

## **1.11 GARBAGE DISPOSAL**

### **1.11.1 Scope**

- a The Contractor shall undertake the collection of and disposal of all garbage from within the Site, the Contractor's Site office, the Contractor's temporary facilities, the Engineer's Site office and other areas used in connection with the Works. Garbage collections shall be made at least twice each week and shall continue until completion of the Works.
- b Garbage shall be disposed of in a properly constructed incinerator followed by burial of the residue in an approved location. The Contractor shall submit the proposed design and layout of garbage disposal facilities for approval. Where available, garbage collection by local authorities shall be used in preference to disposal as noted above.

### **1.11.2 Payment**

Separate payment will not be made for the provision for garbage disposal and the cost of this work shall be deemed to be included in the lump sum price entered in the priced Bill of Quantities for Contractor's Site Office and Facilities.

## **1.12 REMOVAL OF FLOATING RUBBISH**

### **1.12.1 Scope**

Removal of all floating rubbish which affects the progress of the Works shall be the responsibility of the Contractor.

All floating rubbish retrieved shall be removed from the Site in a manner for which the Engineer has given his prior approval.

### **1.12.2 Payment**

Separate payment will not be made for the provision for Floating Rubbish Removal and the cost of this work shall be deemed to be included in the rates and lump sum prices entered in the priced Bill of Quantities.

## **1.13 DIVERSION AND CARE OF WATER**

### **1.13.1 General Requirements**

The Contractor shall be responsible for the removal of all water encountered during the execution of the whole of the Works.

The Contractor shall design, construct and maintain all temporary diversion and protective works which are necessary for construction and to prevent surface, drainage and groundwater from entering excavations and shall furnish all materials required therefor.

The Contractor shall furnish, install, maintain and operate all necessary pumping and other equipment for dewatering the various parts of the Works on the surface, in open cut excavation and in the river channel and shall maintain the foundations and other parts of the work free from water as required for constructing each part of the Works and as required, and for a period after any part of the Works is completed for inspection, safety or for any reason determined by the Engineer to be necessary.

The Contractor shall not interrupt or interfere with the natural flow of the West Floodway or Garang River or of other existing drainage channels for any purpose without the written approval of the Engineer.

The Contractor shall remove all water from the Sites of all construction work and shall keep the excavations free of water while excavating, preparing foundations, pile driving and while placing backfill or concrete or as otherwise required for completing the Works. The Contractor shall be responsible for and shall repair, at his expense, any damage to foundations, excavation slopes or any other parts of the Works caused by water, floods or by his failure to protect the Works in accordance with the requirements of this clause. Temporary diversion and protective works, conduits, and sumps shall be readily accessible at all times and the Contractor shall maintain in operating condition an assembly of standby transportable and portable lighting facilities which is adequate, as determined by the Engineer, to provide illumination, at short notice, to any or all of the temporary works.

All temporary cofferdams and protective work shall be removed or levelled as approved by the Engineer to give a neat appearance and so as not to interfere in any way with the operation or usefulness of the permanent works. Temporary cofferdams constructed within the boundaries of the permanent works shall be removed completely. Temporary cofferdams shall not be constructed on or against any part of the permanent works unless the Contractor can demonstrate that no damage to the permanent works will result and shall not be so constructed without the approval and the presence of the Engineer.

#### **1.13.2 Payment**

Payment for Coffering and Dewatering for specific items of work where payment items are included in the Bill of Quantities shall be made in accordance with Clause 1.2, Coffering and Dewatering, of the Technical Specification.

For all other cases, no payment shall be made for complying with this general obligation of the Contractor described in this clause and the cost of this work shall be deemed to be included in the rates and lump sum prices entered in the priced Bill of Quantities.

### **1.14 MAINTENANCE OF EXISTING PUBLIC ROADS**

#### **1.14.1 General**

The Contractor shall maintain all roads within the vicinity which he uses for purposes of carrying out the Works required by this Contract.

#### **1.14.2 Contractor's Operations**

- a If the Contractor's operations obstruct or hinder the passage of traffic on the roads described in this Clause, the Contractor shall provide and maintain for the duration of such disruption an alternative route, approved by the Engineer, of a standard not less than that of the road so affected.
- b Existing roads and bridges have their load limits and the Contractor shall be responsible for determining such load limits. Before moving any heavy construction traffic into highways, roads, and bridges, the Contractor shall make suitable arrangements with the relevant authorities and obtain their approval for the passage of such traffic.
- c The Contractor shall not travel metal-tread vehicles or equipment on any bituminous sealed road surface. Rubber tyred vehicles conforming to

applicable load restrictions will be permitted to use bituminous sealed road surfaces.

- d All the work of improvements or modifications on the existing public roads made by the Contractor for his own convenience shall be at the Contractor's own risk and expense.

### **1.14.3 Maintenance of Roads**

- a The Contractor shall be wholly responsible for maintenance of the public roads used by him in the execution of the Works.
- b In maintaining these roads the Contractor shall :
  - i reinforce to pass his traffic, if necessary, and keep in good working condition at all times all road structures, bridges, culverts, drains and other waterways;
  - ii patch potholes with approved materials, keep the road surfaces in good repair, and perform all grading and necessary resurfacing;
  - iii maintain all fenders, posts, guideposts, guard posts, rails, fencing, signs, signposts and other roadside structures;
  - iv keep road surfaces and shoulders free from all earth, mud, stones, timber, rubbish, and other debris and materials removed from the Works;
  - v adequately maintain cut-slopes and fill-slopes of the roads and appurtenant drainage ditches; and
  - vi keep the road surface watered where dust is likely to be a safety or health problem.

### **1.14.4 Payment**

Separate payment will not be made for complying with the requirements of this Clause, and the cost of this work shall be deemed to be included in the lump sum prices entered in the priced Bill of Quantities for Temporary Construction Road and Bridge.

## **1.15 PLANT, EQUIPMENT AND MATERIALS TO BE FURNISHED BY THE CONTRACTOR**

### **1.15.1 General**

#### **1.15.1.1 Plant, Equipment and Materials to be Furnished by The Contractor**

The Contractor shall furnish all items of plant, equipment and materials required for the execution of the Works except as otherwise provided for in the Contract.

#### **1.15.1.2 Trades Names and Catalogue Numbers**

Unless specifically stated otherwise, any reference in this Specification or on the Drawings to trade names or catalogue numbers or to a particular manufactured product does not imply that article or product so mentioned is the only one that may be supplied or used. Any reference so made is purely given as to the standard of the quality, class, type and finish of the items specified to be used. Articles or products of similar type and quality produced by other manufactures shall be submitted by the Contractor to the Engineer for approval for use in the Works.

### **1.15.1.3 Conformity of Plant, Equipment and Materials with Specification.**

- a All plant, equipment and materials which form part of the permanent Works shall be new and shall conform to the standards provided in the Specification. Where the requirements for any plant, equipment and materials are not stated in this Specification, the plant, equipment and materials shall conform with the appropriate and most recent Japanese or American Standard or such other standard as the Engineer may approve.
- b The Contractor shall make diligent effort to procure the specified materials but where, because of priorities or other causes, materials required by the Specification are not available, substitutes may be used with the prior approval of the Engineer. The approval will state the amount of price adjustment, if any, to be made. The Engineer's decision as to whether substitution will be permitted and as to what substitute materials may be used will be final, binding and conclusive.

### **1.15.1.4 Payment**

- a When a separate item, which includes the furnishing of any plant, equipment or materials, is provided in the Bill of Quantities, the cost of furnishing, transporting, storing and handling such plant, equipment or materials shall be deemed to be included in the rate or lump sum price entered for that item in the priced Bill of Quantities.
- b Where no separate item is provided in the Bill of Quantities for furnishing any plant, equipment or materials required to be furnished by the Contractor, the cost of furnishing, transporting, storing and handling such plant, equipment or materials shall be deemed to be included in the rates or lump sum prices entered in the priced Bill of Quantities for the items for which plant, equipment or materials are required.

