

# CHAPTER 5 : METHOD OF MEASUREMENT

## CHAPTER 5 METHOD OF MEASUREMENT

### NON-PHYSICAL WORK

#### 5.1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) (IF APPLICABLE)

##### 5.1.1 EIA Report

###### Unit

The unit of measurement for preparation of EIA Report shall be Lump Sum (sum).

###### Measurement

The measurement for payment shall be the preparation and approval of the EIA report in accordance to the format in the Guidelines for EIA of Highway/Road Projects and A Handbook of EIA Guidelines prepared by Department of Environment (DOE).

###### Pricing Factors

The item for preparation of the EIA Report shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost of any study required, literatures, references, consultation in the production of the EIA Report;
- (b) cost for the engagement of a registered environmental consultant required for carrying out the respective study and preparation of the said report;
- (c) submission of twenty one (21) hard copies and one (1) digital copy of the approved and accepted report to S.O. The copyright of the said documents shall be transferred and become the absolute property of the Government.

#### 5.2 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

##### 5.2.1 Preparation and acceptance of EMP

###### Unit

The unit of measurement for preparation and acceptance of EMP shall be Lump Sum (sum) and include:

- (a) Erosion and Sediment Control Plan (ESCP)

###### Pricing Factor

The item for preparation of ESCP shall be in accordance with the Preambles to Bill of Quantities:-

- all cost associated in the preparation of a complete report on drainage system, erosion control plan and course of action to be taken;
  - additional cost for the engagement of a professional engineer required for the preparation of the ESCP;
  - submission of five (5) copies of ESCP for endorsement by the S.O.
- (b) Flora Management Plan for tree conservation including method of preservation and course of action to be taken
- (c) Wildlife Management Plan for translocating animal to approved location by Jabatan Perhilitan.

#### Measurement

The measurement for payment shall be made upon submission and acceptance of the EMP prepared in accordance to the format as stipulated in the DOE General Checklist for Preparing EMP as follows:-

- (a) 60% upon submission of draft EMP to S.O.;
- (b) 40% upon approval of EMP by DOE/JKR

#### Pricing Factor

The item for preparation of EMP including updating and revision shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost of literatures, references, consultation and all that is required and specified for the production of the EMP;
- (b) cost for the engagement of the registered environmental consultant required for the preparation of the EMP including its updating and revision;
- (c) submission of five (5) copies and one (1) digital copy of the approved and accepted EMP for endorsement by the S.O. The copyright of the said documents shall be transferred and become the absolute property of the Government.

### **5.3 ENVIRONMENTAL OFFICER (E.O.)**

#### **5.3.1 Environmental Officer**

##### Unit

The unit of measurement for provision of E.O. shall be Lump Sum (sum).

##### Measurement

The measurement for payment shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

The measurement for payment shall be the man-month basis throughout the contract period (excluding Defects Liability Period).

#### Pricing Factors

The item for provision of E.O., assigned to be responsible for environmental management works only, shall be in accordance with the Preambles to Bill of Quantities:-

- (a) the wages and other emoluments paid to the E.O.;
- (b) working outside the Contractor's normal working hours if so required by the S.O.;
- (c) the Contractor, with the approval of the S.O., shall employ a competent E.O. (graduate in science and/or engineering field with a minimum of one year experience in the environmental sector);
- (d) costs and expenses incurred consequent upon the employment or hiring of a competent full time E.O. throughout the contract period including payment of Employee Provident Fund, insurance, medical and hospitalization;
- (e) costs and expenses incurred for the training/awareness briefing by the E.O. to site personnel whose activities have impact on the environment;
- (f) replacement of incompetent E.O. to the equivalent level or higher to the approval of the S.O.;
- (g) any substitution when the appointed E.O. is absent or on leave for more than three (3) consecutive days.

## 5.4 **ENVIRONMENTAL MONITORING, AUDIT AND TRAINING**

### 5.4.1 **Environmental Monitoring**

- 5.4.1(i) **Water Quality Monitoring**
- 5.4.1(ii) **Air Quality Monitoring**
- 5.4.1(iii) **Noise Monitoring**
- 5.4.1(iv) **Vibration Monitoring**

#### Unit

The unit for measurement to conduct the above monitoring shall be Lump Sum (sum) for the whole duration of the contract.

Measurement

The measurement for payment shall be the number of samples taken for monitoring, tested and accepted by the S.O.

