2	20	0,75	Centrifugal (Solar Cell)	2	- Wastewater pump - Use automatic water level controller - Use automatic timer switch
2	Clean Water Pump	1	15	0,37	Centrifugal (Solar Cell)	2	- Use automatic water level controller - Use automatic timer switch

10.1.4. Lightning Protection System

10.1.4.1. General Explanation

1. Scope of Work

This work includes the processing of permits/approvals from the authorized agency, procurement of materials, equipment and labor, installation, testing and repair during the maintenance period for a complete lightning protection system. The work consists of:

- a. Non-conventional Air Terminal R = 100 meters
- b. Down Conductor,
- c. Grounding Terminals and Electrodes,
- d. Installation Permit from the authorized agency,
- e. Other supporting work.

TECHNICAL SPESIFICATIONS

2. Plan Drawings

The drawings generally show the equipment layout and installation. Adjustments must be made in the field, because the actual condition of the location, distances and heights are determined by field conditions.

3. As Built Drawings

The Contractor must make a careful record of implementation and adjustments in the field. As Built Drawings must be submitted to the EMPLOYER.

4. Standards and Treatments

All work must be carried out in accordance with applicable standards and regulations (Ministry of Manpower) or international standards that are not in conflict with General Electrical Requirements, the Department of Labor or Other Bodies (for example, British Standard or Australian Standard for Lighting Protection System). Besides that, it must also obey local laws and regulations that have to do with this work.

5. Material, Equipment and Installer

Materials and equipment to be installed must be in good condition and new, in accordance with the intended standard. Examples of materials, brochures and shop drawings must be submitted to the Engineer and EMPLOYER. The installers must be selected who are experienced and able to handle this installation job safely, strong and neatly.

10.1.4.2. Technical Explanation

Air Termination / Water Termination include the following equipment:

1. Lightning Control Terminal

The lightning rod uses a non-conventional with a protection radius of 100 meters.

2. Pole

The pole is made of galvanized pipe. The construction must be strong and be calculated against strong winds; the dimensions of the galvanized pipe can be seen in the drawings.

TECHNICAL SPESIFICATIONS

3. Grounding Conductor (Down Conductor)

Consisting of BC Ø 50 mm² wire connecting electricity perfectly between the water terminals above and the grounding system

4. Grounding System

Grounding system consists of:

- a. Grounding Terminal.
- b. Grounding Electrodes made of massive copper rods with a diameter of $\frac{3}{4}$ " connected by GIP pipe Ø 1½".
- c. Resistance of the ground must not be more than 2 Ohms.
- d. If the resistance cannot be reached with one electrode, then a number of holding conductors must be made in parallel to the required soil resistance.

10.1.4.3. Processing and Installation

1. The methods for installing the lightning deterrence system must appropriate with the drawings and must follow the Field Supervision Directive.
2. Down Conductor above ground level up to a height of 2 meters from ground level must be installed in a Class AW PVC pipe.
3. On the ground electrodes, the ground terminal must be made with bolts and rings. The connection to the ground electrodes must use a junction box.
4. Grounding electrodes from copper rod diameter $\frac{3}{4}$ " and length of copper must be protected against corrosion with charcoal powder around the copper rod. The location is determined as shown in the drawings. Vertically plant a 4" diameter steel pipe to a depth of 12 meters or reach ground water level. Then the pipe is pulled back so that it will leave a hole with a diameter of less than 4" as deep as 12 meters. Fill the hole with solid charcoal powder. Finally, the ground electrodes are placed in the middle of the charcoal barn.
5. Grounding terminals must be located in special control tanks for this purpose and for periodic earth resistance checks; maximum earth resistance is 2 Ohms.

10.1.4.4. Inspection and Testing

The lightning protection system will be inspected by the Engineer and EMPLOYER to ensure that these requirements are met. All parts of this installation must be inspected by the Engineer and EMPLOYER before they are covered or hidden. Any parts that do not meet the drawing requirements must be replaced immediately,

TECHNICAL SPESIFICATIONS

without imposing additional costs on the EMPLOYER. To find out whether or not a lightning rod system is installed, testing must be carried out on the installation as well as on the grounding system, in order to obtain a guarantee. Testing of soil resistivity can only be done after not raining for 2 consecutive days.