### **1.15.2 Inspection of Plant, Equipment and Materials**

- a) Plant, equipment and materials furnished by the Contractor shall be subject to inspection in accordance with the Contract any one or more of the following locations as determined by the Engineer :
  - b) The place of production or manufacture.
    - The shipping point.
    - The Site.
  - c) The Contractor shall furnish without additional charge all facilities, labour and materials reasonably needed for performing the inspections, examinations and tests as may be required by the Engineer.
  - d) The Contractor shall submit the Engineer all information covering the plant, equipment and materials required by the Engineer for the purpose of inspection which shall in no way relieve the Contractor from his responsibility for furnishing plant, equipment and materials in compliance with the Specifications.
- e) Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the rates and lump sums entered in the priced Bill of Quantities.

## **1.16 SAFETY, HEALTH CONTROL AND SECURITY**

### **1.16.1 General**

The Contractor shall be responsible for all safety, health controls and security and shall submit to the Engineer details of the organisations and regulations for these purposes.

### **1.16.2 Safety Precautions**

#### **1.16.2.1 General**

The Contractor shall comply with any safety instruction given by the Engineer. In the performance of the Works, the Contractor shall exercise every reasonable precaution to protect from injury persons or property. The Contractor shall erect and maintain all necessary temporary fencing, barricades, barriers, signs and lights and provide fire alarm, fire extinguishing and fire fighting services at strategic points on the Site and adequate ventilation, lighting and safe working conditions for his workmen engaged in the performance of the Works. The Contractor shall adopt and enforce such rules and regulations as may be necessary and desirable in the work and in its supervision. Safety measures shall include but shall not be limited to those measures mentioned in this clause.

#### **1.16.2.2 Safety Officer**

The Contractor shall constantly employ during the progress of the Works an employee qualified in safety, and familiar with the type of work being performed, whose assignment shall include initiation of measures for the protection of health and the prevention of accidents and who shall see, by personal inspection, that all safety rules and regulations are enforced. The Contractor shall hold regularly scheduled safety meetings at least once each month with his engineers, supervisors and foremen and, when directed, with the Engineer. The Contractor shall keep the Engineer advised as to when these meetings are to be held and shall provide the Engineer with a copy of the proposed agenda.

#### **1.16.2.3 Temporary Fencing**

The Contractor shall erect, maintain and remove suitable and approved temporary fencing to enclose such areas of the Permanent Works and areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under the Contract in approved manner. Where any temporary fence has to be erected alongside a road, footpath, or other public thoroughfare, it shall be of the type required by and shall be erected to the satisfaction of the Government authority concerned.

#### **1.16.2.4 Lighting**

- a In the event of night work being carried out, the Contractor shall provide sufficient lighting to ensure that in all places where work is in progress :
  - i safe working conditions are provided for the Contractor's personnel and the Engineer;
  - ii the Works can be constructed in complete compliance with the Contract; and
  - iii a complete inspection of all Works in progress can be made by the Engineer.

- b Unless otherwise directed by the Engineer, the minimum service illuminance on ground or working surfaces to be provided for the various operations or work areas shall be as tabulated below :

OPERATION OR AREA	ILLUMINANCE	
	Design Value (Lux)	Measured Minimum Value (Lux)
Earthworks and excavation	50	20
Temporary Bridge	20	10
Access and haul roads where hazardous conditions exist cross traffic or other	20	10
Concrete placing	100	50
Maintenance shops and Auxiliary buildings	300	200

- c All moving equipment or plant used during night operations or in tunnels shall be equipped with sufficient lights and reflectors.
- d Not less than fourteen (15) days before the start of any underground or night operations, the Contractor shall submit to the Engineer his proposals for lighting in the areas in which he proposes to work at night. The Contractor shall modify the proposals if directed and shall not begin operations at night, until the proposals for lighting have been approved.
- e The submission to or approval by the Engineer of the Contractor's proposals for lighting shall not relieve the Contractor of any of his liabilities or obligations under the Contract.

#### 1.16.2.5 Signs

- a The Contractor shall provide all necessary signs for the Works. These shall include, but not be limited to
- i standard road signs;
  - ii warning signs;
  - iii danger signs;
  - iv control signs;
  - v safety signs; and
  - vi direction signs.
- b Wording on all signs shall be in the Indonesian language. The size, colour, lettering and location of all signs will be subject to approval, and attention shall be paid to international system of signs.
- c The Contractor shall maintain all signs placed by himself as well as those placed by the Employer.
- d If the Engineer considers that the system of signs provided by the Contractor is inadequate to ensure safety, or unsatisfactory in other respects, the Contractor shall add to, amend, or otherwise change the system to the satisfaction of the Engineer.

#### 1.16.2.6 Other Safety Measures

- a When working in the vicinity of electrical equipment and in the interest of safety and security, the Contractor shall complete the erection of any safety

fencing around electrical and mechanical equipment by the time that the said apparatus is connected to any electrical supply.

- b Explosives - in the use, handling and storage of explosives, the Contractor shall comply with the guidelines given in Clause 1.16.4 and with all statutory regulations of Indonesia, and the 'Safety Regulations for Sensitised Ammonium Nitrate Blasting Agents' (United States Department of the Interior, Bureau of Mines). The handling or use of explosives shall be discontinued during the approach and progress of a thunderstorm. All persons shall be removed from danger areas to a place of safety during such periods. The Contractor shall supply and install a suitable approved instrument to continuously measure atmospheric electric activity during blasting operation and to sound an alarm when such activity reaches danger levels.
- c Use of Lasers - The use of lasers on the Site shall be done with due regard to eye hazard and all personnel on the Site shall be warned accordingly.
- d Safety instructions - Within sixty (60) days of receipt of the Letter of Acceptance the Contractor shall, at his own cost, supply and issue to his employees, those of his subcontractors and the Engineer, in English, Bahasa Indonesia and in other languages used by his employees at the Site, a booklet containing safety regulations based on good practice. The booklet shall be pocket size and issued to each person employed at the Site. Proof copies of the booklet shall be submitted to the Engineer for approval before printing and amendments shall be made to the booklet to his entire satisfaction. The Contractor shall issue the booklet immediately after printing as required by this clause and ensure that all employees are fully conversant with the instructions. Safety instructions shall deal with all safety including but not limited to the following items where relevant to the Works :
  - i protective clothing, headgear and footwear;
  - ii use of lifting equipment;
  - iii use and storage of explosives;
  - iv earthmoving;
  - v formwork and reinforcement erection;
  - vi concreting;
  - vii structural steelwork;
  - viii compressed air;
  - ix welding and painting;
  - x routine for accidents or fires; and
  - xi watchman, warning notices and barriers.
  - xii electrical safety.

The Contractors shall allow for ten (10) booklets in the English language for the use of the Engineer.

- e Accident Report - The Contractor shall promptly report to the Engineer, in a form to be prescribed, all accidents involving death or serious injury to staff or workmen, and shall furnish monthly reports of all accidents to staff or workmen involving loss of time, giving such information as may be directed.

#### 1.16.2.7 Provision of Safety Equipment

All persons employed on the Works are to be provided with safety equipment appropriate to the tasks upon which they are engaged such as helmets and safety equipment shall be compulsory as deemed necessary by the Engineer.

### 1.16.2.8 Payment

Separate payment will not be made for complying with the provisions of this Clause and all costs shall be deemed to be included in the rates and lump sum prices entered in the priced Bill of Quantities.

### 1.16.3 Sanitary Arrangements

#### 1.16.3.1 Scope of Work

- a The Contractor shall keep the Site in a clean and hygienic condition, and shall provide and maintain sanitary conveniences for use of the persons employed in the Works to the extent, in the manner and at such places as approved by the Engineer and by any Government health authority concerned. All persons connected with the Works shall be enjoined to use these conveniences.
- b The Contractor shall install, operate and maintain an adequate treatment process for disposal of sewage from all temporary buildings including houses, offices, camps, etc., to be constructed by the Contractor, and from all temporary toilet facilities at the Site. Sewage shall be disposed of in a hygienic manner. The Contractor shall post notices and take such other necessary precautions as may be necessary to keep the Site clean. The sewage treatment plant shall be subsequently removed upon completion of the Contract.

#### 1.16.3.2 Payment

Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the item in the priced Bill of Quantities for Contractor's Site Office and Facilities.