Pricing Factor

The item to conduct environmental monitoring (water, air, noise and vibration) shall be in accordance with the Preambles to Bill of Quantities:-

- (a) provision of all necessary equipments as specified;
- (b) carrying out calibration of all necessary equipments prior to use;
- (c) taking samples according to the intervals, parameters and for the duration specified at approved sampling locations by trained laboratory personnel;
- (d) recording and noting of specified data;
- (e) sending samples collected, testing and analysis at approved independent accredited laboratory. The analysis report shall be signed by a registered chemist;
- (f) submission of analysed results for purpose of reporting (preparation of monitoring report is measured separately).

**5.4.1(iv) Environmental Quality Report**

Unit

The unit of measurement for the preparation of submission of the Environmental Quality Report shall be Lump Sum (sum) for the whole duration of the contract.

Measurement

The measurement for payment shall be the number of reports prepared based on monitoring carried out and accepted by the S.O.

Pricing Factor

The item for preparation of the monitoring report shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost associated in the preparation of a comprehensive report;
- (b) submission of five (5) copies of report to S.O.

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**5.4.2 Environmental Audit and Closure Audit**

Unit

The unit of measurement to conduct environmental audit and preparation of environmental monitoring and audit report shall be Lump Sum (sum) for the whole duration of the contract.

Measurement

The measurement for payment shall be the number of reports prepared based on audits carried out and accepted by the S.O.

Pricing Factor

The item to conduct environmental audit and preparation of report including the Closure Audit Report shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost and expenses incurred consequent upon the engagement of a competent, independent environmental auditor, registered with DOE and/or have attended courses on ISO 14001 auditing with a minimum of auditing experience for at least 3 sites;
- (b) cost of carrying out quarterly audits or at any other intervals deemed necessary due to the nature of works on site, evaluation of monitoring data and verifying implementation of corrective and preventive actions;
- (c) cost associated in the preparation of a comprehensive report including recommendations for improvement in accordance with the Standard Report Format as specified in Appendix 2 of this Document;
- (d) submission of five (5) copies of report (per audit) with colour photographs to S.O.

**5.4.3 Training**

Unit

The unit of measurement for training shall be in number (no).

Measurement

The measurement for payment shall be the number of training sessions carried out for the duration of the contract.

Pricing Factor

The item for training JKR personnel shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost associated in organizing and conducting training of JKR personnel locally pertaining to Environmental Management, EIA, Safety and Health, Environmental related legal and other requirements.

## **PHYSICAL WORK**

### **5.5 DUST AND MUD CONTROL**

#### **5.5.1 Water Bowser Truck**

##### Unit

The unit of measurement for provision, operation and maintenance of water bowser truck shall be in number (no).

##### Measurement

The measurement for payment shall be the number of water bowser truck provided on site and shall be made as follows:-

- (a) 60% on complete provision of vehicle and equipment to the satisfaction of the S.O.;
- (b) 40% for operation and maintenance which shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

##### Pricing Factor

The item for provision, operation and maintenance of bowser truck shall be in accordance with the Preambles to Bill of Quantities:-

- (a) all cost associated with the provision and operation of trucks including operators, water supply, pumping of water, water tank and all other necessary equipments needed to carryout water spraying;
- (b) carrying out water spraying minimum 3 times a day along haul/access roads, existing road and nearby settlement zone or other affected areas or as directed by S.O.;
- (c) maintenance in a roadworthy condition of trucks and associated equipments;
- (d) provision of suitable replacement including equipment when the regular truck is not available or unserviceable for more than 24 hours;
- (e) removal of truck and equipment from site on completion of the works.

#### **5.5.2 Tyre Washing Facilities**

**5.5.2(i) Portable Water Jet****Unit**

The unit of measurement for provision, operation and maintenance of portable water jet shall be in number (no).

**Measurement**

The measurement for payment shall be the number of portable water jet provided on site and shall be made as follows:-

- (a) 60% on complete construction of structure, platform, provision and installation of all equipments to the satisfaction of the S.O.;
- (b) 40% for operation and maintenance which shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

**Pricing Factor**

The item for provision, operation and maintenance of portable water jet shall be in accordance with the Preambles to Bill of Quantities:-

- (a) cost of construction and maintenance of the structure for the elevated water tank and the supply of the water tank;
- (b) cost for the construction of the tyre washing concrete platform;
- (c) provision of portable water jet including operator and other necessary equipment deemed required for the successful washing operation;
- (d) carrying out cleaning of all vehicle tyres at various exits of worksites;
- (e) maintenance of all cleaning facilities and associated equipments;
- (f) provision of replacement when the regular equipment is not available or unserviceable for more than 24 hours;
- (g) demolition, and disposal of all rubbish, debris and surplus material including removal of all equipment from site on completion of the works to the satisfaction of the S.O. including reinstatement of the site.

