Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT

IRRIGATION SCHEMES DEVELOPMENT PROJECT

CONSTRUCTION OF NAMALU IRRIGATION INFRASTRUCTURE AND FACILITIES IN NAKAPIRIPIRIT DISTRICT.

MWE/WRKS/22-23/00011

Volume 3 – Technical Specifications

December 2024

1 PREAMBLE TO THE TECHNICAL SPECIFICATIONS

1.1 GENERAL

1) The following Specifications are part of the requirements related to the Works which are to be provided according to the stipulations of the Contract. Hence, the instructions given herein form an integral part of, and are applicable to, all technical and Contract Documents issued for the Works. These Special Specifications shall amend or supplement the Standard Specifications. Where references appear in the text of these Special Specifications to specific clauses in the Standard Specifications, then both clauses must be read together. In the case of clauses where these Special Specifications are silent, the Standard Specifications remain fully applicable where relevant.

2) These Specifications shall be read in conjunction with the Conditions of Contract, the Drawings and the Bill of Quantities, and the Contractor shall comply with all provisions contained within the Contract Documents and Engineer's instructions.

3) It is the intent of these Specifications, together with other relevant documents issued as part of the Bid (or Contract Documents to follow later on), to provide the Contractor with complete and detailed information and subsequent instructions necessary to enable him to submit a well-planned Bid, to carry out the design, where and when required, and to execute properly the work prescribed.

4) It is the intent of these Specifications to establish acceptable standards of quality. Minor deviations in details due to manufacturer's standard shop process will be considered for acceptance provided that, in the opinion of the Engineer, the proposed substitutions are equal in quality to those specified. All deviations shall be called out in writing in the Bid and shall be specifically indicated on the shop drawings.

5) All work shall be executed according to the Detailed Design and/or Construction Drawings as approved by the Engineer and requirements released for construction, in a professional and diligent manner, and all supplies and work shall comply with the quality requirements defined in the relevant sections of these Specifications and other Contract Documents. The Contractor is deemed to have ascertained the nature and scope of the works and shall make all necessary efforts to comply with the intent of these Specifications to the satisfaction of the Engineer.

6) Any approval given by the Engineer of the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for the proper and safe execution of any work covered by these Specifications, or his liability for injuries to or death of persons, or any other obligation under this contract.

7) In the Bill of Quantities reference may have been made to certain Section(s) or Clause(s) in these Special Specifications or the Standard Specifications corresponding to the main type of Works in-volved, but this shall not be construed as limiting the specifications for such item of work only to the Section(s) or Clause(s) referred to. All relevant requirements of these Special Specifications and the Standard Specifications for the particular Item of Work shall be complied with.

8) The apparent silence of these Special Specifications, the Drawings or other Contract Documents as to any detail or the apparent omission from them of a detailed description concerning any Works or requirements, shall be regarded as meaning that good engineering practice shall apply and shall be to the approval of the Engineer.

1.2 EMPLOYER

The Employer is the Government of Uganda.

1.3 RECIPIENT

The Recipient is the Ministry of Water and Environment, Uganda.

1.4 SUBMITTALS

1) The Contractor shall provide the Engineer with all submittals required by these Specifications and other Contract Documents. Although their extent shall be at the Contractor's discretion, such submittals shall adequately illustrate all the main aspects of the matter under consideration for an easy understanding by the Engineer.
2) At any time, the Engineer may call either for additional information, completion of the submittal or request the Contractor not to submit some of them.
3) The Contractor shall submit these documents to the Engineer so that, even if not specifically expressed, reasonable time will be given to the Engineer to comment on or approve the submittal.

1.5 STANDARDS AND CODES

1) Standards referred to in these Specifications are considered to form part of these Specifications.
2) All standards and codes employed or referred to shall be the latest current issue in effect at the date 28 days prior to the Bid submission date.
3) One complete set of standards and codes adopted for the Works shall be submitted free of charge by the Contractor to the Engineer immediately after the Contract has come into force or upon the Engineer's request. Such copies shall also be available at the Contractor's business domicile(s) and at Site, for the use also of the Employer and of the Engineer.
4) In case of discrepancies between these Specifications and national or international standards and codes, these Specifications being part of Contract Documents shall govern, unless otherwise established by the Engineer in each particular case.

1.6 NATIONAL STANDARDS, CODES, LAWS AND REGULATIONS

1) Throughout the duration of the Contract, the materials, equipment, services, design and workmanship shall conform to applicable national codes, standards, laws and regulations in force in Republic of Uganda if not otherwise specified.
2) It is the Contractor's duty to acquaint himself with all available national codes, standards, laws and regulations related to the Works in any way and he shall procure and keep at the Site a copy of each of such applicable documents.

1.7 INTERNATIONAL STANDARDS AND CODES

1) International standards/codes series may be adopted provided:
    - The standards/codes proposed are at least as stringent as the equivalent national ones relevant to the Works, or if there is no applicable national standard/code for the specific item concerned.
    - The Contractor states, prior to starting the work, the international standard/code he proposes to apply, giving full identification of each of them. The Contractor's proposals are subject to the approval by the Engineer.

2) Where reference is made in the technical documents to standards/codes of the country of origin for a supply item, it shall be a recognized national standard/code of the country where the specific supply item is manufactured. To be acceptable under these Specifications, such standards/codes must comply in all respects with the quality requirements of above-mentioned international standards/codes and must be approved by the Engineer.

1.8 SYSTEM OF UNITS

1) The SI system of units has been used throughout these Specifications and this system of units shall be used consequently throughout the duration of Contract for all technical or contractual purposes.

2) The following abbreviations are used in these Specifications and related other Contract Documents:

Parameter	***Unit***	***Abbreviation***
Length	*millimeter* *centimeter meter* *kilometer*	*mm* *cm* *km*
Area	*square millimeter* *square centimeter* *square meter*	*mm^2* *cm^2* *m^2*
Volume	*cubic meter*	*m^3*
Mass	*kilogram* *ton*	*kg* *t*
Density	*kilogram per cubic meter*	*kg/m^3*
Force	*Newton* *kilo Newton* *mega Newton*	*N* *kN* *MN*
Moment	*kilo Newton-meter*	*kN m*
Stress or Strength	*Newton per square millimeter* *kilo Newton per square millimeter* *kilo Newton per square meter*	*N/mm^2* *kN/mm^2* *kN/m^2*
Pressure	*bar* *Pascal* *mega Pascal*	*bar* *Pa* *MPa*
Time	*millisecond* *second hour*	*ms* *s h*
Rate of Flow	*liters per second or minute* *cubic meters per second* *cubic meters per minute*	*l/s, l/min* *m^3/s* *m^3/min*
Velocity	*meter per second*	*m/s*
Velocity of Rotation	*revolutions per minute*	*rpm*
Temperature	*degree Celsius*	*°C*
Concentration	*parts per million*	*ppm*
Illumination Intensity	*lux*	*lx*
Energy	*kilowatt-hour*	*kWh*
Power	*Watt* *kilowatt* *Megawatt*	*W* *kW* *MW*
Slope and Percentage	*percent*	*%*

3) The term "day" as used in these Specifications means the calendar day according to the Gregorian Calendar.
4) Any other system of units utilized shall have only a descriptive value and shall in no case replace the above-mentioned SI system.

1.9 DEFINITION OF TIME AND KEY DATES

The periods of time and key dates used throughout these Specifications have the meanings as assigned to them in the "CONDITIONS OF CONTRACT FOR CONSTRUCTION" by FIDIC, 2017, with amendments.

1.10 DEFINITIONS AND TERMS

Unless inconsistent with the context, in these Specifications, the following terms, words or expressions shall have the meanings hereby assigned to them.

1.10.1 Accepted

Accepted in writing by the Engineer (or by the Employer where appropriate) as meeting the requirements of the Contract Documents and of any authorised variations thereto. "Acceptance" means accepted in writing as aforesaid. "Acceptable" means acceptable to the Engineer as aforesaid.

1.10.2 Access culvert

An access culvert provides an opening under an intersecting side road or entrance to plots along the project road.

1.10.3 Addendum

Amendment of or revision to any of the Contract Documents issued to Tenderers, and which is deemed to form part of the Contract Documents.

1.10.4 Aggregate

Crushed stone of specified size and quality to be used in the Works.

1.10.5 Approved

Approved in writing by the Engineer, including subsequent written approval or confirmation of previous verbal approval by the Engineer. "Approval" means approval in writing as aforesaid.

1.10.6 Base Course

A layer of material constructed on top of the subbase or in the absence thereof, the improved subgrade layer. A base course may extend to outside the travelled way.

1.10.7 Borrow Area

An area within designated boundaries, approved for the purpose of obtaining borrow materials.

1.10.8 Borrow Pit

The excavated pit in a borrow area.

1.10.9 Borrow Material

Any gravel, sand, soil, stones or ash obtained from borrow areas, dumps or sources other than cut within the road prism and which is used in the construction of the Works. It shall not include crushed stone or sand obtained from commercial sources and blasted rock for crushing.

1.10.10 Bridge

A structure for carrying motor, railways, pedestrian or other traffic or services over a river, water-course, railway line or any other gap, with a single span length, or sum of span lengths, of 6.0 metres or more. The length is measured between the abutment faces, or pier head faces respectively, along the centre line of the road at girder-bed level.

1.10.11 Catchwater Drain or Bank

A longitudinal drain or bank outside the road prism for diverting water that should otherwise flow into the road prism.

1.10.12 Certificate Of Guarantee

A signed statement by a person having legal authority to bind a company or supplier to its product, and which confirms that the materials and test results conform to the standards of the Specifications.

1.10.13 Common Excavation

Classification of excavation for payment purposes. Denotes all excavation, except rock excavation, required from the road prism, drains, etc. according to the Drawings and the Specifications.

1.10.14 Conditions Of Contract

The appropriate edition of the General Conditions of Contract issued for execution of the Contract together with any Special or Particular Conditions of Contract forming part of the Contract.

1.10.15 Culvert

A structure other than a bridge, which provides an opening under the carriageway or median for drainage or other purposes.

1.10.16 Cut

A section of the works where the formation level is below the original ground level requiring excavations for the construction of the embankment layers.

1.10.17 Directed

Direction in writing by the Engineer including verbal direction when subsequently confirmed in writing.

1.10.18 Ditch Or Drain

Lined or unlined open drain constructed for the collection of surface water from the embankment, shoulders and adjacent land.

1.10.19 Earth Dam

Earth dams are embankments built across river or stream courses to impound surface water runoff during rainy periods. An earth dam, in particular, is constructed mainly from natural soils locally available at the site or in close proximity to the site.

1.10.20 Earth Dam Spillway

A spillway is a structure for discharging excess floodwaters across a dam embankment. It protects the embankment/dyke from erosion and scouring as a diversion channel that takes away the water when the dam is filled up. It can be constructed as cut in natural ground on the extreme end of the embankment.

Upstream of the spillway is an overflow section, with a crest that determines the maximum water level in the reservoir. The most important dimensions of the spillway include the width, depth and length, the overflow height plus the free board, length and gradient of the chute, width and length of the stilling basin and the height of the counter sill.

1.10.21 Earthworks

Term describing all processed material below the formation level including improved subgrade layers, fill and prepared roadbed.

1.10.22 Pavement

A section of the road where the formation level is above the original ground level.

1.10.23 Fill

That portion of the road prism consisting of approved imported material which lies above the roadbed and is bounded by the side slopes, on which the improved subgrade layers, subbase, base course, shoulders and are to be constructed. Material imported to replace unsuitable material in the roadbed shall also be classified as fill when placed below the improved subgrade layers.

1.10.24 Formation Level

The level of the top of the final layer of earthworks upon which the embankment layers are placed

1.10.25 Improved Subgrade

The upper layer or layers of the earthworks, which is constructed directly onto the fill or in some cases onto the roadbed.

1.10.26 Inlet and Outlet Drains

Channels leading into or discharging from culverts storm water conduits and minor bridges.

1.10.27 Mitre Drain and Bank

A drain constructed at an angle to the centreline of the road to divert water from a side drain. Mitre drains include mitre banks placed across the side drains.

1.10.28 Overburden

Material within a borrow area, which is not required or is unsuitable for use in construction.

1.10.29 Pavement

The upper layers of the road comprising the improved subgrade, subbase, base or gravel wearing course or bituminous surfacing and the shoulder layers.

1.10.30 Gravel Material Classes

Materials used in the dam embankment/road, complying with the requirements of the Specifications, classified as follows:

Unbound natural gravel materials:

G25: natural gravel with nominal CBR value of minimum 25
GW: gravel wearing course for gravel roads or unpaved shoulders

1.10.31 Roadbed

The natural in situ material on which the fill, or in their absence, any embankment layers, are to be

constructed.

1.10.32 Road Prism

That portion of the road construction included between the original ground level and the outer boundaries of the slopes of cuttings, fills and side drains. It shall not include the selected layer, subbase, base course, surfacing, shoulders or roadbed.

1.10.33 Road Reserve or Right-Of-Way

The entire area included by the boundaries of road as proclaimed.

1.10.34 Rock Excavation

Classification of excavation for payment purposes. Denotes excavation required from the road prism, drains, etc, according to the Drawings and the Specifications, that requires drilling and blasting or the use of pneumatic or hydraulic jackhammers in order to be loosened sufficiently for loading and transportation.

1.10.35 Roller Passes

Unless otherwise specified in the Specifications, an area will be taken to have received one roller pass when a roller has passed over such area once. Additional passes made only as a result of nominal overlapping so as to ensure full coverage shall not be taken into account.

1.10.36 Side Drain

An open longitudinal drain situated adjacent to and at the bottom of cut or fill slopes.

1.10.37 Slope

Unless otherwise stated, slope is given in terms of the ratio of the vertical difference in elevation between any two points and the horizontal distance between them. This ratio may also be expressed as a percentage.

1.10.38 Specifications

The Specifications relating to a specific project, which form part of the Contract documents for such project, and which contain the Standard Specifications together with supplementary and/or amending specifications issued in the Special Specifications.

1.10.39 Spoil (Material)

Material originating from construction operations and which is not utilised for construction purposes.

1.10.40 Subbase

The layer of material on top of the improved subgrade layers or fill and below the base course and shoulders.

1.10.41 Subgrade, Improved

The layer of material on top of the roadbed, or fill, and below the subbase.

1.10.42 Subsidiary Works

Works which are subsidiary to or necessary or essential to, or in support of, or usual to, the execution and completion of other Works.

1.10.43 Substructure

All of that part of the structure below the bearings of simple and continuous span bridges, below skewbacks of arches, below deck slab of box and slab culverts, together with return walls and wing walls.

1.10.44 Subsoil Drainage System

A system of subsoil drainage pipes (including any permeable material) constructed to intercept and remove subsoil water.

1.10.45 Suitable Material

Materials that comply with the requirements of these Specifications in respect of the relevant layer or position where the material is intended to be used.

1.10.46 Topsoil

Organic or unsuitable materials in the upper strata encountered after clearing of the vegetation.

1.10.47 Unsuitable Material

Materials that do not comply with all the requirements of these Specifications in respect of the relevant layer or position where the material is intended to be used.

1.10.48 Working Drawings

Shop drawings, steel bending schedules, stress sheets, fabrication and erection drawings, falsework drawings, and any other supplementary drawings or data which the Contractor is required to submit to the Engineer for approval before such Works commence.

1.10.49 Quarry

Area other than cuts within the road prism where rock is extracted for production of crushed aggregate and which is used in the construction of the Works.

1.11 INFORMATION FURNISHED BY THE EMPLOYER

Certain information contained in these contract documents or provided separately is being offered in good faith, but in the circumstances pertaining to the type of information furnished, no guarantee can be given that all the information is necessarily correct or representative of the in-situ condition.

This applies more specifically to all soil tests, soil mapping, drilling results, geophysical survey, geological reports, borrow-pit information, material surveys and reports, and similar information, the accuracy of which is necessarily subject to the limitations of testing, sampling, the natural variation of material or formations being investigated and the measure of certainty with which conclusions can be drawn from any investigations made. It also applies to any materials utilisation plan provided, as the diagram may be subject to major alterations during the progress of the work, depending on site conditions.

The Employer will not accept any liability for the correctness or otherwise of the information furnished or for any resulting damage, whether direct or consequential, should it appear, during the course of the Contract, that the information supplied is either incorrect or not representative

2 GENERAL PROVISIONS AND REQUIREMENTS

2.1 GENERAL

This Section covers matters which relate to the Contract as a whole. Definitions, phrases or wording which would otherwise require repetition in other sections of the Specifications are also covered by clauses in this Section. Matters covered by the Conditions of Contract are not repeated in this Section, except where necessary for providing more detailed information.

2.2 MODIFICATIONS OF AND AMENDMENTS TO THE STANDARD SPECIFICATIONS

The Standard Specifications are to be read together with modifications, additions or amendments which are written in the Special Specifications.