### 1.16.4 Explosives and Fuels

#### 1.16.4.1 General

- a The Contractor shall make arrangement for the transportation, storage and handling of explosives and fuels in a safe manner to protect the public in accordance with the laws and security regulations of Republic of Indonesia.
- b The Contractor shall obtain all necessary licences and shall pay all fees and charges as may be necessary for moving explosives and fuels from place to place and storing at the same. The Contractor shall prepare and file all applications and obtain the approvals from the authorities of the Government of Indonesia concerned.
- c The Contractor shall furnish and install an efficient warning system, such as, but not limited to sirens and signs, so that adequate warning may be given to all workers and the public endangered by the charging or firing the explosives. The Contractor shall ensure, prior the discharging an explosive, that the area to be blasted is clear of all residents, pedestrians, and vehicular traffic. In addition, he shall post all flagmen on each of the roads leading to the areas so as to stop and prevent any traffic and person from entering the area until the "all clear" notice is given.
- d Explosives shall be stored at a safe distance from the public areas, work areas and living quarters. The location of explosives magazines compound shall be as approved by the Engineer. The compound shall be surrounded with barbed wire and the magazine shall be protected by safety locks, shall be well-ventilated, and shall be fitted with lightning arresters. The explosive



magazine shall be surrounded by earth dikes, if so required by safety regulations or directed by the Engineer, according to the location of the Site of the magazine. Adequate air space shall be provided between the ceiling and the roof to prevent internal room temperatures rising to dangerous levels. The Contractor shall not make use of any explosive without the approval of the Engineer. Approval by the Engineer shall not relieve the Contractor from any of his obligations and responsibilities for all blasting operations.

- e The Contractor shall keep a record of use of each kind of explosive, detonator and lead wire by preparing a daily record of warehousing, delivery and in-stock quantities, and shall report periodically to the Engineer as directed.
- f If electrical blasting is used, possible electric discharge in the ground due to thunderstorm, electric lines, electric motors, etc., shall be carefully observed. As soon as a discharge which could affect the safety level of detonators is noted or anticipated, electrical blasting operation shall be interrupted.
- g Above-ground gasoline and liquefied petroleum gas storage tanks shall not be located within the limits of the camp Site or closer than 1,000 meters to any building in the Site.

#### 1.16.4.2 Payment

Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the item in the priced Bill of Quantities for Contractor's Site Office and Facilities.

#### 1.16.5 Fire Prevention

##### 1.16.5.1 General

The Contractor shall take every precaution to prevent fire occurring on or about the Site. The Contractor shall comply with the laws and regulations of the appropriate Government authority relating to fires and shall provide fire fighting equipment, which the Engineer considers to be suitable and adequate, ready to use in all structures, buildings or the works under construction, including his, labour camps and ancillary buildings. The Contractor shall maintain such equipment and such additional fire fighting equipment as may be required, in good working condition until the Works are accepted by the Employer.

The Contractor shall extinguish promptly any fire which may occur on the Site wherever the fire may originate. In this regard, he shall employ all requisite equipment and manpower for fire fighting up to the limits of his equipment and manpower employed at the Site including the equipment and manpower of his subcontractors.

##### 1.16.5.2 Payment

Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the various rates and lump sums entered in the priced Bill of Quantities.

## **1.16.6 Earthing**

### **1.16.6.1 General**

All appliance and facilities which are possibly subject to lightning strikes shall be electrically grounded and the effectiveness of such grounding shall be periodically checked by the Contractor.

### **1.16.6.2 Payment**

Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the various lump sums and rates entered in the priced Bill of Quantities.

## **1.16.7 Medical and Health Services**

### **1.16.7.1 General**

- a The Contractor shall make his own arrangement on the Site for treatment of casualties in a first aid unit in conformity with the requirement of all duly constituted medical and health authorities. The Contractor shall provide such first aid units and shall be responsible for and bear all costs in connection with the first aid services including removal by ambulance of injured or sick employees to hospital in Semarang or other places.
- b Except as provided for in paragraph c. of this Subclause the Contractor shall, in cases of emergency, also make the services in paragraph a. of this Subclause available to the Employer's and Engineer's staff working on the Site of the Works at no cost.
- c The Contractor shall provide first aid services for the Employer's and Engineer's staff working on the Site.

### **1.16.7.2 Payment**

Separate payment will not be made for medical and health facilities provided by the Contractor for his employees, for his subcontractors and the Employer's and Engineer's staff, as required by this clause, and all costs shall be deemed to be included in the various rates and lump sums entered in the priced Bill of Quantities.

## **1.16.8 Security**

### **1.16.8.1 Responsibility of the Contractor**

- a The Employer will specify overall security requirements for the project and the Contractor shall perform to such requirements and be responsible for such action of his personnel in respect of such requirements.
- b The Contractor shall be responsible for the security of the Works and the Employer's Quarters at Site and shall provide and maintain continuously and adequate security force to fulfil these obligations. The duties of the Contractor's security force shall include, but not be limited to, maintenance of order on the Site, provision of all lighting, fencing, guards, flagmen, all other measures necessary for the protection of the Works within the Site, all material delivered to the Site, the public, and all persons employed in connection with the Works, continuously throughout working and non-working periods, including nights, Sundays and holiday, for the duration of the Contract.

#### **1.16.8.2 Payment**

- a Separate payment will not be made for the provisions of security services and all costs shall be deemed to be included in the various rates and lump sum prices entered in the priced Bill of Quantities.

### **1.17 SURVEY AND MEASUREMENT OF THE WORKS**

#### **1.17.1 Bench Mark and Reference Point**

Bench mark and reference points have been established on the Site by the Employer as shown on the drawing or as advised by the Engineer. The Contractor shall use the co-ordinates and elevations of such bench marks and reference points in setting out the Work. Any bench marks or reference points damaged as the result of action by the Contractor shall be replaced by the Contractor at his own expense.

The Contractor may establish temporary bench marks and reference points for his own convenience but each point shall be of a design and at a location approved by the Engineer. Each point shall be accurately related to the points established by the Employer.

#### **1.17.2 Responsibility for Setting Out**

The Contractor shall be solely responsible for the correct setting out of the Works and shall employ experienced and qualified surveyors approved by the Engineer.

The Contractor shall furnish all materials, labour and equipment including stakes, templates, patterns, platforms and special labour that may be required by the Contractor in setting out any part of the Works. The Contractor shall use survey equipment of the type and accuracy to permit correct setting out and control of the Works.

The Contractor's obligations for surveying shall include the surveying of the original surface levels where works are to be performed. The method used and spacing of cross-sections shall be agreed by the Engineer prior to commencement of the survey.

Before surveying the original surface levels to be plotted in the working drawings as described in 1.4.4, the Contractor shall give the Engineer at least 7 days notice before commencing such survey in order that the Engineer or his representative can witness and verify levels so determined. The original surface level determined shall be subject to the Engineer's approval.

The Contractor shall co-operate with the Engineer in checking the setting-out and in performing the measurement surveys for record and payment purposes. The Contractor shall render all necessary assistance to the Engineer and shall provide, as required for the use of the Engineer, sufficient quantities of pegs, poles, straight edges, stagings, mounds, templates, profiles, survey assistants, labourers and transport for checking the Contractor's setting-out and measurement of the Works.

#### **1.17.3 Survey Data and Calculations**

The Contractor shall submit all survey data, information, calculations, results and records to the Engineer as soon as they are available.

#### **1.17.4 Specific Survey Requirements**

Further to the general requirements for survey and setting out as specified above the Contractor shall carry out the following surveying work and produce the Drawings as detailed below:

A plan of the Site covering all of the area in which the dikes, floodwalls, revetments or embankments are to be constructed, to a scale of 1:500

Cross-sections at intervals of 50 m covering all of the areas in which the dikes, floodwalls, revetments or embankments are to be constructed.

Cross-sections of the river at intervals of not greater than 100 m for the entire length of the Site.

Plans to a scale of 1:500 covering areas for temporary facilities, borrow pits and spoil banks.

#### **1.17.5 Payment**

Payment for surveying shall be made at the lump sum entered in the priced Bill of Quantities. Monthly progress payments shall be made in proportion to the progress of the Work.

### **1.18 RELOCATION OF EXISTING FACILITIES**

#### **1.18.1 Scope**

Where existing facilities such as electric power lines, or other public facilities are required to be relocated, the Engineer shall direct the Contractor regarding how such facilities shall be relocated.