**5.5.2(ii) Wash Trough**

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Unit

The unit of measurement for construction and maintenance of wash trough shall be in number (no).

Measurement

The measurement for payment shall be the number of wash trough constructed on site as shown in Drawing and shall be made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% for maintenance which shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for construction and maintenance of wash trough shall be in accordance with the Preambles to Bill of Quantities:-

- (a) preparation of site and approaches including excavation and disposal of surplus excavated material;
- (b) construction of wash trough including concrete, formwork, reinforcement, hardcore complete as shown in Drawing;
- (c) filling and regular maintaining of water during the course of the works;
- (d) maintenance of wash trough and surrounding areas clean including desilting and disposal of material;
- (e) demolition and disposal of all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site.

**5.5.3 Water Sprinkler**Unit

The unit of measurement for provision and maintenance of water sprinkler shall be in number (no)

Measurement

The measurement for payment shall be the number of water sprinkler installed at quarry/batching plant and shall be made as follows:-

- (a) 40% on complete installation;

- (b) 60% for operation and maintenance which shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for provision and maintenance of water sprinkler shall be in accordance with the Preambles to Bill of Quantities:-

- (a) supply and installation of water sprinkler system including all other necessary equipments and facilities;
- (b) maintenance of water sprinkler system and associated equipments;
- (c) removal of all installation on site to the satisfaction of the S.O..

**5.6 EROSION CONTROL**

**5.6.1 Creepers**

Unit

The unit of measurement for planting and maintenance of creepers shall be Square Metre (m<sup>2</sup>).

Measurement

The measurement for payment shall be made of the plan area placed to the lines, level grades and dimensions shown in Drawing or as directed by the S.O.

Pricing Factor

The item for planting and maintenance of creepers shall be in accordance with the Preambles to Bill of Quantities:-

- (a) removal of debris from the surfaces of earthwork to be turfed;
- (b) the preparation of the areas to be turfed including if appropriate the amount of topsoil to be used and its method of application;
- (c) the details and results of investigations to determine which types of grass and legume are compatible with the soil in the areas to be turfed;
- (d) the types of grass and legume (if any) and strains of seed to be used, and the function, root and growth characteristics of each type;
- (e) the rates of application of the grass and legume seeds;

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- (f) the type of mulch to be used and its method and rate of application;
  - (g) the amount of lime or other chemicals (if any) to be applied to improve the soil before, during and after turfing;
  - (h) the equipment and methods to be used in preparing and placing the turf mix and other materials;
  - (i) the cultivation and after – care of the turfed areas, including rates and frequencies of watering, fertilising, grass cutting and general maintenance for 1 year after turfing;
  - (j) an estimate of the time required after turfing for establishment of a permanent dense growth of grass which will require minimal maintenance.

### 5.6.2 Artificial Erosion Control Items

#### Unit

The unit of measurement for installation and maintenance of artificial erosion control items shall be Square Metre (m<sup>2</sup>).

#### Measurement

The measurement for payment shall be made of the plan area placed to the lines, level grades and dimensions shown in Drawing or as directed by the S.O.

#### Pricing Factor

The item for installation and maintenance of artificial erosion control items shall be in accordance with the Preambles to Bill of Quantities:-

- (a) removal of debris from the surfaces of earthwork to be artificially controlled;
- (b) the preparation of the areas to be artificially controlled including (if any) the amount of topsoil to be used and its method of application;
- (c) the details and results of investigations to determine which types artificial erosion control items used are compatible with the soil in the areas to be artificially controlled;
- (d) the types of artificial erosion control items (if any) and strains of artificial erosion control items to be used, and the function, root and growth characteristics of each type;

- (e) the type of artificial erosion control items to be used and its method and rate of application including equipments and maintenance required.

**5.7 SEDIMENT CONTROL**

**5.7.1(i) Construction of Silt Fence**

Unit

The unit of measurement for construction of silt fence shall be Linear Metre (m).

Measurement

The measurement for payment shall be the length of complete fence constructed as shown in Drawing and shall be made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.
- (b) 20% on removal

Pricing Factor

The item for construction of silt fence shall be in accordance with the Preambles to Bill of Quantities:-

- (a) clearing of site for base preparation ;
- (b) construction of silt fence complete as shown in Drawing;
- (c) removal and disposal of all rubbish, debris and surplus material from the site
- (d) to the satisfaction of the S.O. including reinstatement of the site

**5.7.1(ii) Maintenance of Silt Fence**

Unit

The unit of measurement for maintenance of silt fence shall be Linear Metre (m).