2.3 PRECEDENCE OF SPECIFICATIONS

In any case where there appears to be any conflict between the Standard Specifications and the Special Specifications, the Special Specifications shall govern.

2.4 DRAWINGS

The Drawings comprise the following:

2.4.1 Engineer's Drawings

The drawings issued from time to time by the Engineer.

2.4.2 Record Drawings

Record Drawings as hereinafter described.

2.4.3 Issued Drawings

These are drawings issued to the Contractor with the Bid Documents for the purposes of preparing a bid. Such drawings shall be deemed to have been issued for the guidance of bidders, and shall be referred to for the interpretation of the Contract only where the drawings supplied by the Contractor at the time of bidding and incorporated in the Contract are insufficient.

2.4.4 Bid Drawings

The Bid Drawings are supplied by the Contractor for the purpose of illustrating his bid, and they shall include:

- a layout of the whole scheme, scale 1:100
- drawings and technical details of the major works in sufficient detail to illustrate that the several items of major works are suitable for their intended purpose.

Where Bid Documents including Bid Drawings show features not in compliance with this Specification, and where such features are not listed in the Technical Schedules then the requirements of the Issued Documents will be taken as the basis of the Contract.

2.4.5 Approved Drawings

These are drawing submitted by the Contractor and duly approved for works to commence/proceed as hereinafter described. Installation of pipelines and other works for which Approved Drawings are required shall not begin until the appropriate Approved Drawings are available. The Contractor shall submit, for approval, each drawing in the following categories and schedule:

a) Irrigation System Layout and Block Mapping System

For the construction of canals and drainage network, the drawings shall show the location, lined or un-

lined, cross-section dimensions, length, base invert and ground levels above mean sea level, other services to be encountered or crossed by the canals and drains and any structures to be constructed along it including control structures (turnout, off-takes, checks, check-drops, drops, etc), trench cut-offs and anchor blocks. The Contractor has to fit all this information in the block-mapping system or other digital format.

b) Preliminary Civil Outline Drawings

These shall be submitted within 3 months of the Commencement Date. These drawings shall include information to allow the structural design to commence.

These drawings shall inform the Engineer of the basic physical shape, including channel sizes, and positions relative to one another, of the structures, and confirm the hydraulic levels through the area.

They shall indicate in broad terms the locations for control structures. Location, line and level of major equipment/structures shall be positioned to an accuracy of ±300 mm.

c) Detailed General Arrangement Drawings

These shall be submitted within 5 months from the Commencement Date.

These drawings shall include information required to allow all major structural design and civil general arrangement drawings to be completed.

The drawings shall comprise:

- general arrangement drawings to scale of site plans showing each structure and building, principal routes for cables, pipes and chemical ducts and services
- drawings of each building/structure shown in plan and elevation

d) Final Civil Outline Drawings

These shall be submitted within 4 months of the Commencement Date.

These drawings shall include information to allow all major civil detail drawings to be completed.

These drawings shall include final positions and loadings and dimensions of major structures.

2.4.6 Procedure for Approval of Drawings

Unless otherwise indicated within this Specification, preliminary copies of drawings for approval shall be submitted to the Engineer.

Any alterations required by the Engineer to be made to drawings submitted for approval shall be made by the Contractor without extra charge, or extension of time, provided such alterations are not consequential upon a change in the requirements of the Contract.

Drawings when approved will be stamped with the Engineer’s approval stamp and one copy of each such approved drawing will be returned to the Contractor.

Acceptance of Bid Drawings shall not be deemed to confer the Engineer's approval upon them.

2.4.7 Record Drawings

The Contractor shall provide a set of as built drawings for the works. He shall submit four hard copies of the drawings, a soft copy (digital format), a print out of the co-ordinates of the fixtures (e.g., Earth dams, Headworks, Intakes, Control Structures, manholes, etc.) and an electronic copy of the co-ordinates. The Contractor shall agree with the Engineer on the details of the electronic copies.

A coloured and framed drawing showing the irrigation system layout, together with detailed operating instructions and four full sets of Record Drawings will be required by the Employer on the completion

of the work. All drawings submitted for approval shall be included in the record drawings. Revised drawings shall be submitted within one month of any amendments made during erection. The record drawings shall be submitted with the operating instruction manuals as specified in Clause 1.21.

2.4.8 Contractor's Calculations and Technical Details

Within two months of the Commencement Date the Contractor shall submit to the Engineer design calculations and technical details of the structures further to those accepted with his Bid, in sufficient detail for the Engineer to satisfy himself that the and the structures are jointly and severally suitable for their intended purpose.

The submitted report shall include design calculations, instrumentation diagrams, hydraulic flow diagrams, technical details and schedules of major structures.

The Contractor shall also provide such additional details and calculations and other data as may be reasonably required by the Engineer to satisfy himself to the stability, durability and safety of the works and for ascertainment and inspection of structures during construction that it is in conformity with the Contract.

2.5 PROGRAMME

2.5.1 Work Programme

The Contractor shall submit with his Bid the Work Programme and Detailed Works Schedule with details elaborated hereafter.

In accordance with relevant clauses of the Conditions of Contract and prior to commencement of the Works, the Contractor shall submit to the Engineer for his approval, an updated programme of the works showing the order of procedure and methods in which he proposes to carry out the Works. The programme shall be in the form of a bar chart, or any other form as may be agreed by the Engineer. It shall be co-ordinated to take into account transportation and delivery times for the materials and for climatic and other conditions to provide for the completion of the Works in accordance with the Contract.

The programme shall show:

- The order of work by major activity.
- Planned rate of progress.
- Amount and type of equipment proposed.
- Details of methods to be employed.
- Details of Temporary Works.
- The time allocated for work by others, including the Employer and by utility undertakings.

The programme shall not be in form of a bar chart only, but shall show clearly the anticipated quantities of work/output for each major activity to be performed each month, as well as the anticipated earnings for the various sections of work. Further it shall show the critical path of activities. Sufficient space should be provided in the programme for recording the actual progress against the programmed progress for each activity.

The programme submitted by the Contractor shall take into account the weather forecasts for the duration of the execution of the works.

The Works shall be carried out so as to achieve a continuous and consecutive output of fully completed scheme. The order of execution of the Works shall be subject to reasonable adjustment as requested by the Engineer.

Should the Contractor fall behind with the programme submitted by him in terms of the relevant clause of the Conditions of Contract, which programme has been approved by the Engineer, or if the sequence of operations is altered, or if the programme is deviated from in any other way, the Engineer

may, without prejudice to the Employer's rights in terms of the relevant clause of the Conditions of Contract, require the Contractor to submit, within seven days of the date on which he has received a notice to this effect, a revised programme in terms of this Clause, which indicates the manner in which the Contractor undertakes to complete the Works within the required time. Any proposal in the revised programme to accelerate the rate of progress shall be accompanied by positive steps to increase production by more and/or better labour, equipment and materials being provided on the site or by the available labour and equipment being utilised more effectively.

Failure on the part of Contractor to work according to the programme or revised programmes, shall be sufficient reason for the Employer to take steps as provided for in the Conditions of Contract and shall be construed, as not executing the Works in accordance with the Contract.

The approval by the Engineer of any programme shall have no contractual significance other than that the Engineer would be satisfied if the work is carried out in accordance with such programme and that the Contractor undertakes to carry out the work in accordance with the programme.

2.5.2 Detailed Works Schedule

The Detailed Works Schedule shall be submitted with the work programme within 7 days from the date of receipt of the Engineer's order to commence the Work. Thereafter an updated Detailed Works Schedule shall be submitted with the updated Works Program monthly and at any time as required by the Engineer.

The Detailed Works Schedule shall to elaborate the details of the programme for the Works, includeing a complete resource allocation showing the number of units and allotted times for each unit of constructional Plant, materials and labour allocated to each part of the Works, with the following:

- the quantity of output of key activity to be delivered in a given duration of the programme
- a statement personnel inputs giving the numbers, categories and productivity of supervisory and technical staff and skilled and unskilled workers to be employed on each of the key activity/sub-activity of the Works
- plant and equipment deployment list detailing types, number, working durations (hours) and productivity of major plant and equipment (including vehicles) which the Contractor proposes to employ on each of the key activity of the Works
- materials inputs/utilisation schedule detailing types, quantity of major plant and equipment (including vehicles) which the Contractor proposes to employ on each of the key activity of the Works.
- details of the Contractor's methods of working for all operations and key activities

2.6 TEMPORARY WORKS

The Contractor shall submit to the Engineer for approval full details of his proposals for temporary works at the Site, at least 14 days prior to the intended start of such work. The Contractor shall supply the Engineer with drawings for approval showing the layout and general arrangement of all Temporary Works he proposes to construct for the purpose of the Contract including, but not limited to:

- Camps, including accommodation for staff and labour.
- Offices
- Laboratory
- Workshops
- Stores
- Aggregate crushing plants
- Concrete manufacturing plants
- Precast concrete yards
- Temporary river crossings and diversion works

– Temporary bypass and access roads.

For the diversion works, including coffer dams, the Contractor shall undertake hydrological and flood analyses including the design for the foundation and embankment for the coffer dam for prior approval by the Engineer.

The Contractor shall not proceed with any temporary works until he has received the Engineer's written approval of his proposals for the temporary works. Such approval shall not relieve the Contractor of his obligations and liabilities under the Contract. The Contractor shall be responsible for removal of all temporary works, including restoration and reinstatement, as directed and to the satisfaction of the Engineer.

No separate payment will be made for Temporary Works, the relevant cost being included in the rates of the Bill of Quantities for other work.

2.7 SAFETY PRECAUTIONS

2.7.1 SAFETY PROGRAM AND ITS IMPLEMENTATION

1) Within 14 days from the date of issue of the Notice to Commence, the Contractor shall submit, in writing, his proposal for a comprehensive safety program covering all aspects of the Works.
2) This safety program shall detail policies, procedures, and plans which the Contractor intends to implement to ensure the safety and health of his employees. It shall comply with the standards and regulations in force in the country of the Works applicable to construction safety.
3) The Contractor shall designate a competent employee specially trained and experienced to act as Safety Officer, who will administer and be responsible for the implementation of the safety program. He shall carry out frequent and regular safety inspections of the working areas, materials, and equipment. The name and qualifications of the Safety Officer shall be submitted for approval to the Engineer prior to his appointment.
4) The Contractor shall be responsible for the enforcement of the health and safety provisions that he himself and his subcontractors shall adopt on Site.
5) Prior to the start of any major construction activity or hazardous operation, the Contractor shall submit to the Engineer for approval, a specific plan for safety precautions covering such operation.
6) All accidental occurrences with serious accident potential such as major equipment failures, contact with high-voltage lines, exposure to hazardous materials, slides, cave-ins, etc., shall be reported to the Engineer as soon as practicable.
7) All serious and fatal injuries and diseases caused by the progress of work shall be immediately investigated by the Contractor and a comprehensive report shall be submitted to the Engineer.
8) In case of a fatal accident, only rescue and emergency teams and operations shall be permitted at the place of the occurrence until the Engineer gives permission to resume normal operations.

2.7.2 SAFETY STANDARDS

In addition to the requirements specified herein, the Contractor shall comply with applicable safety requirements of the following documents and/or organizations:

a) Safety regulations in force in the country of the Works
b) US Bureau of Mines or equivalent
c) USBR-Construction Safety Standards or equivalent

In addition to the requirements specified herein, the Contractor shall comply with applicable safety requirements in force in the United Republic of Uganda.

2.7.3 PERSONAL SAFETY EQUIPMENT

1) The Contractor shall provide his and his subcontractor's personnel as well as the Employer's and

Engineer's representatives and visitors with appropriate personal safety equipment. The use of such equipment shall be compulsory.
2) All persons entering the working areas wear a protective helmet.
3) Safety footwear with steel toe caps shall be worn by all personnel engaged in work having an inherent danger to the feet.
4) During drilling works and in areas where workers are exposed to harmful noise and dust levels, ear protectors and dust masks shall be worn.
5) Workers engaged in work having an inherent danger of eye or face injury shall be furnished and required to wear protection glasses, goggles or face masks. Where irritants or toxic substances may come in contact with the skin or clothing, employees shall wear protective clothing or apply a protective ointment prescribed by a competent physician.
6) Employees working on steep slopes or otherwise subject to possible falls from levels not protected by fixed guardrail or safety nets, shall be secured by safety belts and lifelines.
7) A suitable protection shall be installed on the upstream face of the dam during construction of the asphaltic concrete facing to limit fall hazard associated with this type of work.

2.7.4 RESCUE TEAM

1) Prior to the commencement of construction, the Contractor shall organize and train a Rescue Team composed of his employees. This Rescue Team shall be capable to render help after accidents caused by fire, gas, explosion, rockslides, etc.
2) The Rescue Team shall be organized in such a way that a sufficient number of its members will be ready for action at any time until the Completion of Works.
3) The Rescue Team members shall be instructed and trained for their task by a qualified and experienced person. If necessary, the Contractor shall hire an outside specialist to perform such training. A refresher training for all members of the Rescue Team shall be conducted at least every six months
4) Each Rescue Team member shall be skilled in giving the first aid, dealing with the appliances for artificial respiration, and firefighting equipment and shall possess a good local knowledge. Adequate equipment for reaching even the remotest working area shall be at their disposal.
5) The Contractor shall submit the details of the proposed Rescue Team organization to the Engineer for approval.

2.7.5 ILLUMINATION AND EARTHING

Illumination

All outdoor working sites, roads, storage and borrow areas, stationary plants, and all other site facilities, shall be adequately illuminated during night work by electrical lights.

Earthing, Wet Work Areas, Control of Electric Discharges

1) Equipment and appliances which are exposed to lightning shall be electrically earthed and the effectiveness of such earthing shall be periodically checked by the Contractor's specialized personnel.
2) Where electrical blasting will be used, equipment shall be installed to control possible electric discharges in the ground due to storms, electrical motors, etc. As soon as such discharges are noted, electrical blasting operations shall be suspended, or the detonator type changed.
3) No equipment electrically powered by more than 24 Volts shall be operated by personnel standing in water.
4) Only suitable insulated equipment shall be allowed in the very wet areas.

Maintenance of Traffic and Safety on Public Roads

1) The Contractor shall be responsible for the safety along the roads related to the Site, and he shall take all necessary precautions for the protection of the work and the safety of the public

on the roads affected by his activities. Where the work will be carried out at the site of, or close to an existing road, the Contractor shall maintain the vehicular and pedestrian traffic safe at all times. If his operations can cause traffic hazards, he shall repair or fence or take such other measures for ensuring safety which are satisfactory to the Engineer.

2) Public roads subject to interference by the works shall be kept open or suitable detours shall be provided and maintained by the Contractor, who shall provide, erect and maintain all necessary barricades, suitable and sufficient flagmen, danger signals, signs etc.
3) Roads which will be closed to traffic shall be protected by effective barricades on which acceptable warning and detour signs shall be placed. All barricades and all lights shall be kept burning from sunset to sunrise.
4) The Contractor shall submit his weekly activities schedule and the locations of his work along the existing public roads to the authorities concerned and obtain all necessary approvals prior to commencement of the respective work.
5) At the road crossings or in heavy traffic locations, the Contractor shall carry out the work within the working hours as directed by the Engineer, and after the completion of the work he shall immediately make the necessary backfill and pavement at the crossings.
6) The Contractor shall provide temporary passes and bridges to give an access to the existing villages, houses, etc., to the satisfaction of the Engineer and the authorities concerned whenever he disturbs such existing way during the execution of the Works.

2.7.6 STORAGE AND TRANSPORT OF EXPLOSIVES

1) The Contractor shall in due time apply for a permit which allows him to buy, store and use the explosives required for the Works. The local security forces or other competent authorities will issue the permit.
2) The Contractor shall strictly comply with the rules and regulations in force in the country of the Works regarding purchase, transport, storage, handling and use of explosives.
3) Explosive magazines shall be reinforced concrete buildings with walls and slabs of a minimum 25 cm thickness. Doors shall be made of double sheets having a minimum thickness of 5 mm each and shall be fitted with safety type locks.
4) Explosives magazines shall be kept at a safe distance from working areas and living quarters. They shall be surrounded with barbed wire, protected by safety locks, ventilated, and fitted with lightning arresters. An air space shall be provided between the ceiling and the roof to prevent temperatures from reaching dangerous levels.
5) Blasting caps and detonators shall not be stored in the same magazines as explosives but shall be located in separate magazines at least 15 m away if barricaded and 30 m if un- barricaded.
6) Explosives shall be stored only in their original containers and with the top side up as designated on the container.
7) Access to the magazines and permission to handle explosives shall be granted exclusively to trustworthy personnel, adequately instructed and experienced in the use and handling of explosives.
8) The Contractor shall provide all reasonable and adequate security measures necessary to prevent loss or theft of explosives. Storage of explosives and detonators outside of the magazines shall not be permitted.
9) The Contractor shall maintain a record of storage and withdrawal of all explosives. This record shall be made available to the Engineer on request. The Engineer shall be promptly notified of any loss or theft of explosives.
10) Between the magazines and the place of use, the explosives and detonators shall be transported separately in lockable metallic containers loaded on a special wagon destined for the purpose of explosives transport only. These wagons shall be painted with striking colours for easy recognition. The inside of the containers shall be lined with wood in order to prevent a direct contact of the explosive or detonators with the metal.