#### **1.18.2 Payment**

Payment for Relocation of Existing Facilities shall be made from the provisional sums provided in the Bill of Quantities

### **1.19 SOIL INVESTIGATION**

#### **1.19.1 General**

This work includes the conducting of soil investigation in locations and to the depths and extents directed by the Engineer as more specifically described hereunder.

#### **1.19.2 Auger Boring**

The scope of work shall include the following:

- Execute auger boring to depths and in locations determined by the Engineer.
- Collect soil samples
- Conduct mechanical tests on samples
- Interpret the characteristics of samples from visual inspection and from the results of mechanical testing.
- Prepare a report in a format acceptable to the Engineer of the results of the boring.

Boring, interpretation and reporting shall be performed by a specialist soil investigation subcontractor engaged by the Contractor and approved by the Engineer.

### **1.19.3 Rotary Boring**

The scope of work shall include the following:

- Execute rotary boring to depths and in locations determined by the Engineer.
- Collect core samples
- Conduct mechanical tests on samples
- Interpret the characteristics of samples from visual inspection and from the results of mechanical testing.
- Prepare a report in a format acceptable to the Engineer of the results of the boring.

Boring, interpretation and reporting shall be performed by a specialist soil investigation subcontractor engaged by the Contractor and approved by the Engineer.

### **1.19.4 Exploratory Excavation**

The scope of work shall include the following:

- Excavate test pits at locations and to depths and extents directed by the Engineer.
- Following investigation of the pits by the Engineer, backfill the pits to the same degree of compaction as the adjacent soil.

This work is not required to be performed by a specialist subcontractor nor is interpretation or reporting by the Contractor required.

### **1.19.5 Payment**

#### **1.19.5.1 Auger Boring**

Measurement shall be made of the sum of the depths of auger boring performed and documented in a report to the approval of the Engineer.

Payment for Auger Boring shall be made at the rate per metre entered in the priced Bill of Quantities which shall include allowance for the complete cost of performing the boring, sampling, laboratory testing, interpreting and preparing reports and all labour, equipment and incidentals necessary to do the work

#### **1.19.5.2 Rotary Boring.**

Measurement shall be made of the sum of the depths of rotary boring performed and documented in a report to the approval of the Engineer.

Payment for Rotary Boring shall be made at the rate per metre entered in the priced Bill of Quantities which shall include allowance for the complete cost of performing the boring, sampling, laboratory testing, interpreting and preparing reports and all labour, equipment and incidentals necessary to do the work.

#### **1.19.5.3 Exploratory Excavation**

Measurement will be made of the volume of exploratory excavation made by the in the locations and to the dimensions directed by the Engineer. Measurement shall not be made of over-excavation.

Payment shall be made at the rate per cubic metre entered in the priced Bill of Quantities which shall include allowance for the cost of all labour, equipment and materials necessary to complete the exploratory excavation and, where directed, to backfill such exploratory excavations to the satisfaction of the Engineer.

## **1.20 OTHER ITEMS**

### **1.20.1 Securities and Insurance**

#### **1.20.1.1 Performance Security and Advance Payment Security**

The Contractor shall furnish an Advance Payment Security and a Performance Security and in accordance with Clause 52 of the Conditions of Contract to ensure the refund of the Advance Payment and for the due performance of the Contract respectively.

#### **1.20.1.2 Insurance**

The Contractor shall effect certain insurances relating to the Contract in accordance with Clause 13 of the Conditions of Contract. In handling compensation to workmen under the above Clauses, the Contractor shall arrange that any compensation amount determined shall be paid without delay by the Contractor to the workmen entitled to such compensation irrespective of the time for payment of insured amount from the Insurance company to the Contractor.

#### **1.20.1.3 Payment**

Separate payment will not be made for complying with this Clause and the Conditions of Contract and all costs shall be deemed to be included in the rates and lump sums for the various items entered in the priced Bill of Quantities.

### **1.20.2 Audits by the Employer**

#### **1.20.2.1 General**

The Employer shall be entitled at his discretion to conduct audits as necessary for his own investigation in connection with :

- a Cost incurred in relation to any compensation event as provided in clause 44 of the Conditions of Contract;
- b Cost incurred in the event of termination of the contract as provided in Clause 59 or 63 of the Conditions of Contract; and
- c Any other costs that the Contractor may claim to the Employer, which are not specifically covered by the terms of the Contract.

#### **1.20.2.2 Records**

The Contractor is obligated to keep accurate and up-to-date accounts and records concerning the above items.

#### **1.20.2.3 Payment**

Separate payment will not be made for complying with the requirements of this Clause and all costs shall be deemed to be included in the rates and lump sums entered in the priced Bill of Quantities.

### **1.20.3 Liquidated Damages**

#### **1.20.3.1 Amount of Liquidated Damages**

If the Contractor should fail to complete the Works by the Intended Completion Date as defined in Clause 1.1 of the Conditions of Contract, the Contractor shall pay to the Employer liquidated damages pursuant to clause 49 of the Conditions of Contract.

#### **1.20.3.2 Maximum Damages**

The maximum amount of liquidated damages payable or allowable to the Employer will be limited to the percentage of the final Contract Price stated in the Contract Data.

#### **1.20.3.3 Other Rights of the Employer**

Nothing contained in this Clause shall prejudice or affect any other rights of the Employer under the Contract.

### **1.20.4 Monthly Statement**

#### **1.20.4.1 General**

The Contractor shall submit a monthly statement in accordance with the requirements of Clause 42 of the Conditions of Contract. The monthly statement shall be accompanied by copies of all survey notes, records of measurements and calculation which the Engineer has directed to be prepared by the Contractor in support of the amounts claimed for the work executed.

#### **1.20.4.2 Payment**

All costs associated with the submission of the monthly statement shall be deemed to be included in the rates and lump sum prices entered in the priced Bill of Quantities.

### **1.20.5 Hours and Days of Working**

Before commencement of work on the Contract, the Contractor shall notify the Engineer, in writing, of the hours and of the number of shifts that he proposes to work and shall give at least 48 hours notice to the Engineer of any changes to such hours of working and/or number of shifts that may be necessary during the currency of the Contract.

### **1.20.6 Prevention of Water Pollution**

#### **1.20.6.1 Scope**

The Contractor's construction activities shall be performed by methods that prevent entrance or accidental spillage of solid matter, contaminants, debris and other objectionable pollutants and wastes into streams, flowing or dry water courses and underground water sources. Such pollutants and wastes include but not restricted to refuse garbage, cement, concrete, sewage effluent, industrial waste, oil and other petroleum products. The Contractor shall submit his plan showing the location and design of the water pollution prevention systems and facilities to the Engineer for approval.

### 1.20.6.2 Payment

Separate payment will not be made for complying with the provisions of this Clause, and the costs shall be deemed to be included in the rates and lump sum prices entered in the priced Bill of Quantities.

## 1.21 MEASUREMENT AND PAYMENT (GENERAL)

The method of measurement shall be in accordance with the methods and procedures stipulated in the particular clauses and as set forth herein.

The various unit rates and lump sums for each work item entered in the priced Bill of Quantities shall be deemed to have included full compensation for supplying all materials, labour, equipment consisting of owning, operation and repair costs, and other expenses necessary to complete the work in accordance with the Drawings, the Specifications, the instructions of the Engineer and compliance with all other obligations, including rectification of defects, as required under the Contract.

### 1.21.1 Tolerance for Measurement

This clause explains the tolerance for measuring the dimensions of the work and the method of calculation of the quantity of the work completed following categories :

#### (1) Category - 1 (linear metres, m)

The work item shall be measured to the second decimal place of a metre and be approved by the Engineer at every work stage on an inspection sheet.

The amount of payment will be determined by multiplying the measured length by the unit rate and then rounding the result to the nearest integer of appropriate currency.

The following items are to be included in this category :

- Auger Boring
- Rotary Boring
- Steel Fence
- Reinforced Concrete Pile
- Test Piling
- Driving Reinforced Piles
- Reinforced Concrete Sheet Piles
- Concrete Pipes
- Waterstop
- Log Pile

#### (2) Category - 2 (square metres, m<sup>2</sup>)

The work item shall be measured to the second decimal place of a square metre by multiplying the two dimensions, measured to two decimal places, and rounded off, and approved by the Engineer at every work stage on an inspection sheet.