Measurement

The measurement for payment shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of silt fence shall be in accordance with the Preambles to Bill of Quantities:-

- (a) inspection at regular interval and after heavy rain of geotextile and other components for rips, tears and other types of deterioration and replacement if required;
- (b) removal of silt and sediment accumulated to approximate 2/3 of filter height including its disposal ;

**5.7.2 Sand bag barrier**

**5.7.2(i) Installation of sand bag barrier**

Unit

The unit of measurement for Installation of sand bag barrier shall be In number (no).

Measurement

The measurement for payment shall be the number of sand bag barrier constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of installation of sand bag barrier shall be in accordance with the Preambles to Bill of Quantities:-

- (a) labour required for installation purposes;

**5.7.2 (ii) Maintenance of sand bag barrier**

Unit

The units of measurement for maintenance of sand bag barrier shall be in number (no).

Measurement

The measurement for payment shall be maintenance of the completed sand bag barrier and shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of sand bag barrier shall be in accordance with the Preambles to Bill of Quantities:-

- (a) sand bag barrier shall be checked daily before and after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- (b) Sediment should be removed when the sediment accumulation reaches to approximate 1/3 of the barrier height and it has to be incorporated into earthwork on the site or disposed at an appropriate location.

**5.7.3 Silt Trap & Sediment Basin****5.7.3 (i) Gabion**Unit

The unit of measurement for construction of gabion units in silt traps or sediment basins shall be In number (no)

Measurement

The measurement for payment shall be the number of specified size gabion unit constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of gabion units in silt traps and sediment basins shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for preparation of the silt trap and disposal of surplus excavated material;
- (b) construction of gabion overflow including cage, geotextile and rockfill complete as shown in Drawing;
- (c) assembling, tying and staking for the positioning of the gabion units. ÷
- (d) removal and disposal of all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site

**5.7.3 (ii) Sand Bedding**

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Unit

The unit of measurement for sand bedding in silt traps or sediment basins shall be in cubic meter (m<sup>3</sup>).

Measurement

The measurement for payment shall be the volume of sand bedding constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of sand bedding in silt traps and sediment basins shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for construction of the sand bedding and disposal of surplus excavated material;
- (b) maintenance of the sand bedding to effectively control siltation and sedimentation.

**5.7.3 (iii) Stone Filling**Unit

The unit of measurement for construction of stone filling in silt traps or sediment basins shall be in cubic meter (m<sup>3</sup>).

Measurement

The measurement for payment shall be the volume of stone filling constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of stone filling in silt traps and sediment basins shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for construction of stone filling and disposal of surplus excavated material;
- (b) maintenance of the stone filling to effectively control siltation and sedimentation.

**5.7.3 (iv) Mortared Rip Rap**

Unit

The unit of measurement for construction of mortared rip rap in silt traps or sediment basins shall be in cubic meter (m<sup>3</sup>).

Measurement

The measurement for payment shall be the volume of mortared rip rap constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of mortared rip rap in silt traps and sediment basins shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for construction of the mortared rip rap and disposal of surplus excavated material;
- (b) maintenance of the mortared rip rap to effectively control siltation and sedimentation.

**5.7.3 (v) Excavation for silt trap construction**

Unit

The unit of measurement for excavation of earth for silt traps or sediment basin shall be in cubic meter (m<sup>3</sup>).

Measurement

The measurement for payment shall be the volume of earth excavated as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for excavation of earth for silt traps or sediment basin shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for preparation of the silt trap and disposal of surplus excavated material;

**5.7.3 (vi) Maintenance of Silt Trap or Sediment Basin**

Unit

The units of measurement for maintenance of silt trap or sediment basin shall be lump sum (sum).

Measurement

The measurement for payment shall be maintenance of the completed silt trap or sediment basin and shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of silt trap or sediment basin shall be in accordance with the Preambles to Bill of Quantities:-

- (a) regular inspection and maintenance throughout the construction period as directed by the S.O. and make good and replace any damaged component;
- (b) removal of silt and sediment accumulated to approximate 2/3 of filter height including disposal

**5.7.3(vii) Temporary Drainage**

Unit

The unit of measurement for provision and maintenance of temporary earth drain shall be Cubic Metre (m<sup>3</sup>).

Measurement

The measurement shall be the volume of the void formed from the surface of the ground after clearing and excavation of top soils to the lines, levels, grades and dimensions as shown in Drawings or as directed by the S.O.