2.7.7 BLASTING

1) All blasting shall be carried out in a proper and safe manner by a competent and experienced blast-man and no blast shall be fired without his approval.
2) Blasting will be permitted only after adequate provisions have been made for the protection of persons, the Works, and public or private property. The Engineer's approval of any of the Contractor's blasting operations shall not relieve the Contractor of his sole responsibility for the safety of persons and property. Any damage done to the Works or property by blasting shall be repaired by the Contractor.
3) Blasting in the open air shall be carried out only at certain hours of the day agreed upon by the Contractor and the Engineer. Barriers shall be erected, and warning shall be given to the workers at the Site and to the public immediately before blasting, so that no person will enter the danger zone until blasting is finished.
4) Upon completion of blasting, an "all clear" signal shall be given by the responsible blasting engineer after he has satisfied himself that all charges loaded have detonated and that no delay-explosions or misfiring are to be expected.
5) Such methods of blasting shall be employed that shock and vibration are minimized.
6) No blasts involving charges larger than 200 kg shall be carried without the written approval by the Engineer, who shall be notified at least one hour prior to the blast.
7) No blasting shall be permitted within 30 m of any concrete placed within the previous 7 days. After 7 days, blasting may be performed only with the approval of the Engineer. Blasting will not be permitted within 10 m of structures or installations vulnerable to damage by blasting.
8) No charging and firing will be executed during thunderstorm (except in underground works) and other electrical disturbances which can cause uncontrolled blasting.
9) Mats or rubber tires tied together with rope shall be used as protection from flying debris to cover the charges where blasting may expose persons or property to injury or damage.

2.7.8 FIRE PRECAUTIONS

1) The Contractor shall organize a fire brigade equipped for the fighting of any fires which could break out on the construction sites, in temporary structures, stores, residential quarters, etc.
2) An adequate number of fire extinguisher shall always be available at each construction site and in each building in camps and in offices and they shall be kept in satisfactory working order.
3) Firefighting equipment shall be of the gas, dry powder or other suitable chemical or pumped water type. Their number, type and location will be subject to the approval of the Engineer.

2.7.9 DUST ABATEMENT

During the performance of the work and any operations appurtenant there to, the Contractor shall carry out proper and efficient measures, such as sprinkling with water or other means, whenever necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging crops, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from his operations.

2.7.10 POLLUTION OF STREAMS AND RIVERS

1) The Contractor shall take all possible steps to prevent pollution of streams, rivers, and other water supplies, at or in the vicinity of the Site and shall comply with applicable laws, orders and regulations in force in the country of the Works concerning the control and abatement of water pollution.
2) Under no circumstances shall the sewage from the camps, or other contaminated water, be released directly into river or other natural streams or any open areas without prior treatment.

2.7.11 NOISE DUE TO CONSTRUCTION ACTIVITIES

1) The background sound level at any point along the boundary of the Site or Working Areas, arising from the operation of any mechanical equipment, with the exception of the diesel gen-

erators, shall not exceed 70 dB (A). The background sound level at any point along the boundary of the Site, arising from the operation of the diesel generators for standby generation shall not exceed 80 dB (A).

2) The Contractor shall take adequate measures to keep as low as possible noise caused by construction activities and specially that due to construction equipment and stationary plant. In particular, the following shall be observed.
   i. All engine operated equipment shall be as a minimum provided with standard silencer; however, equipment operating near the Contractor's camps or existing villages and houses shall be provided with high performance silencers, keeping the noise level below 70 dB measured at a distance of 3 m from the equipment, or sound pressure level not exceeding 85 dB (A) when measured at a distance of 1 m from the reference surface of that item, according to ISO 3746 'Acoustic Determination of Sound Power Levels of Noise Services - Survey Methods' or the equivalent ANSI SI.36.
   ii. Sound pressure levels shall be measured in dB (A), using a calibrated sound meter meeting the requirements of BS 5969 with the responses speed set to 'slow'. The background noise level shall be at least 10 dB (A) below the operating noise level of the machine or other item of Plant and Equipment.
   iii. The Contractor shall produce certified evidence from the manufacturer that the appropriate tests have been carried out on all items of the same type which is in all relevant respects similar to the item to be supplied. Such relevant respects would include the running speeds, the power input under the loading conditions which would produce the most noise, the power input under normal operating conditions (if different from the foregoing), the number of stages (for rotary machines) or the number of cylinders (for reciprocating machines).
   iv. If an item in its standard build does not comply with the above requirement, the Contractor shall be required to reduce the sound pressure level by providing improved or additional silencers or fitting sound insulating materials to the item.
   v. Motor compressors, motor generators, ventilation fans and other similar equipment if located near camps or existing villages and houses shall also, if necessary, be housed in a building;
   vi. Equipment and stationary plant shall be generally located at adequate distance from camps or existing villages and houses, in such a way to avoid disturbance to personnel working on the project and local inhabitants.
3) The Engineer shall have the right to require additional measures such as sound-dampening screens or more efficient silencers in case the noise level results higher than 70 dB measured at camp or village or house close- to the source of noise.

2.7.12 LOCAL COMMUNITIES AND RELIGIOUS CUSTOMS

1) The Contractor shall pay care to avoid damage to properties, buildings, artifacts and objects of local communities or individuals during the execution of the Works; similarly, he shall avoid to make use or occupy areas without the prior consent of the owners.
2) The Contractor shall also have due regard to religious and other, customs of local communities, and shall never interfere in any religious or civil ceremony.

2.7.13 VEGETATION AND WILDLIFE

The Contractor shall care, in planning, constructing, maintaining and operating temporary works, such as camps, roads, spoil, stockpile and construction facilities areas, to avoid unnecessary damage to areas of particular environmental interest, such as patches of remaining forest, valuable trees and erosion sensitive areas.

2.7.14 FINDINGS OF ARCHEOLOGICAL, HISTORICAL OR CULTURAL INTEREST

1) In case fossils, articles of value or antiquity and/or structures and other remains of things of archaeological, historical or cultural interest are discovered during the activities related to the construction of permanents or temporary works, the Contractor shall notify the Engineer without removing any part of the article or thing found.
2) The Contractor shall take the necessary measures for preventing that any person or equipment may damage the article or thing, and shall provide barricades, fences, signals and, if necessary, protection against atmospheric agents.
3) The Engineer shall agree with the Contractor about the possible required modification of permanent and/or temporary works in connection with archaeological or historical findings and deal with the additional costs to the Works, if any, as a Variation.

2.7.15 ESHS RISKS AND IMPLEMENTATION PLANS

The Contractor shall submit the Implementation Plans to manage the following key Environmental, Social, Health and Safety (ESHS) risks.

- Construction Environmental and Social management Plan, to ensure the compliance with the ESMP findings
- Labour Influx Plan, to avoid negative impacts on the host community,
- Traffic Management Plan, to ensure safety of local communities from construction traffic
- Water Resource Protection Plan, to prevent contamination of drinking water
- Boundary Marking and Protection Strategy, for mobilization and construction to prevent offsite adverse impacts
- Consents/Permits Strategy, to obtain Consents/Permits prior to the start of relevant earth works,
- Occupational Health and Safety Plan, to entails the inclusion of EHS considerations in the implementation processes
- Access Road Plan, to cover the road risks and to avoid erosion effects,
- Material Use, Handling and Storage Plan, for the management for use and disposal of hazardous substances
- Waste management Plan, for the management of waste and dump sites
- Wastewater Plan, to adhere to the national rules and regulations,
- Dust, Air Emission and Noise Pollution Plan, to avoid risks of related accidents and risks,
- Emergency Preparedness Plan, to ensure the efficiency of the safety procedures

The Contractor shall be required to submit for approval, and subsequently implement, the Contractor's Environment and Social Management Plan (C-ESMP), in accordance with the Particular Conditions of Contract Sub-Clause 4.1, that includes the agreed Management Strategies and Implementation Plans described here.

The CESMP will cover the remedial and/or mitigation measures identified and reported in the Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan (ESMP), Resettlement Action Plan and the Consent Conditions issued by the regulatory authority and to be attached to any permits or approvals for the project.

Furthermore, it will indicate the strategies to be adopted during the construction and operation phases to be submitted in appropriate Method Statements namely: Work site boundaries and safety area, Access Roads, Site clearing, Materials Use, Handling and Storage, Quarries, Refuelling and Workshop management, Waste Management, Wastewater, Fire Control, Dust control and Air Pollution Management, Water Pollution Management, Noise control, Cement and concrete batching, Emergency Procedures, Safety Plan, Traffic Management Plan, Biodiversity protection.

2.7.16 MEASUREMENT AND PAYMENT

1) No extra measurement for payment or payment will be made for the items listed in the chapter 2 and the entire cost thereof shall be included in the Unit Prices for other items of the Works.
2) Any repair work or any indemnities required due to Contractor's non-compliance with the safety requirements shall be to the Contractor's expense.

2.8 PROGRESS MEETINGS AND REPORTS

During the period of the Contract, the Contractor shall allow for all consultations with the Employer and the Engineer and his staff as necessary.

From the commencement of the work on Site there will be a series of monthly Site progress meetings to coordinate the civil works. Representatives of the Contractor, approved by the Engineer, shall attend monthly progress meetings on Site or at the offices of the Employer. In addition, approved representatives of the Contractor shall attend further meetings in cases of emergencies or for other reasons when called upon by the Employer.

The Contractor shall submit to the Engineer each month a report on his progress in the performance of the Contract. The report shall include a copy of the approved programme with the current progress for each activity shown.

2.9 ORGANISATION OF ACTIVITIES

The Contractor shall organise his activities within the Contract Area in such a way as to minimise disruption to the public, existing users/farmers on the irrigation scheme and his sequence of working shall be clearly indicated in the Programme. The Contractor shall submit a fully detailed programme of work to the Engineer for approval.

2.10 NOTICE OF OPERATIONS

The Contractor shall give full and complete written notice of all important operations to the Engineer sufficiently in advance to enable the Engineer to make such arrangements, as he may consider necessary for inspection, including site entry or for any other purpose. The Contractor shall not commence any important operation without the written approval of the Engineer. Important works shall include all operations occurring on the site outside the following hours: Monday to Friday: 7:30 am to 5:30 p.m.

2.11 COMMISSIONING

The Contractor is required to provide suitable personnel, to be approved by the Engineer, to operate each section of the Works during commissioning, i.e. the setting to work and testing of individual components of the Works or the complete Works. Commencing during the commissioning period the Contractor shall instruct the Employer's staff in the operation and maintenance of each section of the Works

2.12 WATER AND ELECTRICITY SUPPLY

The Contractor shall make his own arrangements for the supply of water and electricity for the purposes of the Works.

2.13 CONTRACTOR'S FACILITIES

The Contractor shall provide all site facilities including offices, workshops, stores, accommodation, washing, sanitation etc. necessary for use by his own staff, for the execution of the Works.

The Contractor shall be responsible for making all arrangements for drainage from his site facilities and shall be responsible for payment of all charges in connection therewith.

2.14 CLIMATIC DATA AND LOCATION LEVEL

The Contractor shall investigate and ascertain the following climatic conditions at the site of the Works for the design and selection of all plant and equipment and the construction of the Works:

- Mean Maximum ambient temperature
- Mean Minimum ambient temperature
- Maximum humidity
- Minimum humidity
- Location Level

2.15 CONTAMINATION OF WATER SUPPLIES

Before any person is engaged on work involving a risk to the purity of potable water supplies or deemed to involve such a risk by the Engineer, he shall be tested to indicate that he is not a carrier of typhoid or other water-borne disease and he shall be informed of the dangers of contamination. The Contractor shall notify the Engineer of any person who has been certified by a doctor as suffering from an illness associated with looseness of the bowels, and no such person shall be employed on such work until the Employer's medical adviser is satisfied that it is safe for him to be so employed.

The Contractor shall comply with the provisions of 'Safeguards to be adopted in the Operation and Management of Waterworks' published by HMSO (UK).

2.16 SITES ACCESS AND BOUNDARY

It is the Contractor's responsibility to make provision for any additional accommodation, any special or temporary wayleave, or any tip for the disposal of surplus materials, or any borrow pit or quarry required by him outside the Working Areas to carry out the Works.

For the purposes of this Clause, 'accommodation' shall be deemed to include housing, offices including office accommodation for the Engineer, workshops, warehouses, and storage areas.

In the event of the Contractor making use of any special or temporary wayleave or additional accommodation required by him or any tip for the disposal of surplus materials, or any borrow pit or quarry, he shall obtain the written consent of the owner, occupier or authority having charge of the land in which such wayleave, accommodation, tip, borrow pit or quarry is situated and shall make a record agreed by the owner, occupier or authority as aforesaid of the condition of the surface of that land before entering thereon.

The Contractor shall permit the Engineer and any person authorised by the Engineer access for the purposes of the Contract to any such special or temporary wayleave or additional accommodation.

In the event of the Contractor making use of any special or temporary wayleave or additional accommodation made available to him for the purpose of the Contract, the land in which such wayleave or accommodation is situated shall be deemed to be part of the Site.

The extent of the site is indicated below. The Contractor shall not use the site for any purpose not required by the Contract.

The site generally comprises Working Areas in each street or field sections where the various Works are to be constructed. Working Area boundaries will be as directed by the Engineer and will generally compose a strip extending not more than 5 metres from excavations under the Contract.

Access to the Site will be as follows:

a) New site roads or existing roads to be constructed are to be used as shown on the Issued Drawings. The contractor shall note that there is no motorable access to the headworks and will have to arrange for appropriate means of access.

b) The Contractor shall at all times confine his operations to those areas identified on the Issued Drawings as within the Site boundaries.

c) The Contractor shall execute the Works in such manner as to minimise interruption and inter-

ference with the operation of any existing facilities. Access to existing facilities shall be maintained to the satisfaction of the Engineer at all times.

d) The Contractor shall apply to the Engineer in writing at least 28 days before starting any work which involves interference with existing structures, equipment, etc. or otherwise interferes with or interrupts the Employer's normal operation. The Contractor shall not execute such work until he has received permission to proceed in writing from the Engineer.

2.17 USE OF PUBLIC HIGHWAYS AND ROADS

The Contractor shall ensure that roads and thoroughfares used by him in any way are not damaged as a result of such use and in the event of their becoming thus dirtied in the opinion of the Engineer, the Contractor shall take all necessary steps to repair them, at no extra cost to the Employer. The Contractor shall obtain all permits required for carrying out the Works on public roads and shall liaise with the appropriate authorities with regard to the timing and execution of the road works.

The Contractor shall be responsible for establishing and maintaining temporary road diversions for the duration of the roadwork. The road shall be kept open at all times during the road works period, and the work shall be carried out in such a manner as to minimise the disruption to traffic.

2.18 PRIVATE PROPERTY

The Contractor shall make a record, to be agreed by the Engineer, of the condition of the surfaces of any private property, private lands or of any public cultivated or maintained lands over which access to the Site lies before any work is commenced, to make them suitable for access. He shall keep such surfaces in a reasonable state of cleanliness and repair during the execution of the Works. On the termination of the Contractor’s use of such access he shall restore the surfaces to a condition at least equal to that existing before his first entry on them.

The Contractor shall not first enter any part of the Site in private lands without the prior permission of the Engineer and without first having obtained the consent of the owner of such lands. The Contractor shall give a minimum of two weeks’ notice to the Engineer of his intention to begin works in any area.

The Contractor shall provide and maintain at all times, vehicular and pedestrian access to all properties, private and public, to the satisfaction of the Engineer, and not impede access to any properties.

2.19 CLEARANCE OF THE SITE

The Contractor shall clear the Site to the extent required by the Engineer for checking the setting out. Clearance of the Site shall also include the demolition and removal of all articles, objects and obstructions, which are expressly required to be cleared. The Contractor shall not clear the Site of any structure without the prior written permission of the Engineer. The Contractor shall remove the material arising from such clearance and dispose of it in a manner and at a location, on or off the Site, to the approval of the Engineer.

The Contractor shall fill and make good with appropriate materials those cavities and losses of soil, which result from clearing the parts of the Site not subsequently to be occupied by the Permanent Works.

2.20 CONDITION OF THE SITE

The Contractor shall maintain the Site in a clean, tidy and healthy condition for the whole of such time as he is responsible for the care of the Works.

The Works shall be kept in a dry state and any water entering the Works from any source shall be collected and discharged in a safe manner approved by the Engineer.