The amount of payment will be determined by multiplying the measured area by the unit rate and then rounding the result to the nearest integer of appropriate currency.

The following items are to be included in this category :

- Clearing and Grubbing
- Joint Filler
- Cement Mortar Pointing
- Filter Cloth



- Sodding
- Palm Fibre Filter under Gabion
- Chipping of Existing Concrete
- Gravel Pavement 200 mm thick
- Penetration Macadam 200 mm thick

**(3) Category - 3 (cubic metres, m<sup>3</sup>)**

The work item shall be measured to the second decimal place of a cubic metre by multiplying the three dimensions, measured to two decimal places of a metre, and rounded off and approved by the Engineer at every work stage on an inspection Sheet.

The amount of payment will be determined by multiplying the measured volume by the unit rate and then rounding the result to the nearest integer of appropriate currency.

The following items are to be included in this category :

- Stripping of Topsoil
- Excavation (all classes and materials)
- Embankment
- Fill (all classes)
- Soil Filling
- Backfill (all classes)
- Gravel Bedding
- Rubble Stone Bedding
- Concrete (all classes)
- Wet Stone Masonry
- Stone Facing
- Rip Rap
- Gabions (all types)
- Demolition of Existing Revetment
- Filling
- Embankment
- Gabions

**(4) Category - 4 (Number (No.))**

The work item shall be measured to the exact number installed and approved by the Engineer at every work stage on an Inspection Sheet.

The amount of payment will be determined by multiplying the number by the unit rate and then rounding the result to the nearest integer of appropriate currency.

The following items are to be included in this category :

- Maintenance marker posts
- Drilling, Anchoring Steel Bars in Existing Flow Wall and Filling The Hole with non-shrinkage mortar
- Steel Flap Gate
- Stop Log
- Weep Hole
- Tree Planting
- Relocation of Tree

**(5) Category - 5 (kilogram)**

The work item shall be measured to the second decimal place and multiplied by the approved mass per unit at every work stage on an inspection sheet.

The amount of payment will be determined by multiplying the measured quantity by the unit rate and then rounding the result to the nearest integer of appropriate currency.

The following items are to be included in this category :

- Deformed Reinforcing Bars (for all applications)
- Handrail
- Steel Maintenance Steps
- Steel Handrail
- Steel Ladder
- Anchor Bars and Metal Guide Frame
- Steel Tie Rod, Steel Channel and Steel Plate to PC Sheet Pile

**(6) Category - 6 (Item)**

The method of measurement and payment shall be as set out in this section for each particular item. The following items are in this category :

- Mobilisation and Demobilisation
- Temporary Construction Road and Bridge
- Contractor's Site Office and Facilities
- Engineer's Site Office
- Drawings
- Surveying
- Coffering and Dewatering
- Gauging House
- Water Level Gauge
- Slide Gate
- Hoist
- Setting Bench Mark

**DIVISION B**  
**TECHNICAL SPECIFICATIONS, CIVIL WORKS**

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## SECTION TS 1. PREPARATORY WORKS

### 1.1 GENERAL

The works described under this clause shall include coffering and dewatering, clearing and grubbing, demolition works including the breaking up of existing structures, breaking up and removal of pavements and the cleaning up and disposal of demolished structures, pavements, debris and other objectionable matter as directed by the Engineer.

### 1.2 COFFERING AND DEWATERING

#### 1.2.1 General

The Contractor shall provide coffering and dewatering of works to be constructed in the river channel in accordance with his general obligations for diversion and care of water as described in clause 1.13 of the General Specification.

The work shall include the provision of all labour, material and equipment for the construction of coffer dams and other equipment required for dewatering the areas to be protected from water during the course of their construction.

The Contractor shall submit to the Engineer for his approval three copies of Drawings, showing his proposed method of cofferdam construction and of the type and number of units of dewatering equipment to be used. Construction shall not commence until the Engineer's approval has been given. Such approval shall not relieve the Contractor of his obligations for the adequacy of the cofferdam or of the sufficiency of the dewatering equipment.

#### 1.2.2 Method of Construction

Cofferdams shall be constructed in accordance with the design approved by the Engineer. Where sheeting is used it shall be carried well below the bottom of footings and shall be well braced and shall be as water-tight as practicable. The clearance between the inner face of coffer dams and the outer face of permanent works to be constructed shall be 600 mm in order to allow sufficient space for formwork, access and pumping equipment.

Cofferdams which move out of position due to any cause during the course of the work so as to endanger the permanent works or to reduce the clearance specified above shall be corrected at the sole expense of the Contractor.

Cofferdams shall be constructed so as to protect green concrete against damage from the effects of rising river level and to prevent damage to foundations of the permanent works caused by erosion. Struts or braces shall not be shall not extend to any part of the permanent works without the approval of the Engineer. Following completion of the portions of the permanent works under the protection of the coffering works, the cofferdams shall be removed in such a manner as not to disturb or damage the finished work.

The removal of cofferdams shall include the excavation and disposal of all temporary earth fill used as part of cofferdams and the complete reinstatement of the area to the approval of the Engineer.

#### 1.2.3 Dewatering

Pumping for the inside of any coffered area shall be done in such a manner as to preclude the possibility of damage to the permanent works and, in particular, the carrying away of concrete materials.

No pumping shall be carried out during the placing of concrete or for a period of 24 hours thereafter unless it is done from a suitable sump, separated from the concrete work by a water-tight wall.

### **1.3 CLEARING AND GRUBBING**

#### **1.3.1 Scope**

Clearing and grubbing shall consist of the removal and disposal of all stumps, veins, brush, grass, roots, vegetation, fences, rocks, masonry, trash and debris within the area to be occupied by the permanent works.

The extent of the area for clearing and grubbing shall be agreed by the Engineer prior to commencement by the Contractor.

Where directed by the Engineer, the holes resulting from grubbing operations shall be filled with approved materials which shall be placed and compacted to the same density as the adjoining soil.

All non-combustible materials shall be transported to a dumping site approved by the Engineer then spread and buried to the approval of the Engineer.

Any combustible material shall be removed from the site and burnt. Burning on site shall only be permitted with the approval of the Engineer.

All salvageable materials shall remain the property of the Employer and shall be transported and stacked at locations as directed by the Engineer.

### **1.4 DEMOLITION WORKS**

#### **1.4.1 Scope**

The work consists of the complete demolition and removal of existing concrete and masonry structures which are required to be removed for the purposes of constructing the permanent works and shaping the improved waterway channel to the required profile.

#### **1.4.2 Method of Execution**

Structures to be demolished shall be broken into units of sufficiently small size so as to be safely handled and removed from the site.

All non-combustible materials shall be transported to a dumping site approved by the Engineer then spread and buried to the approval of the Engineer.

Any combustible material shall be removed from the site and burnt. Burning on site shall only be permitted with the approval of the Engineer.

All salvageable materials shall remain the property of the Employer and shall be transported and stacked at locations as directed by the Engineer.

### **1.5 MEASUREMENT AND PAYMENT**

#### **1.5.1 Coffering and Dewatering**

Payment shall be made for the complete system of cofferdam and for the dewatering of the its enclosed area and the subsequent removal of the cofferdam and all associated equipment to the approval of the Engineer.

Payment of the lump sum shall be made as follows:

- 40 % on completion of the cofferdam
- 30 % on completion of all dewatering following completion of the permanent works protected by the cofferdam
- 30 % on the complete removal of the cofferdam to the approval of the Engineer

Items to be paid under this clause are as follows:

Pay Item No.	Description	Unit of Measurement
B.1.1	Coffering and Dewatering	LS
C.1.1	Coffering and Dewatering	LS
D.1.1	Coffering and Dewatering	LS
E.1.1	Coffering and Dewatering	LS
F.1.1	Coffering and Dewatering	LS
G.1.1	Coffering and Dewatering	LS
H.1.1	Coffering and Dewatering	LS
I.1.1	Coffering and Dewatering	LS

### 1.5.2 Clearing and Grubbing

Measurement for payment will be made in square metres (m<sup>2</sup>) of the area actually cleared and grubbed and approved by the Engineer.