Pricing Factor

The item for provision and maintenance of temporary earth drain shall be in accordance with the Preambles to Bill of Quantities:-

- (a) preparation of site, excavation, leveling, trimming, shaping and compacting surface of excavation to the required lines, levels,

grade and dimensions and disposal of surplus excavated material;

- (b) Reinstatement of site on completion of the work, to the satisfaction of the S.O..
- (c) inspection at regular interval and after heavy rain to check for clogs and sediment-laden;
- (d) removal of accumulated sediment to disposal site and reshaping of temporary drainage;

#### 5.7.4 (i) **Construction of Gabion Wall**

##### Unit

The unit of measurement *for construction of gabion wall* shall be ~~in~~ number (no).

##### Measurement

*The measurement for payment shall be the number of specified size gabion constructed as shown in Drawing and approved by the S.O. and made as follows:-*

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

##### Pricing Factor

The item for construction of gabion wall shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for preparation of bed and disposal of surplus excavated material;
- (b) construction of gabion overflow including cage, geotextile and rockfill complete as shown in Drawing;
- (c) assembling, tying and staking for the positioning of the gabion units;
- (d) removal and disposal of all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site.

#### 5.7.4 (ii) **Maintenance of Gabion Wall**

Unit

The unit of measurement for maintenance of gabion shall be In number (no).

Measurement

The measurement for payment shall made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of gabion wall shall be in accordance with the Preambles to Bill of Quantities:-

- (a) regular inspection and maintenance throughout the construction period as directed by the S.O. and make good and replace any damaged component;
- (b) removal of accumulated silt and sediment when full including disposal.

**5.7.5 (i) Construction of Check Dam**

Unit

The unit of measurement for construction of check dam shall be Cubic Metre (m<sup>3</sup>).

Measurement

The measurement for payment shall be the volume of rock constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete construction to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for construction of check dam shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for preparation of bed and disposal of surplus excavated material;
- (b) construction of rock check dam including overflow complete as shown in Drawing;
- (c) removal and disposal of check dam, all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site.

**5.7.5 (ii) Maintenance of Check Dam**

Unit

The unit of measurement for maintenance of check dam shall be Cubic Metre (m<sup>3</sup>).

Measurement

The measurement for payment shall be maintenance of the completed check dam and shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of check dam shall be in accordance with the Preambles to Bill of Quantities:-

- (a) regular inspection and maintenance throughout the construction period as directed by the S.O. and make good and replace any damaged component;
- (b) removal of silt and sediment accumulated to approximate 2/3 of filter height including disposal.

**5.7.6 (i) Installation of Silt Curtain**

Unit

The unit of measurement for installation of silt curtain shall be Square Metre (m<sup>2</sup>).

Measurement

The measurement for payment shall be the area of curtain constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 80% on complete installation to the satisfaction of the S.O.;
- (b) 20% on removal

Pricing Factor

The item for installation of silt curtain shall be in accordance with the Preambles to Bill of Quantities:-

- (a) installation of silt curtain complete as shown in Drawing;

- (b) removal including of all rubbish, debris and surplus material from the site to the satisfaction of the S.O..

**5.7.6 (ii) Maintenance of Silt Curtain**

Unit

The unit of measurement for maintenance of silt curtain shall be Square Metre (m<sup>2</sup>).

Measurement

The measurement for payment shall be maintenance of the completed silt curtain and shall be made in each interim payment in proportion of the total period lapsed to the Contract Period (excluding Defects Liability Period).

Pricing Factor

The item for maintenance of silt curtain shall be in accordance with the Preambles to Bill of Quantities:-

- (a) inspection at regular interval and after heavy rain for rips, tears and other types of deterioration and replacement if required.

**5.8 TOPSOIL AND FINISHED SLOPE TEMPORARY PROTECTION**

**5.8.1 Plastic Sheeting**

Unit

The unit of measurement for plastic sheeting to temporarily cover topsoil and finished slope shall be Square Metre (m<sup>2</sup>).

Measurement

The measurement for payment shall be the area of sheeting laid (laps shall not be measured for payment) as approved by the S.O. and made as follows:-

- (a) 90% on complete installation to the satisfaction of the S.O.;
- (b) 10% on maintenance and removal

Pricing Factor

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The item for installation of plastic sheeting shall be in accordance with the Preambles to Bill of Quantities:-

- (a) supply and placing of sheeting to cover topsoil stockpile

## 5.8.2 **Silt Fence**

### Unit

The unit of measurement for construction of silt fence shall be Linear Metre (m).