2.21 ACCESS FOR THE EMPLOYER AND ENGINEER

The Contractor shall permit the Employer and the Engineer and any person authorised by the Employ-

er or the Engineer, including workmen of the Employer, other contractors or utility undertakings, access for the purposes of the Contract, or performing their normal duties, to all areas of the Site and to any additional accommodation or temporary wayleave for the duration of the contract period.

2.22 TOILETS AND LATRINES

Throughout the period of construction of the Works the Contractor shall provide, maintain and clean suitable and sufficient toilets and latrines for use by his employees. He shall ensure that his employees do not foul the site but make proper use of the toilets & latrines. The cost for the provision and maintenance thereof shall be included in the Contract Price.

Where practicable the toilets shall be connected to the nearest sewer, or if this is not practicable the Contractor shall provide an adequately sized septic tank and soakaway or alternative approved by the Engineer.

2.23 PHOTOGRAPHS

The Contractor shall supply negatives of photographs and unmounted positive prints not less than 250 x 200 mm of such portions of the Works, in progress and completed, as may be directed by the Engineer and specified herein. The negatives and prints shall not be retouched. The negative of each photograph shall be the property of the Employer and shall be delivered to the Engineer with the prints. No prints of these negatives shall be supplied to any other person without the written permission of the Engineer.

If so, directed by the Engineer, the Contractor shall supply transparencies and colour prints in lieu of black and white negatives and prints.

The photographs shall be in two categories:

- progress photographs
- record photographs

Both categories of photographs shall be properly referenced to the approval of the Engineer and on the back of each print shall be recorded the date of the photograph, the direction in which the camera was facing, an identifying description of the subject and the reference.

Photographs taken for record purposes as ordered by the Engineer or as specified herein shall be supplied with three prints, having the reverse of one subscribed with the signatures of the Contractor and the Engineer (or their authorised representatives) for the purpose of attestation. If required, the Contractor may at his own expense have an additional print similarly attested for his retention.

The Contractor shall supply one negative and three prints of each progress photograph ordered by the Engineer. He shall supply two additional prints of progress photographs selected by the Engineer for incorporation in albums. He shall supply two sets of albums, mount the prints, and title the prints and albums all to the approval of the Engineer.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in Uganda or in any other country shall not be carried out without written approval from the Engineer.

The Contractor can also use a digital camera. The above given specifications shall also be valid and shall be used in the same sense.

2.24 SETTING OUT

Final positions and levels of structures and the horizontal and vertical alignment of all canals, drains and pipelines shall be agreed with the Engineer prior to the commencement of works.

2.25 UNITS OF MEASUREMENT

All designs, drawings, specifications and manuals shall use SI (kg, m, s) units and all measurements, dimensions and performance data shall be quoted in those units.

2.26 LANGUAGES

All drawings, instructions, signs, notices, name-plates etc for use in the operation and maintenance of the completed works shall be in English.

Warning signs shall be in English.

2.27 CONTRACT SIGNBOARD

The Contractor shall supply and erect at least five contract signboards at locations to be specified by the Engineer. The signboards shall be of substantial construction to the approval of the Engineer and the lettering shall be black on a white background. The layout and dimensions of the signboards are shown in the Standard Details Drawings.

2.28 ADVERTISING

The Contractor shall not use any part of the Site for any form of advertising without the prior written approval of the Engineer.

2.29 PROTECTION OF EXISTING PUBLIC AND PRIVATE SERVICES

The Contractor shall notify all public authorities, utility companies and private owners of proposed works, which will affect them not less than one week before commencing the Works.

The Contractor shall adequately protect, uphold, maintain and prevent damage to all services and shall not interfere with their operation without the prior consent of the public authorities, utilities, utility companies, private owners, or the Engineer as appropriate.

If any damage to services results from the execution of the Works, the Contractor shall immediately carry out the following:

- Notify the Engineer and appropriate public authority, utility company or private owner
- Make arrangements for the damage to be made good without delay to the satisfaction of the public authorities, utility company or private owner as appropriate. The Contractor shall be liable for all costs for making good such damage.

The Engineer may issue instructions or make other such arrangements, as he deems necessary, to repair rapidly any essential services damaged during the execution of the Contract. Such arrangements shall not affect any liability to pay for making good the damage.

2.30 PERMITS

The Contractor shall be fully responsible for obtaining all necessary permits, licences and permissions required for the execution of the Works, prior to the commencement of the Works.

2.31 INSURANCE

The Contractor is required to maintain insurance for the Works in accordance with the Conditions of Contract, including insurance of all pipe work, fixtures, fittings, valves, meters etc. supplied by others, for which the Contractor is solely responsible. In addition, the Contractor is required to maintain the value of his insurance cover and Performance Security in respect of the rise and fall of costs, in accordance with the Conditions of Contract.

2.32 WORKMANSHIP AND QUALITY CONTROL

a) The onus rests with the Contractor to produce work which conforms in quality and accuracy of detail to all the requirements of the Specifications and Drawings, and the Contractor shall, at his own expense, institute a quality control system and provide experienced engineers, foremen, surveyors, materials technicians, other technicians and other technical staff, together with all transport, instruments and equipment, to ensure adequate supervision and positive control

of the Works at all times. The Contractor shall provide chainmen and labourers as necessary for the Engineer to carry out checks on the Works.

b) The Contractor shall conduct tests or have them conducted continually on a regular basis, to check the properties of natural materials and processed natural materials and of products manufactured on the site, such as concrete. Although not a requirement for the Contractor to conduct regular tests on any commercially produced products such as cement, steel and pipes, the Contractor shall remain fully responsible for any defective material or equipment provided by him. Similarly, the quality of all elements of the Works shall be checked on a regular basis so as to ensure compliance with the specified requirements.

c) The intensity of control and of tests to be conducted by the Contractor in terms of these obligations is not specified but shall be adequate to ensure that proper control is being exercised.

d) Where any natural materials or products made from natural materials are supplied, and upon completion of each element of the construction work, the Contractor shall test and check such materials, products and/or elements for compliance with the specified requirements and shall submit his results to the Engineer for approval. Such submission shall include all his measurements and test results and shall furnish adequate proof of compliance with the specified requirements.

e) No specific pay items are provided as compensation for the above obligations, including the provision of all samples delivered to the Engineer, the repair of places from which samples were taken, and the provision of the necessary personnel and testing apparatus and facilities, for which compensation shall be included in the bid rates of the Contractor for the various items of work to which these obligations apply.

f) The Contractor’s attention is also drawn to institute and implement a control system for monitoring the quality of the work and materials supplied. The Contractor's attention is also drawn to the provisions of the various sections of the Specifications regarding the minimum frequency of testing that will be required to undertake process control. The Contractor shall at his own discretion increase this frequency where necessary to ensure adequate control.

g) The Contractor shall submit to the Engineer for examination, the results of all relevant tests, measurements and levels indicating compliance with the Specifications on completion of every part of the Work.

2.33 THE SETTING OUT OF WORK AND PROTECTION OF BEACONS

a) The Contractor’s attention is drawn to the requirements of the relevant clause of the Conditions of Contract, and he shall also comply with all legal provisions in regard to surveying and setting out work.

b) The Contractor shall be responsible for the proper and accurate setting out of the works as required in the Contract documents. The Contractor shall provide all survey and measuring equipment and instruments necessary for his use in the execution of the scheduled Works.

c) The Contractor shall re-establish existing control points, replace and install new control point or points where necessary as guided by the Engineer.

d) Control points not affected by the works shall be protected and preserved by the Contractor. In the case of negligence on the part of the Contractor, or his employees, resulting in the destruction of control points, an amount equal to the cost of replacing the same may be deducted from subsequent payments due the Contractor.

e) Control points affected by the works shall be offset by the Contractor to the satisfaction of the Engineer.

f) The Contractor shall, prior to any setting out, submit to the Engineer for his approval, the method of setting out he proposes to employ. The plan shall include the accuracy, positions of the various types of stakes, method of marking stakes, and methods to be used for protecting stakes, etc. No survey work shall proceed prior to the Engineer's approval of the Contractor's plan. At least 24 hours before he intends to survey any portion of the Works, the Contractor shall give written notice to the Engineer. Such notice shall include time, location and type of Works to be set out. The Contractor shall set out the Works and obtain approval of his setting out before proceeding with construction.

g) In general, the Contractor shall check for the existence of original marks, lines and levels of reference not less than one month prior to commencing works in any section, to allow sufficient time for reinstatement of markings, and checking of lines and levels. Any discrepancies encountered shall be immediately reported to the Engineer, for instruction and co-ordination. The Contractor shall be deemed to have allowed in his bid price for checking and reinstatement of original markings.

h) Special care shall be exercised during construction not to damage, displace or disturb property and trigonometrical survey beacons. If such beacons are disturbed or destroyed by the Contractor, they shall be replaced without delay by a registered land surveyor at the Contractor's expense.

i) The Engineer may if he deems it necessary, revise the line and grade and will require the Contractor to adjust the stake-out accordingly.

j) The Contractor shall check the condition of all reference and level beacons and shall satisfy himself that they have not been displaced and are true in regard to position and level. If beacons have been destroyed, displaced or damaged before the site is handed over to the Contractor, the Contractor will arrange to have new beacons installed. A beacon, which has been displaced, shall not be used unless its true position and level have been re-established and the new values verified by the Engineer.

k) Where a beacon is likely to be displaced during construction operations, the Contractor shall establish suitable reference beacons at locations where they will not be displaced during construction. No beacon shall be covered over, displaced or destroyed before accurate reference beacons have been established and details of the positions and levels of such beacons have been submitted to and approved by the Engineer. The Contractor’s reference beacons shall be of at least the same quality and durability as the existing beacons.

l) The Contractor shall submit to the Engineer the method of setting-out he proposes to employ. To ensure beyond all doubt that the complex elements of the road, such as traffic interchanges, structures and other important features are located truly and correctly, the Contractor shall check all setting-out by a second method. The Engineer may at any time request the Contractor to submit proof that his setting-out has been satisfactorily checked.

m) In cases where the displacement of or damage to property beacons or trigonometrical survey beacons is unavoidable, the Contractor shall notify the Engineer in good time so that he may arrange to have such beacons suitably referenced and later on reinstated. The cost of such work, if paid for by the Contractor, shall be reimbursable as extra work, as provided for in the Conditions of Contract.

n) For the purposes of this Clause and of the relevant clause of the Conditions of Contract, any beacon made from a metal peg cast in concrete and any boundary beacon, whether or not cast in concrete, shall be regarded as a beacon. To protect beacons, shall be splayed at corners so as to avoid the use of corner posts in the same position as property or trigonometrical survey beacons, all as shown on the Drawings.

o) The setting-out of work will not be measured and paid for separately, and compensation for the work involved will be deemed to be covered by the rates bid and paid for in the various items of work included in this Contract. No separate payment will be made to the Contractor for the provision of camber boards, straight edges and measuring wedges, their cost being included by the Contractor in his rates in the Bill of Quantities.

p) Final horizontal and vertical alignment of all roads and canals shall be agreed with the Engineer prior to the commencement of works.

q) No separate payment will be made for stake-out, adjustments to the stake-out, or to establish and compute new points/benchmarks the relevant costs being deemed to be included in the bid rates for other items in the Bill of Quantities.

2.34 METHODS OF MEASUREMENTS

a) Units of measurements

All work shall be measured in accordance with the SI system of metric units.

b) Bill of Quantities

The quantities set out in the Bill of Quantities are estimated quantities and are used for the comparison of bids and for awarding the Contract. It must be clearly understood that only the actual quantities of work done or materials supplied will be measured for payment, and that the scheduled quantities may be increased or decreased as provided for in the Conditions of Contract. Furthermore, this shall not call for a new/revised rate

c) Measurement of completed Work

All distances shown on the Drawings are horizontal distances, which will be used in calculating the quantities of fill and embankment layers for purposes of payment. All cross-sections shall be taken in a vertical plane.

No material shall be measured in the vehicle for payment purposes.

Structures shall be measured to the neat lines shown on the Drawing and shall include any changes ordered in writing by the engineer and, for purposes of payment, the calculated volume of concrete structures shall include the volume of reinforcing steel, and minor ducts up to 150 mm in diameter.

2.35 METHODS OF PAYMENT

a) Contract rates: In computing the final Contract amount, payment shall be based on the actual quantity of authorised work done in accordance with the specifications and drawings. The bid rates shall apply, subject to the provisions of the Conditions of Contract, irrespective of whether the actual quantities are more or less than the scheduled quantities.

Where no rate or price has been entered against a pay item in the Bill of Quantities by a bidder it shall be understood that he does not require any compensation for such work. Where, however, a pay item described in these Specifications or in the Special Specifications does not appear in the

Bill of Quantities, the Contractor will receive reasonable compensation for such work if required, unless anything to the contrary has been determined elsewhere.

b) Rates to be inclusive: The Contractor shall accept the payment provided for in the Contract and represented by the rates bid by him in the Bill of Quantities, as payment in full for executing and completing the work as specified, for procuring, furnishing, placing and installing all materials, for procuring and providing labour, supervision, constructional plant, tools and equipment, for wastage, transport, loading and off-loading, handling, maintenance, temporary work, testing, quality control including process control, overheads, profit, risk and other obligations and for all other incidentals necessary for the completion of the work and obligations during the Defects Liability Period.

c) The Contractor shall note that the cost of all Works and materials for minor construction details at bridges, for example small quantities of caulking compound and joint filler (other than expansion joints), anchor-bar covers, etc, not shown in the Bill of Quantities, shall be included in the bid rates for concrete.

This CLAUSE shall apply in full to all pay items except where these requirements may be specifically amended in each case.

2.36 THE MEANING OF CERTAIN PHRASES IN PAYMENT CLAUSES

i) Procuring and furnishing (material).

Where any of the words “supply”, “procure”, “provide”, “provision of”, “furnish (material)”, are used in the description of a pay item, it shall mean the supply and delivery to the point of use of all materials of any kind required for the work covered by the particular pay item, including all tax, purchase costs, claims, damages, royalties and transport costs involved. In the case of borrow materials, gravel, clay, rock, aggregate, stone, sand and black soil, the Contractor is deemed to have identified and ascertained sources of suitable quality material to meet technical specification within a radius of 120km from the site for the works, and the pay items shall also include all negotiations with the Owners concerned, excavating, producing, preparing, processing, testing, hauling and delivering the material to the point of use; the construction, repair, maintenance and making good after completion of all access roads, and all work required in opening, using and finishing off borrow pits unless covered by other pay items in the Bill of Quantities.

ii) Placing Material

The phrase “placing material” shall mean the off-loading, spreading, blending, processing, watering, mixing, shaping and compacting (where specified) of the material in the embankment layer, fills and bypasses, as well as the procuring, furnishing, applying and admixing of water, the breaking-down of oversize material, the removing of oversize material which cannot be broken down, correcting irregular or uneven surfaces or layers, the thickness of which is not to specification, finishing-off to within the specified tolerances, the refilling of test holes and maintaining the completed work.

The phrase, “procuring, furnishing and placing” shall mean procuring and furnishing in addition to placing, all as defined herein.

iii) Pay Items

The description under the pay items in the various sections of the Specifications, indicating the work for which allowance shall be made in the bid rates for such pay items, are for the guidance of the Contractor and do not necessarily repeat all the details of work and materials required by and described in

the Specifications.

These descriptions shall be read in conjunction with the relevant Specifications and Drawings, and the Contractor shall, when bidding, bear in mind that his rates shall be inclusive as specified in SUBCLAUSE (b) above.

iv) Materials on the Site

Payment in terms of the relevant clause of the Conditions of Contract for materials on the site, which have not yet been incorporated in the works, will be calculated at 80% of their purchase price, or, in the case of crushed stone which has not been purchased but has been produced on the site, at 50% of the bid rate for such material.

The Engineer may at his sole discretion allow payment under "materials on the site" in respect of articles such as precast beams manufactured and stored off site, subject to their having been completed, to proof of their ownership as being that of the Contractor, and to the articles being clearly marked with the Contractor's name, the Contract number and other particulars in accordance with the Engineer's instructions.

v) Rate-only items

Against an item in the Bill of Quantities where no quantity is given but a rate only is required, the Contractor shall fill in a rate or amount which will constitute payment for work which may be done in terms of this item.

Work under rate-only items will be paid for only if it has been executed in terms of a written instruction by the Engineer.

vi) Provisional Sums

The Bill of Quantities may contain Provisional Sums, so designated, which are entered as a preliminary allowance to cover the cost of work, materials, goods or services to be provided by the Contractor and which have not been fully specified or measured or to cover the cost of undefined items of work or contingent expenditure, for which no rates are applicable but for which the Contractor is to be paid according to the applicable provisions of the Contract.

Work done under such Provisional Sums shall only be executed upon a written order by the Engineer which order shall also specify the method of payment. The expenditure in respect of a Provisional Sum for work ordered by the Engineer shall be entirely at his discretion and any final expenditure in respect of a Provisional Sum may be more, less or equal to the amount provided in the Bill of Quantities.