Payment will be made at the rate entered in the Bill of quantities and include the entire cost of completing the work including materials, labour, equipment, transportation and disposal of non-combustible and combustible material and all associated costs. Clearing in excess of the approved area shall not be paid for.

Items to be paid under this clause are as follows:

Pay Item No.	Description	Unit of Measurement
B.1.2	Clearing and Grubbing	m <sup>2</sup>
C.1.2	Clearing and Grubbing	m <sup>2</sup>
D.1.2	Clearing and Grubbing	m <sup>2</sup>
E.1.2	Clearing and Grubbing	m <sup>2</sup>
F.1.2	Clearing and Grubbing	m <sup>2</sup>
G.1.2	Clearing and Grubbing	m <sup>2</sup>
H.1.2	Clearing and Grubbing	m <sup>2</sup>
I.1.2	Clearing and Grubbing	m <sup>2</sup>

### 1.5.3 Demolition Works

For Pay Item Number B1.3 measurement is not required.

For Pay Item Numbers B.1.4, C.1.3, D.1.3, F.1.3, and G.1.3 measurement shall be made of volume of existing structure demolished and removed in accordance with the specification and to the approval of the Engineer.



Payment for Pay Item B.1.3 shall be made in the amount of the lump sum entered in the Bill of Quantities which shall include the entire cost of completing the work including materials, labour, equipment, transportation and disposal of non-combustible and combustible material and all associated costs.

Payment for items B1.4, D.1.3, F.1.3 and G.1.3 shall be made at the rates for the respective items entered in the Bill of Quantities which shall include the entire cost of completing the work including materials, labour, equipment, transportation and disposal of non-combustible and combustible material and all associated costs.

Items to be paid under this clause are as follows:

Pay Item No.	Description	Unit of Measurement
B.1.3	Demolition of Existing Concrete Sheet Pile Wall Type Revetment	L.S.
B.1.4	Demolition of Existing Concrete/Masonry Structures in River Channel	m <sup>3</sup>
C.1.3	Demolition of Existing Buttress Wall (Wet Stone Masonry)	m <sup>3</sup>
D.1.3	Demolition of Existing Wet Masonry Wall	m <sup>3</sup>
F.1.3	Demolition and Removal of Existing Concrete and Masonry Structures	m <sup>3</sup>
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## SECTION TS 2. EARTHWORKS

### 2.1 GENERAL

#### 2.1.1 Character of Strata

The Contractor shall acquaint himself with all available data regarding earthworks and the character of strata and materials to be excavated and used as filling. He shall satisfy himself as to :

- the general circumstances at the Site of the Works
- any obstructions thereon
- the form of riverbeds and banks
- the flow of water in the rivers
- the surface of the ground
- possible subsidence of soft ground
- poor materials
- possibility of floods
- his obligations for diversion and care of water under clause GS 1.13
- slipping clay
- running sand
- gravel and boulders
- springs, subsoil and river water, loose or solid rock and stones
- trees, brushwood, timber and debris
- obstructions of any kind and material of whatever nature.

Rates entered in the Bill of Quantities shall reflect the Contractor's own assessment of risk and influence that these matters may have on his costs and no subsequent adjustments shall be made to rates for any reason.

#### 2.1.2 Earthworks to Dimensions, Lines and Levels

All earthworks shall be carried out to the dimensions, lines and levels as shown on the Drawings, or to such other dimensions, lines and levels as may be ordered by the Engineer. Dimensions and lines, which are based on or related to ground levels, shall be referred to the Engineer before commencing earthworks at any location.

For the purpose of the Specification the term original surface level shall refer to the ground or the river bed surface before the start of earthworks in accordance with the provisions provided for in clause 1.17 in the General Specification.

The Contractor shall be completely and solely responsible for setting out the works and establishing an adequate number of bench marks and reference points. Surveys to be performed by the Contractor are described in clause 1.17 of the General Specification.

### **2.1.3 Method of Excavation**

The Contractor shall carry out excavation in whatever material may be encountered and by any method or combination of methods he considers most suitable subject to any restrictions herein.

The Contractor shall give due consideration to the matters in clause 1.1.1 (Character of Strata), clause 1.13 (Diversion and Care of Water) of the General Specification, location and access to soil disposal areas, fill and stock pile areas and all other relevant factors.

### **2.1.4 Unsuitable Materials**

Excavated materials which, in the opinion of the Engineer, do not meet required Specifications for fill, embankment or backfill shall not be used for such purpose and shall be transported to spoil dumps or stockpiles.

### **2.1.5 Transportation of Excavated Material**

The transportation of excavated material to fill embankment, backfilling or stockpile site or disposal of excess or unsuitable materials shall be carried out in accordance with the approved schedule of earthworks operations. The Contractor shall transport material by the most appropriate route between excavation and placement or disposal areas using, as far as practical, access and haul roads within the site in order to minimise disruption to the population in the vicinity of the Works. Protective measures shall be made and maintained throughout for the safety of operations both on-site and off-site.

When hauling is done off-site loads shall be trimmed to prevent spillage. Wet materials to be hauled shall be dried sufficiently prior to loading to prevent spillage by leaking. Any damage or unsightly appearance on the surface of any road caused by the Contractor's hauling operation shall be reinstated by the Contractor at his own expense.

### **2.1.6 Disposal of Excavated Materials**

Excavated material which, in the opinion of the Engineer, is suitable for use in filling, embankment or backfill may be transported directly to its final position, stock piled, or placed as otherwise Approved by the Engineer.

Unsuitable soil or surplus excavated materials shall be disposed of in approved disposal areas as directed by the Engineer. The Contractor shall trim and grade spoil tips to profiles, heights and levels approved by the Engineer. He shall also maintain without interruption the flow of water courses affected by tips and comply with any other arrangement at the site existing between the Engineer and any other parties involved.

## **2.2 CLEARING AND GRUBBING**

### **2.2.1 Scope**

The work covered under this clause shall include the supply of all labour and materials and the Contractor's equipment for the performance of all works necessary for clearing the Site occupied by the Works.

Such clearing shall include cutting down and uprooting of trees, shrubs and bushes, grubbing and removal of roots and stumps, removal of vegetation, structures and other obstructions to the extent required by the Engineer.

All combustible materials from Site Clearing shall be burned, removed from the Site or otherwise disposed of all to the satisfaction of the Engineer. Such materials shall, when dry, be burned completely and reduced to ashes. The Contractor shall at all times take precautions to prevent the spread of fire. On-site burning of combustible material shall be subject to the prior approval of the Engineer.

Holes resulting from Site Clearing shall be filled with approved materials, and compacted in layers to the dry density of the surrounding soil.

The Contractor shall obtain the Engineer's written approval prior to commencement of any Site Clearing.

## **2.3 STRIPPING TOPSOIL**

### **2.3.1 Scope**

Stripping topsoil shall consist of the removal of all organic materials such as sod, topsoil and roots from areas where earth fill or embankment are to be constructed.

Stripping of topsoil shall be to the depth and area limits shown on the drawings or as directed by the Engineer. All topsoil stripped, except that as may be used or saved in accordance with the Engineer's order, shall be disposed of in the manner described for soil unfit for reuse in clause 2.1.6. The minimum depth of topsoil stripping shall be 250 mm unless otherwise specified on the Drawings or directed by the Engineer.

## **2.4 EXCAVATION**

### **2.4.1 Channel Excavation**

#### **2.4.1.1 General**

The work covered by this clause relates to the excavation of the improved waterway channels of the West Floodway and the Garang River.

For the purposes of this Contract the following arbitrary definitions shall apply:

#### Excavation Below Water Level

Excavation below water level shall mean channel excavation carried out below the low water levels shown on the cross-sections in the Bid Drawings.

#### Excavation Above Water Level

This sub-category shall mean channel excavation carried out above the upper surface of Excavation Below Water Level as defined above.

The Contractor shall carry out all channel excavation in whatever material may be encountered in accordance with these Specifications, the Drawings and any directions of the Engineer. The Contractor shall provide and operate all necessary excavating, lifting, hauling, transport and other equipment to deal with any type of material encountered. Excavation for the various works shall be carried out to such widths, lengths, depths and profiles as shown on the Drawings, or to such other dimensions as may be ordered by the Engineer in writing.