### Measurement

The measurement for payment shall be the length of complete fence constructed as shown in Drawing and shall be made as follows:-

- (c) 80% on complete construction to the satisfaction of the S.O.
- (d) 20% on removal

### Pricing Factor

The item for construction of silt fence shall be in accordance with the Preambles to Bill of Quantities:-

- (a) clearing of site for base preparation ;
- (b) construction of silt fence complete as shown in Drawing;
- (c) removal and disposal of all rubbish, debris and surplus material from the site
- (d) to the satisfaction of the S.O. including reinstatement of the site

## 5.9 **FUEL SPILLAGE MANAGEMENT**

### 5.9.1 **Containment Bund for Bulk Fuel Tank**

#### Unit

The unit of measurement for skid tank bund shall be In number (no).

#### Measurement

The measurement for payment shall be the number constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 70% on complete construction to the satisfaction of the S.O.;

- (b) 20% on maintenance;
- (c) 10% on removal.

#### Pricing Factor

The item for construction of containment bund shall be in accordance with the Preambles to Bill of Quantities:-

- (a) excavation for preparation of base and disposal of surplus excavated material;
- (b) construction of concrete base, brick wall including grease trap with oil and grease separator overflow complete as shown in Drawing;
- (c) regular cleaning and maintenance of grease trap, bund and surrounding areas to prevent surface corrosion;
- (d) installation of proper drainage to bund and surrounding area;
- (e) demolition, removal and disposal of bund and all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site.

### **5.10 WASTE MANAGEMENT**

#### **5.10.1 Scheduled Waste Disposal**

##### **5.10.1 (i) Storage Shed**

#### Unit

The unit of measurement for construction of storage shed shall be Lump Sum (sum)

#### Measurement

The measurement for payment shall be the shed constructed as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 90% on complete construction to the satisfaction of the S.O.;
- (b) 10% on maintenance and removal

#### Pricing Factor

The item for construction of containment bund shall be in accordance with the Preambles to Bill of Quantities:-

- (a) all cost associated with the construction, maintenance and removal of suitable storage shed for the purpose of housing scheduled waste

#### 5.10.1 (ii) **Scheduled Waste**

##### Unit

The unit of measurement for *disposal of* scheduled waste shall be Lump Sum (sum).

##### Measurement

The measurement for payment shall be the number of consignment of scheduled waste disposed from the project site.

##### Pricing Factor

The item for disposal of scheduled waste shall be in accordance with the Preambles to Bill of Quantities:-

- (a) identifying the category of scheduled waste generated from the project site as per the 1<sup>st</sup> Schedule;
- (b) treating and recovering of scheduled waste generated on site according to the regulations and specification;
- (c) storing and labeling of scheduled waste as per regulations;
- (d) delivering of scheduled waste by licensed contractor to prescribed premises for treatment;
- (e) training of all relevant employees involved in identification, handling, transportation, storage and response to spillage or release of scheduled wastes.

#### 5.10.2 **Grease Trap**

##### Unit

The unit of measurement for grease trap shall be In number (no).

##### Measurement

The measurement for payment shall be the number of grease trap constructed as shown in drawing.

##### Pricing Factor

The item for construction of grease trap shall be in accordance with the Preambles to Bill of Quantities:-

- (a) construction and maintenance of grease trap at kitchen areas, kongsi and workshop;
- (b) skimming of oil and grease from the trap for disposal as scheduled waste;
- (c) removal of grease trap to the satisfaction of S.O.

## 5.11 **MANAGEMENT OF DISPOSAL SITE FOR SURPLUS MATERIAL**

### 5.11.1 **Earthworks**

#### 5.11.1 (i) **Close Turfing**

Refer to Earthworks Method of Measurement

#### 5.11.1 (ii) **Hydroseeding with fibromat or equivalent**

Refer to Earthworks Method of Measurement

#### 5.11.1 (iii) **Vertiver Z**

##### Unit

The unit of measurement for planting and maintenance of vertiver Z shall be Square Metre (m<sup>2</sup>).

##### Measurement

The measurement for payment shall be made of the plan area placed to the lines, level grades and dimensions shown in Drawing or as directed by the S.O.

##### Pricing Factor

The item for planting and maintenance of vertizer Z shall be in accordance with the Preambles to Bill of Quantities:-

- (a) removal of debris from the surfaces of earthwork to be turfed;
- (b) the preparation of the areas to be turfed including if appropriate the amount of topsoil to be used and its method of application;
- (c) the details and results of investigations to determine which types of grass and legume are compatible with the soil in the areas to be turfed;

- 
- (d) the types of grass and legume (if any) and strains of seed to be used, and the function, root and growth characteristics of each type;
  - (e) the rates of application of the grass and legume seeds;
  - (f) the type of mulch to be used and its method and rate of application;
  - (g) the amounts of lime or other chemicals (if any) to be applied to improve the soil before, during and after turfing;
  - (h) the equipment and methods to be used in preparing and placing the turf mix and other materials;
  - (i) the cultivation and after – care of the turfed areas, including rates and frequencies of watering, fertilising, grass cutting and general maintenance for 1 year after turfing;
  - (j) an estimate of the time required after turfing for establishment of a permanent dense growth of grass which will require minimal maintenance;

#### 5.11.1(iv) Creepers

##### Unit

The unit of measurement for planting and maintenance of creepers shall be Square Metre (m<sup>2</sup>).