Payment as specified in the order given by the Engineer shall be either at contract rates, where such are applicable, or where none is applicable, the Contractor shall submit a separate quotation to the Engineer.

vii) Retention money

All payments are subject to deduction of Retention Money, as provided in the Conditions of Contract.

2.37 CERTIFICATE OF COMPLETION OF THE WORK

A certificate of completion of the Works (Taking Over Certificate) in terms of the relevant clause of the Conditions of Contract will be issued only if 95% of contracted works are completed.

2.38 ALTERNATIVE DESIGNS AND OFFERS

Unless anything to the contrary has been determined elsewhere in the Contract documents, a bidder may, together with his bid for the original designs contained in the Contract documents, submit alternative designs and offers for consideration. Such alternative designs and offers shall be subject to the following conditions and requirements.

a) Bids

An alternative offer or design will be considered only if the bid for the original items has been fully priced and completed.

Unless the alternative offer stipulates to the contrary, it shall be assumed that the period for completion of the Works shall be the same as for the original design.

An alternative offer or design shall be submitted together with the bid for the original items or design, otherwise it will not be considered when bids are adjudicated.

Calculations, drawings and a modified Bill of Quantities (as determined hereafter) in respect of each alternative offer or design shall accompany the alternative bid offer.

b) Design codes

Alternative designs shall be executed strictly in accordance with the appropriate design codes and prescriptions of the Employer. Copies of such codes and prescriptions will be available for perusal at the office of the Engineer, but the onus rests with the Contractor to ensure that he complies with the design requirements of the Employer.

c) Preliminary calculations

Preliminary calculations for an alternative design shall be submitted with the bid. Such calculations shall give adequate details so as to enable an assessment to be made of the general efficacy of the design and of its principal elements, also of the degree to which the design prescriptions and codes of the Employer are being complied with. The calculations shall be clear and in a logical sequence and shall clearly reflect all the design assumptions.

d) Preliminary drawings

Preliminary drawings of the alternative designs shall also be submitted with the bid. These drawings shall comprise adequate layout plans, elevations and sections and shall clearly illustrate the general efficacy of the design and its principal elements. Foundation depths and other elements depending on foundation conditions shall, in so far as may be applicable, be in accordance with foundation particulars appearing in the Contract document.

e) Quantities

Each alternative offer shall be accompanied by a modified priced Bill of Quantities compiled in accordance with the Standard Specifications, in so far as it is applicable. In addition to the Bill of Quantities, a set of calculations shall be supplied to show how the quantities have been determined. All assumptions in regard to foundation conditions or other factors which will determine quantities shall be clearly and conspicuously marked by underlining or colouring, and shall indicate whether or not the assumptions have been based on information furnished in the Contract documents (with the necessary references).

f) Further details

Should the Engineer find that the calculations and drawings submitted for alternative designs are not complete enough for proper adjudication of the alternative designs, it may mean that no further consideration will be given to such alternative designs. The Employer, however, reserves the right to call on the bidder to submit such further calculations and drawings as may be required. If such further details are not submitted within ten days of having been requested, the alternative designs may possibly not be given further consideration

g) Preliminary adjudication of alternative designs

The Engineer will undertake a preliminary scrutiny of any alternative designs for compliance with the specified requirements of the Employer. Should he find any mistakes or unsatisfactory aspects, he may afford in the Contractor the opportunity to rectify them within a period to be determined by the Engineer. However, it is emphasised that the preliminary scrutiny of the design and bid by the Engineer, by its very nature, cannot be comprehensive, and no guarantee can be given in this regard that all the mistakes made by the Contractor will in fact be detected. Any correction of such mistakes shall be made with the bid price of the Contractor being retained, and, wherever necessary, the priced Bill of Quantities for the alternative design shall be adjusted accordingly.

h) Acceptance of alternative design

The Contractor shall note that the acceptance of a bid which includes alternative designs shall mean that the alternative designs have been approved in principle only. If the final calculations, drawings and details do not comply with the specified requirements, such alternative designs may be rejected, unless they are suitably amended by the Contractor so as to be acceptable to the Engineer.

i) Final drawings and calculations and the price. Bill of Quantities

Where a bid with an alternative design has been accepted, the Contractor shall, not less than three months before he intends starting with the construction of such design, submit to the Engineer a complete set of working drawings, detailed calculations and a complete Bill of Quantities, for approval. The Bill of Quantities shall be based on the preliminary Bill of Quantities, but with the necessary adjustments in quantities and prices and with the bid price for the alternative design being retained.

Within six weeks of having received the above, the Engineer will indicate which drawings, calculations, quantities, prices and other particulars are acceptable to him and which not, with reasons furnished. The Contractor shall then submit to the Engineer in good time any modified drawings and other particulars for approval, for which he will require two weeks. Any delay arising from the fact that the amended particulars do not meet the requirements shall be the responsibility of the Contractor.

No work which will be affected by an alternative design may be commenced, unless the Drawings, Bill of Quantities and prices for such alternative design have been approved. Should the Contractor fail to modify any drawings, calculations, quantities, prices or any other particulars to the satisfaction of the Engineer, the alternative design will be rejected and the original design shall be constructed for the same amount as has been bid for the alternative design.

j) Responsibility for alternative design

The approval of a design by the Engineer shall in no way relieve the Contractor of his responsibility to produce a design which conforms in all respects to all the specified requirements and which will be suitable for the purpose envisaged.

Should it appear later during construction or during the maintenance period that the design does not conform to the specified requirements, the Contractor only shall be liable for any damage arising there from and he shall, at his own expense, do all the necessary work to ensure that the structure conforms to all the specified requirements.

k) Payments for alternative design

Payments for alternative designs will be based on the finally approved Bill of Quantities and rates for such designs. The lump sum for an alternative design will remain fixed and will be the final amount payable to the Contractor in regard to such design, except only for deviations arising from:

- foundation conditions which differ from foundation conditions shown in the contract documents, or in regard to assumptions regarding foundation conditions stated in his bid by the Contractor and accepted by the Engineer.

- changes not arising from any failure or fault of the Contractor, but from modifications requested by the Engineer.

l) Cost of checking alternative designs

The Contractor shall, in his bid for each alternative design, include an item to cover the cost for checking his design. This item shall be 5% of the bid amount of the design without any price adjustment in terms of the relevant clause of the Conditions of Contract being considered, and the amount will be payable to the Engineer only upon an authorisation issued by the Employer.

2.39 FAULTY WORK, REMEDIAL WORK

a) General

Any work which fails to comply with the Specifications shall be rejected and the Contractor shall, at his own expense, make good any defects, as directed by and to the satisfaction of the Engineer.

When any part of the Works or any equipment or material is found, upon examination by the Engineer, not to conform to the requirements or at any stage before final acceptance is damaged so that it no longer conforms to the requirements of the Specifications, the Engineer may order its complete removal and replacement, at the Contractor's expenses, with satisfactory work, equipment or material, or he may permit the Contractor to apply remedial measures in order to make good any such defects or damage. The actual remedial measures taken shall at all times be entirely at the Contractor's own initiative, risk and costs, but subject to the Engineer's approval regarding the details thereof.

In particular, remedial measures shall ensure full compliance with the requirements of the Specifications of the final product, shall not endanger or damage any other part of the Works, and shall be carefully controlled and submitted to the Engineer for examination when completed or at any intermediate stage as may be required.

For the guidance of the Contractor, an indication is given below of what would normally be required in the more common cases of defects or damage, but the Engineer will in no way be bound to accept or approve the measures given below, as the actual remedial measures will be dictated by the circumstances of each particular case.

b) Earthworks

i) Where a cut slope has been over excavated or undercut or where the floor of a cutting has been taken too deep, back filling and re-compaction shall be carried out as set out in SECTION 7.5 d). All necessary measures shall be taken to drain away groundwater that may accumulate in back filled sections.

ii) Excess width of fills shall to be trimmed down if required by the Engineer.

iii) Where erosion has damaged the surface of cuts or fills, the damage shall be made good by back filling with suitable material and re-trimming. In more serious cases in the opinion of the Engineer, the slopes shall be cut back by benching, back filled and compacted to the required standard of compaction with suitable light equipment and then re-trimmed.

c) Concrete

Concrete work will normally require the cutting-back and complete removal of any weak or honey combed sections and making good by using special epoxy adhesives to bind fresh concrete to old concrete. Cracks, when permitted to remain, shall be injected with suitable epoxy compounds, and test cores shall then be drilled for testing the efficacy of the injection process

2.40 AUTHORISED MEASUREMENTS AND TOLERANCES

a) The work specified in the various sections of these specifications shall comply with the various dimensional and other tolerances specified in each case. Where no tolerances are specified, the

standard of workmanship shall be in accordance with normal good practice. No representation is made that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more tolerances relating to other aspects of the Work may lead to its rejection. The latter would apply particularly in respect of level tolerances on layer work and the related requirements regarding layer thicknesses.

b) In the description of certain pay items, where it is stated that quantities will be determined from the authorised dimensions, this shall be taken to mean the dimensions as specified or shown on the Drawings, or, if changed, as finally instructed by the Engineer, without any allowance for tolerances being specified. If the work is therefore constructed in compliance with the authorised dimensions, plus or minus any tolerances allowed, quantities will be based on the authorised dimensions regardless of the actual dimensions to which the work is constructed.

c) Where the work is not constructed in accordance with the authorised dimensions, plus or minus any tolerances allowed, the Engineer may nevertheless, in his sole discretion, accept the work for payment. In such cases no payment will be made in respect of quantities of work or material in excess of those calculated from the authorised dimensions and where the actual dimensions are less than the authorised dimensions, minus any tolerance allowed. Quantities for payment shall be based on the actual dimensions as constructed.

2.41 USE OF EXPLOSIVES

a) For handling of explosives and blasting, the Contractor shall employ only persons experienced in blasting and these persons must be in possession of an approved current blasting certificate or be able to demonstrate their experience to the satisfaction of the Engineer. The purchase, transport, storage and use of explosives shall be carried out in accordance with the most recent Explosive Ordinance and Rules issued by the Government of Uganda.

b) The Contractor shall use explosives for blasting in connection with the Works only at such times and places and in such a manner as the Engineer may approve but such approval shall not relieve the Contractor from his responsibilities for injury, loss, inconvenience and annoyance to persons, damage to the work and adjoining structures, roads, places and things, and injury or damage to animals and property consequent to the use of such explosives. The Contractor shall be entirely liable for any accident which may occur and shall save the Employer and the Engineer harmless and indemnified from all claims arising there from. Where loss, inconvenience, injury or accident is likely to be caused to persons, animals, works, property, places and things, the Engineer shall have the power to regulate or prohibit blasting and in the event of such regulations or prohibition the Contractor shall have no claims against the Employer.

c) Contractor will be permitted to use explosives for breaking up rock and hard materials during excavation, for demolishing existing structures, and for such other purposes for which it may normally be required, on the approval of the Engineer and subject to the following conditions:

- The Engineer will have the right to prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or adjoining structures is too high. Such action by the Engineer shall not entitle the Contractor to any additional payment for having to resort to other less economical methods of demolition unless otherwise provided in the Special Specifications or the Bill of Quantities.
- Legal provisions in regard to the use of explosives and the requirements of the Inspector of Explosives or equivalent shall be strictly complied with.
- The Contractor shall, at his own cost, make arrangements for supplying, transporting, storing and using explosives.
- Before any blasting is undertaken, the Contractor together with the Engineer, shall examine

and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record, together with the Owner thereof, the extent of any cracks or damage that may exist before blasting operations are commenced. It shall be the responsibility of the Contractor to make good, at his own expense, any further damage to such houses, buildings or structure which results from the blasting operations.

- Where there is danger of damage to power or telephone lines or underground or other services or any other property, the Contractor shall suitably adapt his method of blasting and the size of the charges, and shall take adequate protective measures, such as cover blasting, in order to limit the risk of damage as far as possible.
- The Engineer shall, twenty- four hours before each blasting operations is carried out, be advised thereof, in writing, unless otherwise agreed on the Engineer.
- No explosives of any kind shall be used by the Contractor without the prior consent of the Engineer in writing. The Contractor shall purchase and import his own explosives for use in connection with the Works and shall comply with all relevant ordinances, instructions and regulations which the Employer, or other person or persons having due authority, may issue from time to time regarding the handling, transportation, storage and use of explosives.
- The Contractor shall comply with the Statutory Regulations in force in Uganda regarding the use and storage of explosives.
- Before commencing demolition work on any unit, the Contractor shall ensure that all affected public utilities have been disconnected as directed by the Engineer and any necessary temporary arrangements made. Any material or equipment required by the Employer shall be transferred to his own store and the remaining debris shall become the property of the Contractor who shall dispose of it from the Site.
- The Contractor shall at all times when engaged in blasting operations post sufficient warning flags and other measures to the full satisfaction of the Engineer.

2.42 ACCESS TO CONTRACTOR'S RECORDS, MONTHLY SITE MEETINGS AND PROGRESS PHOTOGRAPHS

- The Engineer shall at all times have full access to all files, drawings, documents, records and whatsoever in connection with the execution of the Works.
- The Contractor or his authorised representative shall attend monthly meetings on the site with representatives of the Employer and Engineer, at dates and times to be determined by the Engineer. Such meetings will be held for evaluating the progress of the Contract which any of the parties represented may wish to raise.
- The Contractor shall arrange with a photographer approved by the Engineer for the taking of progress photographs during the construction of the Works. The Contractor shall submit each month good quality photographs of at least 5 different subjects as agreed with the Engineer. For each subject, the Contractor shall supply at least three colour photographs plus the negatives reproduced in three sets in size 100 x 150 mm. The photographs shall be arranged in plastic photo-pockets with 3 photographs on each side and with a label next to the photograph giving appropriate title and a number with reference to a suitable key plan. Negatives shall also be suitably filed and referenced.
- If so, specified in the Special Specifications the progress photographs shall be taken by digital camera (min. 2.1 million pixels). In this case a CD-ROM with the photographs as well as prints as specified above shall be provided. No separate payment will be made for attending site meetings or furnishing progress photographs, the relevant cost being included by the Contractor in his rates in the Bill of Quantities.

2.43 LEGAL PROVISIONS

- The Contractor shall keep himself fully conversant with the latest enactment, provisions and regulations of all legislative and statutory bodies and in all respects and at all time shall comply with such enactment, provisions and regulations in regard to executing the Contract

2.44 POSITION OF WORKS

- The Works are shown on the Drawings, but the precise positions, lines and directions of all the Works are not necessarily indicated and will be determined by the Engineer as the Contract proceeds.

2.45 ACCESS TO SITE(S)

- The Contractor shall make his own arrangements for access to the various parts of the Site where works are to be constructed but all such accesses shall be subject to the approval of the Engineer.
- Where the access to the Site proposed to be used by Contractor lies across the land of any third party, the Contractor shall produce to the Engineer the written consent of the owner and the occupier of the land over which the access lies before making use of the same. The Contractor shall also make a record to be agreed by the Engineer of the conditions of the surfaces of any land (and of any crops on such land) over which access lies before he uses it for access purposes and he shall keep all such surfaces in a reasonable state of repair during the execution of the Works. On the termination of the Contractor's use of such access he shall restore the lands to a condition at least equal to that existing before his first entry on them.
- It is the Contractor’s responsibility to make provision for any additional accommodation, any special or temporary wayleave, or any tip for the disposal of surplus materials, or any borrow pit or quarry required by him outside the Working Areas to carry out the Works.
- For the purposes of this Clause, ‘accommodation’ shall be deemed to include housing, offices including office accommodation for the Engineer, workshops, warehouses, and storage areas.
- In the event of the Contractor making use of any special or temporary wayleave or additional accommodation required by him or any tip for the disposal of surplus materials, or any borrow pit or quarry, he shall obtain the written consent of the owner, occupier or authority having charge of the land in which such wayleave, accommodation, tip, borrow pit or quarry is situated and shall make a record agreed by the owner, occupier or authority as aforesaid of the condition of the surface of that land before entering thereon.
- The Contractor shall permit the Engineer and any person authorised by the Engineer access for the purposes of the Contract to any such special or temporary wayleave or additional accommodation.
- In the event of the Contractor making use of any special or temporary wayleave or additional accommodation made available to him for the purpose of the Contract, the land in which such wayleave or accommodation is situated shall be deemed to be part of the Site.
- The Contractor shall not use the site for any purpose not required by the Contract.
- The site generally comprises Working Areas in each field sections where the various Works are to be constructed. Working Area boundaries will be as directed by the Engineer and will generally compose a strip extending not more than 5 metres from excavations under the Contract.
- New site roads or existing roads to be constructed are to be used as shown on the Issued Drawings. The contractor shall note that there is no motorable access to the intake and will have to arrange for appropriate means.
- The Contractor shall at all times confine his operations to those areas identified on the Issued Drawings as within the Site boundaries.
- The Contractor shall execute the Works in such manner as to minimise interruption and interfer-

ence with the operation of any existing facilities. Access to existing facilities shall be maintained to the satisfaction of the Engineer at all times.