#### **2.4.1.2 Trimming Tolerances**

Excavated surfaces shall be trimmed to the lines and grades as shown in the Drawings or to other lines and grades as may be directed by the Engineer.

Cross- sections on completion of excavation in waterway channels shall conform to the following tolerances :

a) Over-excavation of the depth of the low water channel	500 mm
b) Under-excavation of the depth of the low water channel	Nil
c) Over-excavation of the width of the river channel	500 mm
d) Under-excavation of the width of the river channel	Nil
e) Deviation of the shoulders of low and high water channels towards the channel centerline	Nil
f) Deviation of the shoulders of low and high water channels away from channel centerline	500 mm
g) Over-excavation of bed of the high water channel	200 mm
h) Under-excavation of the bed of the high water channel	Nil

Note that the above tolerances shall not apply when channel dimensions are specified to structures such as revetments of floodwalls.

#### 2.4.1.3 Excavation Beyond True Line

The waterway channels shall be cut to the lines and level as shown in the Drawings and to the tolerances stated in clause 2.4.1.2.

For all parts of the waterway channels, with the exception of the low water channel, any over-excavation, for whatever reason and cause, unless as a result of the Engineer's direction, the Contractor shall, at his own expense, make good the excavation to the required line and level with approved material and in such a manner as the Engineer may approve. Where over-excavation is not detrimental to river flow and not unsightly, the Engineer may, at his sole discretion, waive the requirement for making good such over-excavation.

#### 2.4.1.4 Inspection and Survey

The Contractor shall measure work in progress by means of appropriate survey methods and in the presence of the Engineer or his representative.

The Engineer will carry out inspection of work progress and measurement of work completed assisted by the Contractor who shall provide boats, boatmen, labourers, materials and all other items necessary for the Engineer's use.

### 2.4.2 Common Excavation and Structural Excavation

#### 2.4.2.1 General

This clause 2.4.2 refers to all common excavation and structural excavation to be carried out under the Contract and shall be read in conjunction with clause 2.1.

The Contractor shall carry out all common and structural excavation in whatever material may be encountered in accordance with these Specifications, Drawings and any directions of the Engineer. The Contractor shall provide and operate all necessary excavating, lifting, hauling, transport and other equipment to deal with any type of material encountered. Excavation for the various works shall be carried out to such widths, lengths, depths and profiles as shown on the

Drawings, or to such other dimensions as may be ordered by the Engineer in writing.

Where necessary the sides of all excavations shall be properly shored up and supported with strutting and planking, and the sides shall be close sheeted where necessary to prevent the entry of running sand, mud and the like.

When any excavation has been completed and trimmed, the Engineer shall be informed so that he may make a formal inspection. No excavation shall be backfilled or covered with concrete until it has been inspected and the Contractor has been authorised to proceed.

#### 2.4.2.2 Excavation Beyond True Line

Where any over-excavation occurs for whatever reason or cause, unless as a result of the Engineer's direction, the Contractor shall, at his own expense, make good those excavations to the required line and level with :

- 1) approved material and in such manner as the Engineer may direct where the excavation is other than for concrete work; or
- 2) concrete of the same grade as that to be used in the true excavated shape, unless directed otherwise by the Engineer, where the excavation is for concrete work.

#### 2.4.2.3 Common Excavation

Common excavation shall mean any excavation works, other than that covered by Clause 2.4.1 (Channel Excavation), Clause 2.4.2.4 (Structural Excavation) or Clause 2.4.3 (Soft Rock Excavation).

#### 2.4.2.4 Structural Excavation

Except where otherwise shown on the Drawings or directed by the Engineer, Structural Excavation shall comprise excavation associated with the construction structures including, but not limited to, flood walls, protection works, revetments, gabions, retaining walls, ground sills, service stairs and any other works where the Engineer determines that Structural Excavation is appropriate.

Unless not shown on the Drawings or where otherwise directed by the Engineer the Contractor shall perform structural excavation to one of the two relevant typical profiles described below.

- 1) Where average depth of excavation, as determined by the Engineer, is less than or equal to 1.2 m then the side slope shall be at 1.0 unit vertical to 1.0 unit horizontal with a horizontal clearance at the underside of the proposed footing to the start of the excavation slope of 250 mm.
- 2) Where average depth of excavation, as determined by the Engineer, is greater than 1.2 m, then the slope shall be at 1.0 unit vertical to 0.5 unit horizontal with a horizontal clearance at the underside of the proposed footing to the start of the excavation slope of 1000 mm.

The base and side slopes of excavation against which concrete is to be placed shall be finished accurately to the dimensions shown on the Drawings or prescribed by the Engineer and the surface so prepared shall be thoroughly compacted with suitable equipment to obtain a satisfactory foundation. If at any point the natural foundation material is disturbed during the excavation process or otherwise, it shall be compacted in place to obtain a satisfactory foundation, or it shall be removed and replaced with approved compacted materials or concrete, all the Contractor's expense.



### **2.4.3 Soft Rock Excavation**

Soft rock excavation shall mean the excavation of soft rock from areas to be excavated to the lines, levels and profiles as shown on the drawings.

This clause shall be read in conjunction with clauses 2.1.

When the Contractor considers that soft rock has been encountered, Contractor shall notify the Engineer who shall confirm or otherwise the presence of soft rock for the purposes of payment. The interface between soft rock and other materials to be excavated shall be determined by survey in the presence of the Engineer or his representative.

For the purposes of this Contract, soft rock shall be defined as rock which is capable of being broken and excavated by excavating equipment or rippers attached to dozers without requiring the use of explosives.

## **2.5 FILL**

### **2.5.1 General**

The work described in this clause shall consist of the furnishing of necessary materials and selecting, stockpiling and blending if required, transporting, placing, spreading, adjustment of moisture content, compaction, shaping and doing incidental items of work to construct the finished fill to the lines, grades and profiles as shown on the drawings or as directed by the Engineer.

The Contractor shall make due allowance for consolidation and settlement whether compaction is specified or not, such that the levels, widths and dimensions of the finished surfaces at the end of the Defects Liability Period shall not be less than the levels and dimension shown on the Drawings.

All filling and embankments shall be constructed to the lines and levels shown on the Drawings or established by the Engineer.

Accumulation of material at the base of embankment slopes will not be permitted.

### **2.5.2 Materials**

Materials to be used for the various types of fills shall conform to the requirements specified herein or as approved by the Engineer.

#### Earth Fill for Embankment, Earth Fill, Soil Filling and Backfill with Selected Soil

Material to be used shall be extracted and selected from excavated material including that from common excavation, structural excavation or channel excavation and shall not contain roots, turf or clod exceeding 75 mm in size or organic matter of any kind and shall be approved by the Engineer.

Generally material shall not be used, unless permitted by the Engineer, where:

- 1) its 60% particle size is less than four times its 10% particle size.
- 2) it contains less than 8% passing 0.075 mm test sieve.

#### Soil Filling

Material to be used shall be extracted and selected from excavated material including that from common excavation, structural excavation or channel excavation and shall not contain roots, turf or clod exceeding 75 mm in size and shall be approved by the Engineer.

#### Gravel

Gravel for use in gravel bedding or gravel backfill shall consist of hard durable stone which will not break down or deteriorate in service and shall be clean and free from clay or other deleterious materials. Unless otherwise specified or directed, gravel shall be natural gravel or crushed stone with grading, by weight, determined in accordance with AASHTO test methods, conforming to the grading shown in the following table:

Sieve Size	Percentage Passing
2 inch	100
1½ inch	95-100
¾ inch	50-100
½ inch	-
⅜ inch	15-55
No 4	0-25
No 8	0-5
No 200	0-3

The Contractor shall submit to the Engineer for approval, samples and grading analyses of potential materials for use as gravel.

#### Rubble Stone

Rubble stone to be used for rubble stone bedding or rubble stone filling shall be clean and free from other deleterious materials. Unless otherwise specified or directed rubble stone shall be hard, natural stone or crushed stone with particle size between 50 mm and 150 mm or as directed by the Engineer.

### **2.5.3 Placing, Compaction and Moisture Content of Filling**

This clause relates to the earth fill used in earth fill, backfill with selected soil and embankment as shown on the drawings.

Prior to commencement of filling, the Contractor shall carry out, under direct supervision and to the satisfaction of the Engineer, a series of field tests to determine optimum conditions and minimum number of passes of each type of equipment required to achieve the specified compaction for each type of fill material.