##### Measurement

The measurement for payment shall be made of the plan area placed to the lines, level grades and dimensions shown in Drawing or as directed by the S.O.

##### Pricing Factor

The item for planting and maintenance of creepers shall be in accordance with the Preambles to Bill of Quantities:-

- (a) removal of debris from the surfaces of earthwork to be turfed;
- (b) the preparation of the areas to be turfed including if appropriate the amount of topsoil to be used and its method of application;
- (c) the details and results of investigations to determine which types of grass and legume are compatible with the soil in the areas to be turfed;
- (d) the types of grass and legume (if any) and strains of seed to be used, and the function, root and growth characteristics of each type;

- (e) the rates of application of the grass and legume seeds;
- (g) the type of mulch to be used and its method and rate of application;
- (f) the amount of lime or other chemicals (if any) to be applied to improve the soil before, during and after turfing;
- (g) the equipment and methods to be used in preparing and placing the turf mix and other materials;
- (h) the cultivation and after – care of the turfed areas, including rates and frequencies of watering, fertilising, grass cutting and general maintenance for 1 year after turfing;
- (i) an estimate of the time required after turfing for establishment of a permanent dense growth of grass which will require minimal maintenance;

#### 5.11.2 Drainage

Taken from Drainage Works Method of Measurement

##### 4.8 SURFACE DRAIN

###### Unit

The unit of measurement for surface drain shall be Linear Metre (m).

###### Measurement

The measurement for payment shall be length measured along the centre line of the drain as shown on the Drawings or as directed by the S.O between any of the following:

- a) the external faces of manholes, sump, chambers, and like the like;
- b) the external faces of headwalls, inlet and outlet structures and the like;
- c) the intersections of the centre at drain/pipe junctions;
- d) the position of terminations as shown on the Drawings; and
- e) the point of change of stage depth.

In the case of cascade drains, the length shall be measured along the centre line of the projected horizontal plane. No allowance shall be made for laps.

The depth of drains shall be the vertical measurement between the invert and the lowest of the following:

- a) lower existing ground level at sides;
- b) lower formations level at sides;
- c) at slopes, for the lower finished earthwork level at sides prior to top soiling measured perpendicular to the invert;
- d) lower finished earthworks level at sides

The average depth to invert shall be calculated arithmetic means of the depths taken at intervals of 10 metres along the drains starting from the outfall end. For terminal lengths of drains less than 10 metres long, the measurement of depths shall be taken at their ends.

Where the depth of drains are not stated, the Contractor shall establish the depth of excavation required from the information provided in the Contract and allow their costs in the rates.

#### Item Coverage

The item for the drain shall be in accordance with the Preambles to the Bill of Quantities General Directions and shall include:

- a) locating existing drains;
- b) breaking into existing drains, chambers and the like, dealing with existing flow and making connections unless otherwise measured separately;
- c) hand or machine excavation in any material except rock, dewatering upholding the sides, keeping the excavation free of water, backfilling with approved material from any source and compaction;
- d) taking precautions to avoid damage to existing works including providing temporary supports;
- e) excavation and filling of soft spot with granular backfilling material and compaction;
- f) brickworks (including rendering), stonework, filter materials, pipes and fittings including cutting, laying, stepping and jointing;
- g) building in drains to sumps, chambers, headwalls and the like;
- h) blinding and bedding;
- i) concrete bedding haunching and surround and cement mortar;

- j) formwork and reinforcement;
- k) trimming of sides slopes and inverts, leveling and compaction;
- l) stepping of inverts;
- m) double handling and disposal of material to dumping site off site provided by the Contractor;
- n) movement joints to concrete beds surrounds and the like;
- o) reinstatement of surfaces;
- p) taking precautions to prevent siltation and desilting prior to handling over;
- q) checking and cleaning;
- r) R.C structs for blocks to drain with brick sides, precast concrete covers (where specified, mild steel gratings, frame and bedding);
- s) Additional excavation the contractor may require for working space and its subsequent backfilling; and
- t) Transport, unload, storage and multiple handling of precast concrete drain sections.

#### **4.10 SUMPS**

##### Unit

The unit of measurement for sump shall be Number (nr).