– The Contractor shall apply to the Engineer in writing at least 28 days before starting any work which involves interference with existing structures, equipment, etc or otherwise interferes with or interrupts the Employer's normal operation. The Contractor shall not execute such work until he has received permission to proceed in writing from the Engineer.

2.46 SECURITY OF THE WORKS

Watching of the Works shall be provided by the Contractor at his own expense. If the Engineer considers it necessary, he will order in writing that additional watchmen be provided all at the Contractor's expense.

2.47 SAFETY & REGULATIONS

The Engineer shall be notified by the Contractor immediately any accident occurs whether on Site or off Site in which the Contractor is directly involved which results in any injury to any person whether directly concerned with the Site or whether a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

Transportation of any material by the Contractor shall be in suitable vehicles which when loaded do not cause spillage and all loads shall be suitably secured. Any vehicle which does not comply with this requirement or any of the local traffic regulations and laws shall be removed from the Site.

Arrangement shall be made with the appropriate Authority before entering in or working on existing and associated works.

The Contractor shall comply with all statutory and other regulations concerning the safety of his site staff, operatives, staff of the Employer and Engineer and members of the public, as a result of his operations. He shall obtain copies of all regulations and shall make them available on Site for inspection by the Engineer.

Notwithstanding the above the Contractor shall ensure that the following primary site safety rules are adhered to at all times:

- All open excavations shall be fenced off with temporary fencing at all times, protected with warning tapes and installed with warning signs in local languages and English and shall be adequately visible during day and night.
- Excavating and earthmoving plant and equipment must not encroach on live carriageways at any time. The Contractor shall ensure that all items of plant working adjacent to live carriageways are accompanied by a Banksman at all times.
- Construction materials, bedding material and excavated material stored adjacent to the pipe trench must be safely and securely stored, and must not encroach onto the live carriageways, pedestrian footpaths, private or public access ways or watercourses, unless prior approval is given by the Engineer.

2.48 VEHICLES FOR THE ENGINEER AND EMPLOYER

The Contractor shall provide new vehicles as listed below licensed and comprehensively insured for replacement value and shall maintain and provide fuel, oil and replacement parts during the whole of the Contract period. The vehicles shall be for the exclusive use of the Engineer, his staff and the Employer during the Contract period. The Contractor shall also insure the vehicles and passengers fully comprehensively for any driver at all times throughout the Contract Period.

i) 1 Wheel Drive Station Wagon
ii) 2 Wheel Drive Pickups, with double cabin.

The vehicles under (i) and (ii) shall have factory installed air-conditioning units and power steering. The vehicles shall have diesel-engines (2750-3000CC) and shall be provided with the following optional equipment, factory installed seat belts, rear pintle hook, front hook, door mirrors, one spare wheel, toolbox with necessary tools, jack etc. Makes of vehicles shall be approved by the Engineer prior to ordering.

The Contractor shall service and maintain in good working order the vehicles at all times. In the event of any vehicle being unavailable for the use due to accident, damage or its being maintained or repaired, the Contractor shall immediately provide a substitute acceptable to the Engineer.

In the event of the Contractor defaulting on this obligation, the Engineer shall be authorised to hire a substitute similar vehicle for the period of non-availability of the Contractor's vehicles, and the cost incurred will be recovered from the Contractor.

Upon completion of the Contract, the Engineer's vehicles specified herein shall revert to either the Contractor or the Employer depending or as specified in the Special Specifications and/or Bills of Quantities.

3 ENVIRONMENTAL PROTECTION AND WASTE DISPOSAL

3.1 SCOPE

This section covers the Environmental Protection and Waste Disposal to be exercised by the Contractor in all work on the Contract. The obligations herein do not prejudice any other clauses in this Specification.

3.2 GENERAL

The Contractor shall comply with the National Environment Statute, 1995, or later Statutory Regulations in force in Uganda regarding environmental protection and waste disposal and shall liase with the National Environment Management Authority (NEMA) and local authorities.

The Contractor shall for those of his activities which have, or are likely to have, an impact on the environment, keep records relating to:

- The amount of waste and by-products generated by the activity
- The economic value of the activity
- The observable effects of the environment
- How far, in the opinion of the Contractor, the provisions of the Statute have been complied with.

The Contractor shall afford the officials of the relevant authority's free access to inspect the project site, plant, workshops and the like to check whether the provisions in the Statute are being complied with.

3.3 LANDSCAPE PRESERVATION

General

a) The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads/dams, or excavation operations, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the Contractor's construction operations and equipment. The edges of clearings and cuts through trees, shrubbery, and vegetation shall be irregularly shaped to soften the undesirable visual impact of straight lines. Movement of labour and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to grazing land, crops, or property.

b) Except as otherwise provided in this Specifications special reseeding or replanting will not be required under these specifications; however, on completion of the work, all work areas not seeded shall be scarified and left in a condition which will facilitate natural re-vegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the Contractor's operations shall be repaired, replanted, reseeded or otherwise corrected as directed by the Engineer, and at the Contractor's expense.

The species used for replanting must not be listed as a noxious weed and the seed blends used must not contain seeds from such.

c) The use of fertiliser can only be carried out with the approval of the Engineer. Especially near open water and at sandy soils near drinking water interests, the use of fertilisers should be avoided. Leaching from manure to open water areas could also cause nutrients pollution to the waters, and the application of such should therefore be avoided, and only carried out if approved by the Engineer. When available well decomposed compost should be preferred to manure.

d) Access roads: The location, alignment, and grade of access roads shall be subject to approval of

the Engineer. When no longer required by the Contractor, access roads shall, if required by the Engineer, be restored to the original contour and made impassable to vehicular traffic. The surfaces of such access roads shall be scarified as needed to provide a condition which will facilitate natural re vegetation, provide for proper drainage, and prevent erosion.

e) Construction facilities: The Contractor's workshops, office, and yard area shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all temporary buildings, including concrete footings and slabs, and all construction materials and debris shall be removed from the site. The area shall be regraded, as required, so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

f) Blasting precautions: In addition to any requirements of local regulations, the Contractor shall adopt precautions when using explosives which will prevent scattering of rocks, stumps, or other debris outside the work area, and prevent damage to surrounding trees, shrubbery, and vegetation.

g) Quarries, borrow pits and storage areas etc. Problems with erosion in the borrow pit must be avoided, if necessary, by the construction of temporary banks, but preferably by the choice of pits. When they are no longer required, all quarry sites, borrow pits and areas used for the disposal or storage of surplus materials and asphalt plants shall be reinstated by landscaping including the replacement and spreading of topsoil as directed by and to the satisfaction of the Engineer. Steep quarry walls shall be fenced to prevent livestock and people falling in the quarry. Permanent water holes shall be left unchanged

3.4 TEMPORARY SOIL EROSION CONTROL

a) Scope: These Works shall consist of temporary control measures as shown on the Drawings or required by the Engineer during the process of the Works, to control soil erosion and water pollution, by use of berms, dykes, silt fences, brush barriers, dams, sediment basins, filter mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. Appropriate control measures will be required to avoid emission of high concentration of sediments into wetlands, swampy areas and other particular sensitive areas.

The temporary erosion control provisions shall be coordinated with permanent erosion control features to assure economical, effective and continuous erosion control throughout the period of the Works.

b) Construction: A schedule of proposed temporary (and permanent) soil erosion control Works shall be developed by the Contractor at the commencement of the Contract, in consultation with the Engineer and to his satisfaction.

c) The Contractor shall carry out (and maintain) temporary erosion control to prevent soil erosion that will adversely affect construction operations, damage adjacent properties, or cause contamination of adjacent streams or other watercourses, lakes, ponds, swamps or other areas of water impoundment. Such Works may involve construction of temporary berms, dykes, dams, sediment basins, slope drains or use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds, to the extent considered desirable and practicable by the Engineer.

d) Temporary erosion control may include construction outside the right-of-way where such work is necessary, as a result of roadway construction, such as borrow pit and quarry operations, haul roads and equipment storage sites.

e) The Contractor shall incorporate all permanent erosion control features as shown on the Drawings into the Works at the earliest practicable time as outlined in his schedule, to minimise the need for temporary erosion control measures.

Where erosion is a problem, clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control features can follow immediately

thereafter if conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.

f) The Engineer will limit the area of clearing and grubbing, excavation, borrow and embankment operations in progress commensurate with the Contractor's capability in keeping the finished grading, mulching, seeding and other permanent erosion control measures current in accordance with the schedule. Should seasonal limitations make such co-ordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

g) The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

h) In the event that temporary erosion control measures are required due to the Contractor's negligence, carelessness or failure to install permanent controls as part of the Works, scheduled or ordered by the Engineer, such Works shall be carried out by the Contractor at his own expense.

i) The Works prescribed in this Clause shall not be measured for direct payment, but shall be considered as subsidiary Works, the costs of which will be deemed to be included by the Contractor in his rates in the Bill of Quantities for other items of work.

3.5 PRESERVATION OF TREES AND SHRUBBERY

a) Preservation

All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall be protected from any damage that may be caused by the Contractor's construction operations and equipment. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage, or other operations; and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Engineer. The removal of trees or shrubs will be permitted only after prior approval by the Engineer.

The layout of the Contractor's construction facilities such as workshops, ware houses, storage areas, and parking areas; location of access and haul routes; and operation in borrow and spoil areas shall be planned and conducted in such a manner that all trees and shrubbery not approved for removal by the Engineer shall be preserved and adequately protected from either direct or indirect damage by the Contractor's operations. Except in emergency cases or when otherwise approved by the Engineer, trees shall not be used for anchorage. Where such use is approved, the trunk shall be wrapped with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.

b) Repair or treatment of damage

The Contractor shall be responsible for injuries to trees and shrubs caused by his operations. The term "injury" shall include, without limitation, bruising, scarring, tearing, and breaking of roots, trunk or branches. All injured trees and shrubs shall be repaired or treated without delay, at the Contractor's expense. If damage occurs, the Engineer will determine the method of repair or treatment to be used for injured trees and shrubs as recommended by an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the Contractor. All repairs or treatment of injured trees shall be performed under the direction of an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the Contractor.

c) Replacement

Trees or shrubs that, in the opinion of the Engineer, are beyond saving shall be removed and replaced early in the next planting season. The replacements shall be the same species, or other approved species, and of the maximum size that is practicable to plant and sustain growth in the particular environment. Replacement trees and shrubs shall be stayed, watered, and maintained for a period of 1 year.

Any replacement tree or shrub that dies shall be removed and replaced, as directed by the Engineer, with such replacements being maintained for a period of 1 year from the date of replacement.

To obtain the maximum success with the planting, the trees shall be well suited for the environment. This will normally mean native species of trees or cultivated trees from local nurseries.

3.6 PREVENTION OF WATER POLLUTION

a) General

The Contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Excavated materials or other construction materials shall not be stockpiled or deposited near or on-stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the watercourse itself.

Turbidity increases in a stream or other bodies of water that are caused by construction activities shall be strictly controlled. When necessary to perform required construction work in a stream channel, the turbidity may be increased, as approved by the Engineer, for the shortest practicable period required to complete such work. This required construction work may include such work as deviation of a stream, construction or removal of cofferdams, specified earthwork in or adjacent to a stream channel, pile driving, and construction of turbidity control structures. Mechanised equipment shall not operate in flowing water except as necessary to construct crossings or to perform the required construction.

Wastewaters from aggregate processing, concrete batching, or other construction operations shall not enter streams, watercourses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates, or other approved methods. Any such wastewaters discharged into surface waters shall contain the least concentration of settleable material possible. For the purpose of these specifications, settleable material is defined as that material which will settle from the water by gravity during a 1-hour quiescent detention period.

b) Compliance with laws and regulations

The Contractor shall comply with all applicable Ugandan laws, orders, regulations, and water quality standards concerning the control and abatement of water pollution.

If wells or other water sources, nevertheless, are polluted, it is the responsibility of the Contractor to compensate for this and provide the consumers with clean drinking water transported through pipes from an unpolluted source if required in the opinion of the Engineer.

3.7 CLEANUP AND DISPOSAL OF WASTE MATERIALS

a) Clean-up

The Contractor shall, at all times, keep the construction area, including storage areas used, free from accumulations of waste materials or rubbish.

All waste water and sewage from office, residential and mobile camps shall be piped to soak pits or

other disposal areas constructed in accordance with local government regulations, and where and when such regulations require it the Contractor shall obtain a permit or other appropriate documentation approving the disposal methods being used.

All used fuels, oils, other plant or vehicle fluids, and old tyres and tubes shall be collected to a central disposal point, on a regular basis and disposed of as specified below.

All household, office, workshop and other solid waste shall be collected to a central disposal area, on a daily basis and disposed of in a manner approved by the Engineer.

Servicing of plant, equipment and vehicles shall whenever possible be carried out at a workshop area. This workshop area shall be equipped with secure storage areas for fuels oils and other fluids constructed in such a way as to contain any spillages which may occur, and similar storage where used fluids can be stored securely prior to their disposal.

When servicing of plant, equipment and vehicles is carried out away from the workshop area it shall be done at locations and in such a manner as to avoid spillage and contamination of streams and other drainage courses. Any spillages shall be cleaned up by either burning in place or collecting the contaminated soils and burning them at the central disposal area, all to the satisfaction of the Engineer.

Prior to completion of the work, the Contractor shall remove from the vicinity of the work all plant facilities, buildings, rubbish, unused materials, concrete forms, and other like material, belonging to him or used under his direction during construction. All work areas shall be graded and left in a neat manner conforming to the natural appearance of the landscape as provided elsewhere in the Specifications.

Any residue deposited on the ground from washing out transit mix trucks or any similar concrete operations shall be buried or cleaned up in a manner acceptable to the Engineer.

In the event of the Contractor's failure to perform the above work, the work may be performed by the Employer, at the expense of the Contractor, and his surety or sureties shall be liable therefor.

b) Disposal of waste material

i) General

Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the Contractor. Disposal of combustible materials shall be by burying, where burial of such materials is approved by the Engineer; by burning, where burning of approved materials is permitted; or by removal from the construction area. Disposal of non-combustible materials shall be by burying, where burial of such materials is approved by the Engineer, or by removal from the construction area. Waste materials removed from the construction area shall be dumped at an approved dump.

ii) Disposal of material by burying

Only materials approved by the Engineer may be buried. Burial shall be in pits the location, size and depth of which shall be approved by the Engineer. The pits shall be covered by at least 0.6 metre of earth material prior to abandonment.

iii) Disposal of material by burning

All materials to be burned shall be piled in designated burning areas in such a manner as will cause the least fire hazards. Burning shall be thorough and complete and all charred pieces remaining after burning, except for scattered small pieces, shall be removed from the construction area and disposed of as otherwise provided in this SUBLAUSE.

The Contractor shall, at all times, take special precautions to prevent fire from spreading beyond the piles being burned and shall be liable for any damage caused by his burning operations. The Contractor shall have available, at all times, suitable equipment and supplies for use in preventing and suppressing fires and shall be subject to all laws and regulations locally applicable for presuppression,

suppression, and prevention of fires.

iv) Disposal of material by removal

Material to be disposed of by removal from the construction area shall be removed from the area prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.

Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees for charges required to be paid for dumping of materials shall be paid by the Contractor and shall be included in the prices bid in the Bill of Quantities for other items of work.

3.8 MITIGATION PLAN FOR PROPOSED CONSTRUCTION WORKS

Component	Negative Impact	Mitigatory Measures	Responsibility
Dam(s)/ Headworks, intake and conveyance	noise and air pollution during construction	the Contractor shall minimise noise and dust during construction	Contractor
	health and safety of public and construction workforce	provision of adequate safety measures and supervision	Contractor
		limited public access during construction	
	waste / spoil generation and disposal	material to be disposed of carefully and to specified sites	Contractor, Employer
Scheme-wide Issues	loss of vegetation, crops and ornamental planting	avoid loss of vegetation if possible	Contractor
		advance warning of works	
		compensatory tree planting	
	disruption to local hydrology and drainage patterns as a result of earthworks	provision of adequate drainage during construction, culverts and embankments to avoid pollution	Contractor
	effects of Contractor's compound	discourage a lot of people from residing in compound	Contractor
	disruption of access roads, tracks and temporary severance	all works that cause severance should be carried out in one day	Contractor
		advance warning to the affected	
	risk of inadequate reinstatement	retention fund to ensure works are completed	Contractor, Employer
		photographic survey before works begin	

3.9 MEASUREMENT AND PAYMENT

Except as specifically included in the Bill of Quantities or otherwise provided above no separate measurement or payment shall be made for any work included in this Section, the relevant cost of all these requirements being included by the Contractor in his rates in the Bill of Quantities for other items of work.