Fill material shall not be placed when, in the opinion of the Engineer, satisfactory results cannot be achieved due to heavy rain or other adverse conditions.

Fill shall be spread and compacted in approximately horizontal layers of uniform moisture content and uniform compacted thickness not exceeding 300 mm (or to lesser thickness as specified elsewhere). Filling, operations shall be such as to ensure that materials will be blended sufficiently to achieve the highest practicable dry density, impermeability and stability. Where the surface of any layer of filling is too dry or too smooth to bond properly with the next layer of material, it shall be moistened and/or scarified in an approved manner to provide a satisfactory bonding surface before the next layer is placed.

The moisture content of filling shall be carefully controlled, either by natural drying or wetting with a fine spray, to achieve optimum values. Fill material shall be compacted to a density of not less than 90% maximum standard dry density determined in accordance with AASHTO T 99. For portions of embankment upon which road pavements are to be constructed the upper 300 mm of fill material directly below the road pavement shall be compacted at optimum moisture content to a compaction of 90% maximum standard dry density in accordance with AASHTO T 99 for the full width of the roadway. Where practical, as determined by the Engineer, moistening of the material shall be performed at the site of stockpiles but such moistening shall be supplemented by fine spraying at

the time of compaction, if necessary. Where moisture content is beyond the optimum range, the operation shall not proceed except with the specific approval of the Engineer, until the material has been conditioned by wetting or drying to achieve a moisture content in the required range.

All compaction equipment shall be approved by the Engineer in writing before commencement of any filling operations.

At the end of each day, or whenever operations are suspended for any reason, the surface shall be rolled smooth and slightly crowned to shed water.

#### **2.5.4 Preparation of Surface under Embankment**

Filling shall not be placed on any portion of embankment foundation until such foundation has been cleared, stripped of topsoil, suitably prepared and has been Approved by the Engineer. Tests pits, trenches and cavities resulting from the removal of unsound foundation materials or for inspection of sub-surface conditions shall be filled with selected materials.

Foundation material which does not have a density in the undisturbed condition as specified for the fill material to be placed upon it shall be moistened and compacted to specified dry density or shall be removed, filled and compacted or shall be treated in a manner as directed by the Engineer.

#### **2.5.5 Filling Adjacent to Structures**

Filling adjacent to structures shall be placed and compacted to avoid damage to such structures. Compaction adjacent to structures shall be carried out by hand or with suitable hand-operated equipment in horizontal layers not exceeding 150 mm thickness after compaction.

Unless otherwise specified or permitted by the Engineer, filling shall not be placed and compacted adjacent to concrete until at least fourteen (14) days after the placing of the concrete.

#### **2.5.6 Embankment Construction**

Filling for embankment construction shall mean completion of all filling constructed in accordance with the requirements of clause 2.5.3 and to the lines, levels and profiles shown on the Drawings or as directed by the Engineer and shall include the following :

- construction of embankments for earth dikes
- construction of embankments associated with floodwall construction or raising
- construction of any other embankments shown on the drawings or as directed by the Engineer

#### **2.5.7 Trial Embankment**

Before full-scale filling is started, the Contractor shall demonstrate to the Engineer, using a trial embankment, the construction equipment to be used and its capability for spreading and compacting at least three contiguous layers of filling in which tests of standard and field compaction shall be conducted. Where different kinds of material are encountered during the course of subsequent work then further trials shall be conducted as directed by the Engineer.

The Contractor shall be permitted to build and incorporate trial embankments on the alignment and in the lower layers of any final embankments provided that all specification requirements are satisfied. Where any trial embankments do not

meet minimum specification requirements they shall continue to be completely removed and reconstructed until minimum specification requirements are achieved.

The minimum length of trial embankments shall be 300 m and their width shall be the full width of the particular embankment at the selected locations. Trial embankments shall be allowed to be incorporated in final embankments only after written permission of the Engineer.

### **2.5.8 Soil Tests**

Tests on materials for use as filling shall be performed by the Contractor and shall enable determination of soil characteristics, suitability, dry density/moisture content relationships and the like. A formal report of all tests shall be prepared by the Contractor and Approved by the Engineer. Tests shall be performed by the Contractor prior to commencement of earthworks, and every time soil characteristics change. Tests shall include but not be limited to the following :

- a) Compaction (AASHTO T 99) (Dry Density)
- b) Particle size distribution
- c) Specific gravity
- d) Moisture content
- e) Plastic limit
- f) Direct shear

Test results shall be submitted to the Engineer for approval.

Field moisture content tests of compacted filling shall be made on each layer and at a frequency of one test for every 200 m<sup>2</sup>.

The Contractor shall prepare a soil test programme in conjunction with his earthworks operation schedule and submit it to the Engineer for approval.

For gravel and rubble stone, only particle size distribution tests are required.

### **2.5.9 Backfilling with Selected Soil**

Backfill comprising approved materials complying with the specification for filling provided in clause 2.5.2, shall be placed and compacted adjacent structures as shown on the Drawings or as directed by the Engineer.

Prior to commencement of backfilling adjacent to structures, the area shall be cleared of all formwork and other temporary works. Compaction shall be carried out by hand or with suitable hand operated equipment so as to achieve specified compaction without damage to structures. Backfilling material shall be wetted or allowed to dry in order achieve optimum moisture content for compaction.

Backfilling shall be placed and compacted in continuous horizontal layers of not more than 150 mm compacted thickness. Unless otherwise specified, backfilling shall be compacted to 90% of the maximum dry density as determined in the laboratory compaction test referred to in clause 2.5.8.

Unless otherwise specified or permitted by the Engineer, backfilling shall not be placed and compacted adjacent to concrete until at least fourteen (14) days after the placing of concrete.

Compaction of backfilling material placed above buried concrete, however, shall not be permitted to be carried out with vibrating equipment except with the prior approval of the Engineer.

### **2.5.10 Soil Filling**

Soil filling for the purposes of this specification shall mean the placement of soil as specified in clause 2.5.2 around cylindrical gabions.

Soil filling shall be placed in layers not exceeding 150 mm thick and compacted with hand tampers or by mechanical equipment until the soil filling ceases to penetrate the voids in the adjacent cylindrical gabions and is firm and stable.

### **2.5.11 Gravel Backfill**

Gravel backfill shall be placed adjacent to structures or footings in the special locations shown on the Drawings or as directed by the Engineer. Selected soil shall comprise imported or otherwise approved material as specified in clause 2.5.2.

Prior to commencement of backfilling adjacent to structures, the area shall be cleaned of all formwork and other temporary works. Compaction shall be carried out by hand or with suitable hand operated equipment so as to achieve a dense stable matrix without damage to structures. Backfilling material shall be wetted or allowed to dry in order to achieve optimum moisture content for compaction.

Gravel Backfill shall be placed and compacted in continuous horizontal layers of not more than 200 mm compacted thickness. Each layer shall be compacted until it is stable and dense and shows no movement under compaction.

Unless otherwise specified or permitted by the Engineer, backfilling shall not be placed and compacted adjacent to concrete until at least fourteen (14) days after the placing of concrete.

Compaction of backfilling material placed above buried concrete, however, shall not be permitted to be carried out with vibrating equipment except with the prior approval of the Engineer.

### **2.5.12 Gravel Bedding and Filling**

Gravel bedding and gravel filling shall be placed in the locations shown on the Drawings or as directed by the Engineer. Gravel material shall comprise imported or otherwise approved material as specified in clause 2.5.2.

Gravel bedding shall be placed and compacted using mechanical compaction equipment in continuous horizontal layers of the compacted thickness specified on the drawings. Each layer shall be compacted until it is stable and dense and shows no movement under compaction.

### **2.5.13 Rubble Stone Bedding and Filling**

Rubble stone, as specified in clause 2.5.2 shall be placed in the locations and to the lines, levels and profiles as shown on the drawings. Stones shall be placed by machine or hand placed with smaller stones placed in the spaces between the larger stones so as to form a stable matrix.

## **2.6 SODDING**

### **2.6.1 General**

This work shall consist of furnishing, placing and compacting topsoil and laying grass sods in accordance with the Specification where shown on the Drawings or ordered by the Engineer.