##### Measurement

The measurement shall be the number of the completed sump (walls and base) as shown on the Drawing or as directed by the S.O. The depth shall be the distance between the top surface or the structure and the invert if the main channel or upper most surface of the base slab.

##### Item Coverage

The item of the sump shall be accordance with the Preambles to the Bill of Quantities General Directions and shall include:

- a) excavation in any material except rock, upholding the sides, keeping excavation free of water, backfilling with approved material from any source and compaction, double handling and disposal of material;
- b) taking precautions to avoid damage to existing works including providing temporary supports;

- c) trimming of side slopes and inverts, leveling and compaction;
- d) excavation and filling of soft spots with granular backfilling material and compaction;
- e) blinding and bedding, haunching and surround material;
- f) concrete, formwork and reinforcement;
- g) brickworks and rendering for brick sumps;
- h) channels, fittings, benching and building, in drains and pipes;
- i) steps iron , safety chains, ladders, handholds, anchor irons, bearers support and the like;
- j) mild steel grating to suit including frame;
- k) reinstatement of surfaces;
- l) cleaning and desilting prior to handing over;
- m) additional excavation for working space and its subsequent backfilling;
- n) movement joints;
- o) joint filler, sealant and waterstops.

### 5.11.3 Retaining Wall

#### Unit

The unit of measurement for construction and maintenance of retaining wall shall be in number (no).

#### Measurement

The measurement for payment shall be the number of specified size of the retaining wall as shown in Drawing and approved by the S.O. and made as follows:-

- (a) 60% on complete construction to the satisfaction of the S.O.;
- (b) 30% for maintenance
- (c) 10% on removal

#### Pricing Factor

*The item for construction and maintenance of retaining wall shall be in accordance with the Preambles to Bill of Quantities:-*

- (a) excavation for preparation of bed and disposal of surplus excavated material;
- (b) construction of gabion overflow including cage, geotextile and rockfill complete as shown in Drawing;
- (c) assembling, tying and staking for the positioning of the gabion units;
- (d) removal and disposal of all rubbish, debris and surplus material from the site to the satisfaction of the S.O. including reinstatement of the site.
- (e) regular inspection and maintenance throughout the construction period as directed by the S.O. and make good and replace any damaged component;
- (f) removal of accumulated silt and sediment when full including disposal.

## 5.12 **NOISE CONTROL**

### 5.12.1 **Noise Barrier**

#### Unit

Allow as provisional sum

#### Unit

The unit of measurement shall be Square Metre (m<sup>2</sup>).

#### Measurement

The measurement for payment shall be the exposed plain surface area on the traffic side of noise barrier installed according to the specification and approved by the S.O.

#### Pricing Factor

The item for construction of noise barrier shall be in accordance with the Preambles to Bill of Quantities:-

- (a) site clearing and base preparation;
- (b) supply and driving of poles;
- (c) replacement of defective materials and components

**5.13 FLORA MANAGEMENT**

**5.13.1 Flora Survey**

Unit

The unit of measurement to conduct Flora Survey shall be Lump Sum (sum).

Measurement

The measurement for payment shall be the submission and acceptance of the report by the S.O.

Pricing Factor

The item for conducting flora survey shall be in accordance with the Preambles to Bill of Quantities:-

- (a) the costs of literatures, references and consultation in the production of the floral survey report.

**5.13..2 Relocation, Transportation and Maintenance of Trees**

Unit

The unit of measurement for relocation, transportation and maintenance of trees with conservation value shall be In number (no).

Measurement

The measurement for payment *shall be upon the completion of the relocation process and acceptance by the S.O.*

Pricing Factor

The item for relocation, transportation and maintenance of trees shall be in accordance with the Preambles to Bill of Quantities:-

- (a) trees relocation to approved site and/or arboretum as required by Jabatan Perhutanan;
- (b) handling, storing and maintaining packages of salvaged trees in well kept condition including safety during relocation and transportation;
- (c) Watering;
- (d) Fertiliser required and nurturing until the flora are established at the temporary nursery and at the final place of relocation.

5.14 **WILDLIFE MANAGEMENT**

15.14.1 **Fauna survey**

Unit

The unit of measurement to conduct fauna survey shall be Lump Sum (sum).

Measurement

The measurement for payment shall be based on the number of surveys scheduled for the project.

Pricing Factor

The item to conduct fauna survey shall be in accordance with the Preambles to Bill of Quantities:-

- (a) fauna survey prior to site clearing, during middle and end of construction period;
- (b) preparation and submission of fauna status report.

5.14.2 **Wildlife Translocation**

Unit

Allow as provisional sum.