4 TESTING OF MATERIALS AND WORKMANSHIP

This SECTION covers the tests and methods of testing which are required for the selection and control of the materials and for control of workmanship, trials and construction control testing.
During the progress of the Work tests shall be conducted on materials and workmanship to ensure compliance with the requirements of the Specifications.

4.1 MATERIALS GENERALLY

All materials shall conform to the requirements of the Contract, the Drawings and the Specifications.

All materials shall be of approved manufacture and origin and the best quality of their respective kinds. Unless otherwise specified such materials shall be new (as compared to used or reprocessed).

No materials of any description shall be used without the prior sanction of the Engineer and any materials condemned as unsuitable for use in the Works shall be removed immediately from the Site by and without recompense to the Contractor.

4.2 STANDARD SPECIFICATIONS

Materials shall comply with, the requirements of the current edition of Specifications issued by the American Association of State Highway and Transportation Officials (AASHTO) or American Society for Testing Materials (ASTM) or British Standard (BS) or, where applicable, an equivalent Specification called for in the contract documents or as directed by the Engineer.

Other equivalent national standard specifications may only be substituted for the above at the sole discretion of the Engineer.

4.3 MATERIALS TESTING AND ACCEPTANCE

As soon as possible after the Contract has been awarded, the Contractor shall submit to the Engineer complete statements as to the origin, composition and manufacture of all materials to be used in the Works together with a list of the suppliers from whom he proposes to purchase these materials.

Prior to delivery of materials to the job site, the Contractor shall submit certified test reports and samples to the Engineer of all materials proposed for use in the Works, whether from an outside supplier or whether supplied by the Contractor from his own resources. The certification(s) shall show the appropriate test(s) for each material, the test results, and a statement that the material meets the specification requirement. The Engineer's approval shall be received prior to any materials being delivered in bulk to the works. The Engineer may request further samples for testing, prior to and during construction to verify the quality of the materials and to ensure conformance with the applicable specifications. The Contractor shall provide all samples free of charge.

The Contractor shall test samples as specified from each quarry location and borrow pit proposed for use in the Works, in accordance with these Specifications. The results of these tests shall be submitted to the Engineer for approval at least 14 days before the quarry or borrow pit is required for use. Should any quarry or borrow pit prove to be unsuitable, the Contractor shall investigate further sites until suitable materials are found and approved.

The Contractor’s programme shall allow sufficient time for materials testing and no claim for delays or extra costs arising out of this will be accepted.

All materials supplied for use in the Works shall conform within specified tolerances, to the quality of the approved samples which will be retained at the Engineer’s office until the completion of the Contract.

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

4.4 TESTING BY THE CONTRACTOR

The Contractor shall provide, use and maintain on the site throughout the period of execution of the works a suitable laboratory and adequate equipment operated by competent staff for carrying out tests required for the selection and control of the quality of materials and for the control of workmanship in accordance with this specification. The contractor shall assume that tests will be required on all materials used in the works and on all finished work.

The Contractor shall carry out all necessary tests and shall report to the Engineer the results of such tests before submitting materials and finished work to the Engineer for approval. In appropriate circumstances, tests may be carried out at the place of manufacture.

4.5 ACCEPTANCE STANDARDS OR MATERIALS

All materials used in or upon the works shall comply with this Specification and the Special Specification and shall be acceptable to the Engineer. Where so specified, the material shall comply with the national specification named or with an alternative national specification on the approval of the Engineer.

Similarly, where a material has been specified by manufacturer's trade name, the product of another manufacturer will be acceptable provided it is in all respects of equivalent or higher quality and provided that the Engineer's approval has been obtained.

Samples of all materials proposed to be used shall be submitted to the Engineer and shall, where required, be tested prior to the material being delivered in bulk upon the works.

4.6 THE COST OF TESTING

a) Process control

The cost of testing undertaken by the Contractor in terms of his obligations under for purposes of process control, including the taking of samples, reinstating where samples have been taken, and all testing equipment, labour, materials, etc, shall be included in the rates bid for the various items of work supplied and will not be paid for separately.

b) Producing certificates

Where the properties of materials or manufactured products are required in these Specifications to comply with specified specifications published by a Standards Authority approved by the Engineer, the Contractor shall produce, when called upon to do so, certificates from the manufacturer confirming that the materials or products supplied comply with the relevant specifications. All costs of providing such certificates shall be borne by the Contractor.

c) Testing materials and products covered by certificates

The Engineer shall be entitled to take samples of, and order tests to be made on, products and materials in respect of which certificates of compliance may be required. The Contractor shall only be paid at the appropriate rates if the costs of such tests are itemised in the Bill of Quantities.

4.7 TAKING AND SUBMITTING SAMPLES

a) General

Where the Contractor is required in these Specifications to submit samples of materials or mixtures to the Engineer for approval prior to their being used in the Works, the use of these materials or mixtures without the Engineer's written approval shall constitute default on the part of the Contractor, who shall be liable for the consequence of such default. All samples shall be submitted in sufficient time for proper testing.

The Engineer's approval of any materials or mixtures shall in no way relieve the Contractor of his obligation to provide materials, mixtures and workmanship which comply with the Specifications.

All samples for testing shall be taken in a random pattern or as prescribed by the Engineer. Where specified or required by the Engineer, stratified random sampling methods shall be followed. For the testing of layer work stratified random sampling methods shall be used for obtaining all the sample portions and for determining the locations of in situ test sites.

The method of taking samples shall be as specified in the appropriate sampling and testing methods. The sampling methods approved by the Engineer, shall apply.

The Engineer shall have full access to the Works for the purpose of taking samples. The Contractor shall render any assistance necessary for taking the samples and shall be responsible for the reinstatement of embankment layers or other structures at the positions where the samples have been taken. Full compensation for rendering assistance with sampling and for reinstatement where samples have been taken shall be included in the rates tendered for the various items of work tested, and no additional payment will be made in this respect.

b) Sampling frequency

Samples shall be taken for laboratory testing for each new material encountered, or when there is a significant change in material properties in the opinion of the Engineer.

The sampling frequencies shall be taken as required in the opinion of the Engineer.

4.8 TESTING METHODS

All tests shall be conducted in accordance with the standard methods specified in the Specifications. Other equivalent national standard specifications may only substitute the prescribed test method at the sole discretion of the Engineer.

Where in the Specifications tests on materials, tests on completed Works and construction control tests are called for or implied, they shall be carried out according to the Laboratory Testing Manual of the Central Materials Laboratory (CML) of the Ministry of Works and Transport unless the test in question is not covered by this standard. When a particular test is not covered by the CML standard, then the method shall be an equivalent standard in the contract documents or as directed by the Engineer.

In addition to the above standard methods of testing, equivalent standard specifications or test methods of other bodies may be used in these specifications if approved by the Engineer.

In all cases the latest amendment or revision current at the closing date of the tender is implied when reference is made to one of the above standards in the Specification.

4.9 QUALITY CONTROL

4.9.1 Routine Tests and Inspection by The Engineer

The Engineer will at regular intervals inspect and test materials and completed work for compliance with the specified requirements, and, where applicable the various specified judgement plans will be applied. The testing frequencies and sample and lot sizes for routine testing shall be at the Engineer's discretion.

All sections of completed work shall be submitted to the Engineer for routine inspection and testing, and the Contractor shall not cover up or construct any work on top of sections of completed work before being advised by the Engineer of the outcome of his tests and inspection. The Contractor shall arrange the submission of work for testing in a manner as will afford the Engineer reasonable opportunity for inspecting and testing.

5 LANDSCAPING AND GRASSING

a) Scope

This Section covers the landscaping of designated areas, the establishing of vegetation for functional and aesthetic purposes on cut and fill slopes, landscaped areas and such other areas where it may be required.

b) Definition

Any declared noxious weeds, as well as any exotic tree, shrub, herb, grass or water plant which, in the opinion of the Engineer, may pose any problems in specified areas at certain times, is regarded as being undesirable.

5.1 MATERIALS

i) Grass cuttings

Grass cuttings shall be fresh cuttings of an approved type of grass with sufficient root material to ensure good growth.

ii) Grass seeds

Only fresh certified seed shall be used and the types of seeds in the seed mixture shall be as specified in the Special Specifications.

Mixing the various types of grass seeds for obtaining the prescribed grass-seed mixture shall be done on the Site in the presence of the Engineer. Storing and identifying the grass seeds and the grass-seed mixtures on the Site shall be the responsibility of the Contractor.

iii) Trees, shrubs and hedge plants

Plants shall be of local variety or other seeds approved by the Engineer. Unless specified in the Special Specifications.

Plants supplied by the Contractor shall be healthy, correctly shaped, and well rooted. The plants must be hardened off and be exposed to direct sunlight for at least 6 months prior to planting in the road reserve. Roots shall not show any evidence of having been restricted or deformed at any time. Plants shall grow well and shall be free from insect pests and diseases.

iv) Grass sods

The grass seed or seed mixture shall consist of local varieties of Stenotaphrum secundatum, Cynodon dactylon or Pennisetum clandestinum grass or other grass seeds approved by the Engineer.

i) Nursery-grown sods: These sods shall be of the variety of grass specified in the Special Specifications, unless the use of an alternative has been approved by the Engineer. The grass shall have been grown specifically for sod purposes, mown regularly and cared for to provide an approved uniformity to the satisfaction of the Engineer.

ii) Bush sods: These sods may be obtained from approved areas within or near the Site where a suitable type and density of grass and type of soil are found.

v) Anti-erosion compounds

Anti-erosion compounds shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and form an encrustation. The application rate shall conform to the manufacturer's recommendations. The materials used shall be of such a quality that grass seeds may germinate and penetrate the crust.

vi) Topsoil

Topsoil shall consist of fertile loamy soil, obtained from areas with a good soil coverage of natural vegetation, preferably grasses. It shall be free from deleterious matter such as large roots, stones, re-

fuse, stiff or heavy clays and the seeds of noxious weeds, which will adversely affect its suitability for grass being planted. Topsoil stripped from areas infested with weeds shall be stockpiled separately.

Topsoil shall be obtained from wherever suitable material occurs either in the road reserve or from areas where cuts and fills are to be constructed. Topsoil stripped from borrow areas may not be removed from that site for topsoiling of other areas, but must be used to rehabilitate the borrow pit itself. The Engineer shall communicate his requirements to the Contractor regarding the quantity of topsoil which is necessary and the areas from which it shall be selected and removed by the Contractor. Unless otherwise specified, topsoil shall be taken from not deeper than 400 mm from the surface. If the Contractor fails to conserve the topsoil as instructed, he shall obtain suitable substitute material from other sources at his own cost.

Where so specified, the Contractor shall procure and furnish topsoil from his own sources outside the Site, after such sources have been approved by the Engineer.

Topsoil shall be stockpiled in separate loose heaps as tipped from the trucks and shall not be stockpiled in heaps exceeding 2 m in height. Care shall be taken to prevent the compaction of the topsoil in any way, especially by trucks being driven over such material.

vii) Manure

Manure shall, unless another type has been approved by the Engineer, be pure kraal manure free from soil, weed seeds or other undesirable material. It shall not contain any particles that will not pass through a 50 mm screen and shall be approved by the Engineer before being delivered to the Site.

viii) Compost

Compost shall be well decayed, friable and free from weed seeds, dust or any other undesirable materials. It shall not contain any particles that will not pass through a 50 mm screen and shall be approved by the Engineer before being delivered to the Site.

5.2 LANDSCAPING AREAS

a) Shaping

Areas within the dam reservoir/road reserve but outside the road prism which require shaping by means of bulk earthworks such as contoured areas at interchanges and intersections and rest areas which require earthworks shall be excavated, filled and compacted when required, and shaped to the correct contours to within a tolerance of plus or minus 150 mm. Such work shall be regarded as being earthworks. Measurement of quantities may be measured by means of a grid system of levels taken at 10 m intervals before and after shaping or else it may be determined by levelled cross-sections.

b) Trimming

Trimming shall consist of trimming the existing or previously shaped ground to an even surface with the final levels generally following the original surface. Trimming shall normally be done by grader, or in more confined or steep areas by bulldozer. Where machine operations are not practicable, because of confined spaces or steep slopes, or when approved by the Engineer, trimming shall be done with hand tools. When trimming is done on slopes steeper than 1:3, the ridges shall be made parallel to the contour. Such ridges shall be approximately 100 mm wide, and the centres between the ridges approximately 400 mm. Trimming shall be done where instructed by the Engineer to areas inside the road reserve but outside the road prism, ie normally outside the tops of cuts or the toes of fills, but trimming of rock outcrops will not be required.

Trimmed surfaces shall be left slightly rough to facilitate a better binding with topsoil or the natural establishing of vegetation.

When subsequent grassing is required or when it is ordered by the Engineer, areas previously shaped shall be trimmed as described above to within a tolerance of plus or minus 100 mm with all undulations following a smooth curve. The above tolerance shall apply only to areas where the final contours are given on the Drawings.

During trimming, all stones in excess of 100 mm in size and all excess material shall be removed. Areas which require grassing shall be trimmed in such a way that, after cultivation and the application of topsoil, the finished surface of the area shall be approximately 25 mm below the top of adjacent kerbing, channelling or embankment.

c) Plant rates

The Engineer shall be entitled to pay for shaping and trimming as described above on the basis of hourly plant rates. The motor grader and bulldozer to be provided shall each have a flywheel power of not less than 93 kW. All machines shall be in a good condition. Any labour or other plant required shall be paid for as extra work as specified in the Contract.

5.3 PREPARING AREAS FOR GRASSING

The various areas to be grassed shall be prepared as follows:

a) Soil ripping

Where soil is too hard to be ploughed with a light tractor, the soil shall be ripped up to a depth of 300 mm before it is loosened by plough to a depth of 150 mm.

b) Areas which do not require topsoil

Where the areas to be grassed consist of organically suitable material, the topsoil shall be loosened by ploughing to a minimum depth of 150 mm. All loose stones exceeding 50 mm in size on areas to be mowed by machine and falling within the road reserve and all stones exceeding 150 mm in size in other areas shall be removed.

c) Areas which require topsoil

Where areas to be grassed consist of organically unsuitable material, the surface shall be roughened to ensure a proper bond between the topsoil and the subsoil. If required, the area shall be scarified as described in paragraphs (a) or (b) above.

Topsoil shall be placed on the prepared surfaces and trimmed to the uniform thickness required. The topsoil shall be scarified by means of hand raking or light rotavators and all stones removed as specified for areas not requiring topsoil in subparagraph (b) above.

Areas inaccessible for topsoil being placed after the construction works have been completed shall be covered with topsoil and protected against erosion during construction works.

d) Fertilising

For all areas to be planted, the Contractor shall have the top 150 mm of the prepared surface tested to determine the quantity and type of fertiliser which will be required for establishing proper growth conditions for the grass. The location of the soil sample taken shall be indicated on plans by the Contractor. The Engineer shall be furnished with the test results. Only after approval by the Engineer of the nature and quantity of the fertiliser, may its application proceed. The fertiliser shall be evenly applied over all surfaces where grass is to be planted, and shall then be thoroughly mixed with the soil to a depth of 100 mm either mechanically or manually. Where hydroseeding is to be performed, the fertiliser may be mixed with the cellulose pulp and water used in hydroseeding. *It is anticipated that the fertiliser to be used will be of a type obtainable from local suppliers in Uganda*

e) General

After an area has been prepared for grassing, the grassing shall be completed before crusting. Where a crust has been formed before grassing is done, the Contractor shall, at his own cost, loosen the crust by ploughing to a depth of 150 mm.

6 FOUNDATIONS FOR STRUCTURES

6.1 SCOPE

This Section covers all foundation work which, for the purposes of these Specifications, shall comprise those elements of construction below the level of the bottom surface of the footings, the pile-capping slabs or the caisson cover slabs, collectively hereinafter referred to as base or bases, which shall include all the associated temporary works.

6.2 MATERIALS

a) General

Material used in the permanent foundation work shall comply with the requirements specified.

b) Rock (for rock fill)

Stones shall be hard, angular, natural or quarry stones of such quality that they will not disintegrate on exposure to water or weathering. The stones shall be free from soil, clay or organic material. Neither the breadth nor thickness of a single stone shall be less than one-third its length. Not more than 10% of the total volume of rock fill shall consist of stones with a mass of less than 0.5 times the specified mass and not more than 10% of the total volume of rock fill shall consist of stones with a mass of more than 5 times the specified mass. At least 50% of the total volume of rock fill shall consist of stones the mass of which exceeds the specified mass.

c) Crushed stone

Crushed stone used for the construction of crushed-stone fill shall originate from sound un-weathered rock approved by the Engineer.

d) Granular fill

Granular material used for constructing the compacted granular fill shall be approved granular material of at least gravel subbase quality.

e) Sand fill

Sand used for filling the caissons shall be clean, hard sand free from lumps of clay or organic or other deleterious matter.

f) Structural steel

Steel in the steel piles shall comply with the requirements of BS 4360 or SABS 1431 or equivalent, BS EN 10113 and BSEN 10155 for the grade of steel specified on the Drawings. I and H sections shall comply with the requirements of BS 4: Part 1.

Fabricated sections shall comply with the details shown on the Drawings.

6.3 GENERAL

If it is found during the course of excavating or caisson work that the soil or founding conditions differ greatly from those shown on the Drawings, the Contractor shall immediately notify the Engineer.

The Engineer shall, as often as he may deem necessary during the course of excavation, be entitled to call on the Contractor to conduct additional foundation investigations and/or tests at or below the respective founding levels in view of establishing safe bearing pressures and founding depths.

a) Channel preservation: The flow of the stream and the conservation of marine and freshwater life shall be maintained at all times. Access to cofferdams, artificial islands and piling platforms shall be effected without unnecessarily disrupting the flow of the stream at the point of crossing, unless otherwise specified.

Precautions shall be taken by the Contractor to maintain water quality standards. Water con-

taminated with silt shall be settled in ponds before being pumped into streams. Water contaminated with chemicals shall be purified before being returned to the stream or disposed of in an appropriate manner as directed by the Engineer. Precautions shall be taken by the Contractor to ensure that the natural pH, electrical conductivity and other indicators as prescribed of the water are not raised or lowered.

b) On completion of the work, surplus excavated materials including materials excavated from caisson compartments and holes for piles, materials used in cofferdams and other temporary works, as well as in-situ material, shall be removed and disposed of by the Contractor to the level of the original bed or such elevation as agreed to by the Engineer or required for stream channelisation at no extra cost to the Employer.

6.4 EXCAVATION

a) General

This work shall include excavations not provided for elsewhere in these Specifications, which are required for founding the structures as well as for the excavating required in respect of the demolition, extension or modification of existing bridges and culverts.

Excavation required for diverting, channelling or widening streams within 5 m or as instructed by the engineer of concrete structures shall be measured and paid for under appropriate Items.

b) Surface levels agreed on for excavations

Prior to commencing with any excavation, the Contractor shall notify the Engineer in good time to ensure that levels be taken of the undisturbed ground surface for determining the ground surface from where the excavation can be measured, and this ground surface shall be agreed on by the Engineer and the Contractor.

c) Excavation

Where in the opinion of the Engineer the casting of concrete against the excavated earth faces is not permissible, or where formwork has to be provided, the extremities of the excavation, for purposes of measurement and payment, shall be deemed to be the vertical planes parallel to and 0.5 m outside the perimeter of the member for which formwork is to be provided.

Where suitable, stable material is encountered during excavating, that part of the trench or foundation pit shall be excavated to the neat dimensions of the base unless otherwise directed by the Engineer. Over-excavation (overbreak) in hard material shall be backfilled with the same class of concrete as that in the base or with mass concrete fill or foundation material as specified or as directed by the Engineer.

Where blasting is required, the Contractor shall complete the entire foundation excavation before he commences with the construction of any permanent concrete work or foundation works, unless otherwise approved by the Engineer.

Boulders, logs or any other unsuitable material excavated shall be spoiled.

When hard material suitable for founding is encountered at the founding level, it shall be cut and trimmed to a firm surface, either level, stepped or serrated, as may be required.

The Contractor shall be deemed responsible for the unforeseen ground conditions within the maximum excavation depths.

Where, in the opinion of the Engineer, unsuitable material is encountered at founding level, such material shall be removed and replaced with foundation fill as directed by the Engineer.

d) Classification of excavated material

For payment purposes distinction shall be made between common excavation in soft material and rock excavation. All excavation for the foundations of structures shall be classified, which definitions are summarised as follows:

i) Rock excavation:

Rock excavation shall be excavation to a maximum depth of 30m in material, including cobbles, boulders, and weathered and un-weathered rock strata, which requires drilling and blasting or the use of hydraulic or pneumatic jackhammers or excavators mounted with a jackhammer to be loosened and to be loaded for transportation.

ii) Common excavation:

Common excavation shall be excavation to a maximum depth of 30m in all material other than rock as defined above and including loose cobbles and boulders.

e) Blasting

Where blasting is permitted, it shall be carried out in accordance with the requirements of CLAUSE 2.41.

f) Deterioration of foundation excavations

Where soft material, or hard material which quickly deteriorates when exposed, is found at foundation level, the excavation shall be excavated to the final slope and level immediately before the screed is placed. Where the bottoms or sides of excavations, in which bases are to be cast, are softened on account of negligence on the part of the Contractor in allowing storm or other water to enter the excavations, the softened material shall be removed and replaced with foundation fill as directed by the Engineer, at the Contractor's expense.

g) The safety of excavations

The Contractor shall take the necessary precautions to safeguard the stability and safety of the excavations and adjacent structures.

The personal safety of no person shall be jeopardised neither shall any situation be allowed to arise which may result in damage of whatsoever nature.

Precautionary measures taken by the Contractor shall comply with the appropriate legal provisions.

h) Inspection

No concrete shall be placed before the excavation has been properly cleaned by the Contractor and inspected and approved by the Engineer.

i) Excavation by hand

Where circumstances prevent the use of mechanical excavators and material can be removed only by hand implements, the Engineer shall authorise the supplementary payment to the Contractor for such work at the bid rates for excavation by hand should he be satisfied that the Contractor had been unable to prevent the necessity for excavation by hand by proper planning and precautionary measures. The supplementary rate for excavation by hand shall not apply to minor finishing or clearing jobs in excavations which are otherwise being done by mass excavation plant.

6.5 FOUNDING

In consequence of possible variations of the anticipated founding conditions, the dimensions and founding levels specified or shown on the Drawings may have to be varied during construction.
The Engineer has full and absolute power to order such variations and to specify the actual founding level for each foundation fill, base or caisson during construction.

6.6 UTILISATION OF EXCAVATED MATERIAL

Excavated material and material recovered from temporary works shall, if suitable, be utilised for backfill. Material unsuitable for use as backfill or in excess of the required quantity, shall be spoiled or utilised as directed by the Engineer.

Excavated material not used for backfill or not taken to spoil but used in the construction of embankments or other parts of the work, as directed by the Engineer, will be paid for under foundation excavation as well as under the relevant item for the purpose for which it is used.

Excavated and stockpiled material shall be so dumped as not to endanger the uncompleted structure either by direct pressure or indirectly by overloading the fills contiguous to the structure, or in any other way.

7 PROTECTION OF EXPOSED SURFACES

7.1 SCOPE

This Section covers the furnishing of materials and the construction of a protective covering in stone pitching, cast in situ concrete pitching, bricks or prefabricated concrete blocks on exposed surfaces such as earth slopes, drains and stream beds, as well as heavier protective layers in the form of riprap and the construction of stone masonry for walls, all as shown on the Drawings or ordered by the Engineer.

7.2 MATERIALS

a) Stone

Pitching

Stone for pitching shall be sound, tough and durable, without any stones less than 200 mm in minimum dimension, except that smaller pieces or spalls may be used for filling spaces between the large stones. The shapes of the rocks or stones shall be so as to form a stable protective layer of the required thickness. Rounded boulders shall not be used on slopes steeper than 2:1 unless grouted.

All stone intended for use on a particular pitching job shall be subjected to the prior approval of the Engineer.

Riprap

Stone for riprap shall be hard field or quarry stone not susceptible to disintegration or excessive weathering on exposure to the atmosphere or water. It shall be free from soft material such as sand, clay, shale or organic material and shall not contain an excessive quantity of elongated stones.

The required size of the stone will depend on the "critical mass" specified. At least 50% by mass of the material comprising the riprap shall consist of stones with a mass heavier than the critical mass, and not more than 10% by mass of the material shall consist of stones with a mass of less than 10% of the critical mass or more than 5 times the critical mass.

b) Cement

Cement shall be ordinary Portland cement which complies with the requirements of AASHTO M85-98 or equivalent.

c) Sand

- **Sand for concrete**

Sand for concrete, cement slurry and cement mortar shall comply with the requirements of AASHTO M6-93 or equivalent.

- **Sand bedding**

Sand for bedding used for paving blocks shall not contain any deleterious impurities and shall comply with the grading requirements in TABLE 7/ 1

TABLE 7/1: GRADING REQUIREMENTS FOR BEDDING SAND

Sieve size (mm)	% Passing
10	100
5	95-100
2.36	80-100
1.18	50-85
0.600	25-60
0.300	10-30
0.150	5-15

0.075	0-10

- **Sand for joints**

Sand used for being brushed into the joints between pavement blocks shall all pass through a 1.18 mm sieve, and between 10 and 15% of it shall pass through a 0.075 mm sieve.

7.3 STONE PITCHING

a) Plain stone pitching

The area shall be prepared by excavating, shaping and trimming necessary for pitching and by thoroughly compacting the area by hand-ramming to prevent subsequent settlement. A trench shall be excavated as directed by the Engineer along the toe of any slopes to be pitched or along the unprotected edge of the pitching in the beds of streams. Two pitching methods follow, and the method to be adopted shall be decided on by the Engineer.

(i) Method 1

Commencing at the bottom of the trench, the stones shall be laid and firmly bedded into the slope and against adjoining stones. The stones shall be laid with their longitudinal axes at right angles to the slope and with staggered joints. The stones shall be well rammed into the bank or surface to be protected and the spaces between the larger stones shall be filled with spalls of approved pitching stone securely rammed into place.

Placing of rock by dumping shall not be allowed.

(ii) Method 2

The technique and requirements laid down in Method 1 shall also apply to Method 2, except in the following aspects:

1. No small stones or spalls shall be used to fill in spaces between larger stones.
2. Simultaneously with the placing of stones, top soil shall be introduced between individual stones, and sufficiently rammed so as to provide a firm bonded structure. The topsoil shall be provided to the full depth of the stone pitching at any point.
3. Rooted grass or tufts of grass shall then be planted in the soil between stones and watered immediately and copiously and thereafter at regular intervals until the grass has been established.

Whichever of the above two methods is adopted, the finished surface of the pitching shall present an even, tight and neat appearance with no stones varying by more than 25 mm from the specified surface grades or lines. The thickness of the pitching, measured at right angles to the surface, shall not be less than 200 mm.

b) Grouted stone pitching

The work shall be done in accordance with all the requirements specified for plain pitching in SUBCLAUSE 6.2(a) above, except that the stone shall be thoroughly cleaned of adhering dirt or clay, moistened and embedded in freshly laid cement mortar composed of one part of cement to six parts of sand. Any spaces between the stones shall be filled with cement grout of the same composition as the mortar. The mortar and the grout shall be placed in a continuous operation for any days run at any one location. The grout shall be worked into the pitching to ensure that all spaces or voids between the stones will be completely filled with grout to the full depth of the stone pitching. Grout spilt onto exposed surface of the stone shall be removed while still soft, and the joints between stones shall be neatly finished.

The grouted pitching shall be cured with wet sacking or other approved wet cover for a period of not less than four days after grouting, and shall not be subjected to loading until adequate strength has been developed. Where required, weep holes shall be formed in the pitching

c) Wired and grouted stone pitching

The area to be pitched shall be prepared as described in SUBCLAUSES 6.2(a) and 6.2(b) concrete bed (Class 15 concrete) with a thickness of at least 75 mm shall then be placed. The stone pitching shall be of stones with a minimum dimension of 200 mm, which shall be laid while the concrete is still fresh. Openings between stones shall be filled with cement grout as described in SUBCLAUSE 6.2(b), and care shall be taken not to spill the grout onto the finally exposed surfaces of the stones. Grout spilt onto the exposed surface of the stone shall be removed while still soft and the joints between stones shall be neatly finished.

Curing shall be done as described for grouted stone pitching in SUBCLAUSE 6.2(b).

The completed pitching shall have an even compacted appearance and nowhere may the surface deviate by more than 25 mm from the specified lines and grades.

7.4 RIPRAP

a) General

Riprap shall consist of a course of large rock placed on upstream dam/bank slopes and toes in stream and river beds and at other localities where protection of this type may be required.

Two types of riprap are specified here, viz. one type where the rocks are individually packed, which is designated as packed riprap, and the other type where the rock is dumped and then spread by machines, which is designated as dumped riprap.

The surface of areas to receive riprap shall be neatly trimmed to line and level and all loose material compacted. The perimeters of riprap areas shall be protected by the construction of either rock- filled trenches, walls or other structures as may be required. Perimeter trenches shall normally be backfilled with rock of the same size and quality as that used in the construction of the adjoining riprap, but any voids shall be filled with similar stone and the entire backfill shall be well compacted.

b) Filter bed

The filter bed shall consist of a layer or layers of permeable material placed on the prepared surface to the required thickness and each layer shall be finished to an even surface and thickness. Compaction of pervious material will not be required. Care shall be taken not mix various grades of filter material nor to disturb material already placed when subsequent layers or riprap are being placed.

When the use of synthetic- fibre filter fabric is required, the material shall be placed on the prepared surface on the filter bed, depending on the instructions. The overlap between adjacent sheets shall be 150 mm unless otherwise specified. Care shall be taken not to damage the filter fabric when subsequent layers are being placed, nor to expose the filter fabric to the sun for periods exceeding three days before it is covered.

c) Packed riprap

Packed riprap shall be constructed from rocks placed individually to stagger the joints and so as to be firmly bedded in the prepared surface. The spaces between larger stones shall be filled with spalls or smaller stones securely rammed into place. On inclined surfaces the rock shall be laid in long horizontal strips starting from the bottom, and not in strips up the slope.

The completed riprap shall present a tight and even surface. Local surface irregularities of the riprap shall not exceed 150 mm.

d) Dumped

Dumped riprap shall be constructed by dumping the stone on the prepared surface, spreading it by bulldozer or other suitable earth-moving equipment, and trimming it to the required lines and levels. The material shall be placed in a manner that will prevent the segregation of the smaller and larger stones and the top layer shall be tight with a minimum of voids.

7.5 STONE MASONRY WALLS

a) General

Stone masonry walls may be plain packed stone walls with dry joints or otherwise mortared stone walls with stones bedded in cement mortar as indicated on the Drawings, as specified or as may be ordered.

The minimum mass of each stone used shall be 10 kg and its minimum dimension 75 mm.

b) Plain packed stone walls

A foundation trench shall be excavated down to rock or to material with an adequate bearing capacity at a minimum depth of 300 mm below ground lever. Larger selected stones shall be used for the foundation layer. Flat and stratified stones shall be laid with the largest dimension in the horizontal plane. Stones shall be packed individually to stagger the joints and to provide a minimum of voids, and shall be firmly bedded against adjoining stones. The spaces between the larger stones shall be filled with spalls securely rammed into place. The larger stones shall not bear on the spalls used for filling the voids. The top and ends of the wall shall be neatly finished with selected coping stones.

The appearance of the completed wall shall present an even and tight surface.

c) Cement – mortared stone walls

The walling shall be constructed as specified in (b) above, with the exception that the stones shall be wetted and set in a 6:1 sand: cement mortar. The exposed parts of the stones on the wall faces shall be cleaned of all mortar by washing or wire brushing. The mortar shall be flush pointed to the satisfaction of the Engineer, who may require a capping and end treatment of the same mortar.

Weep holes shall be provided as prescribed and shall be cleaned of mortar or any other clogging material that may have entered during construction.

The walling shall be protected from the elements and kept moist for a minimum period of four days after completion.

a. The material shall be placed simultaneously, in so far as is possible to approximately the same elevation on both sides of an abutment, pier, or wall where appropriate. If conditions require the backfill or fill to be placed appreciably higher on one side than on the other the additional material on the higher side shall not be placed until authorised by the Engineer, and preferably not until the concrete has been in place for 14 days, or until tests show that the concrete has attained sufficient strength to safely withstand any pressure extended by the backfill or fill or by the method of construction.

b. The material behind abutments directly restrained at the top by the superstructure e.g., portal type of structures, shall be placed as shown on the Drawings or as directed by the Engineer.

c. The material behind the portal walls of portal structures shall not be placed until the top slab has been placed and cured, unless otherwise authorised by the Engineer.

d) Backfill

Excavated areas around structures shall be backfilled with approved material in horizontal layers not exceeding 150 mm in thickness after compaction to the level of the original ground surface. Each layer shall be moistened or dried to the optimum moisture content for the material and then compacted to a density of not less than 90 % of BS-Heavy density for soils and gravels, and not less than 100% of BS-Heavy density for cohesionless sands, or the density of the surrounding soil whichever shall be the less, except that, in the road prism, the material shall be compacted to a density of not less than 93% of BS-Heavy density.

7.6 STEEL REINFORCEMENTS

a) Steel bars

Steel reinforcing bars shall comply with the requirements of BS 4449 or equivalent on the approval of the Engineer unless where otherwise noted on the Drawings. For each consignment of steel reinforcement delivered on the site, the Contractor shall submit a certificate issued by a recognised testing authority to confirm that the steel complies with the specified requirements.

b) Welded steel fabric

Welded steel fabric shall comply with the requirements of AASHTO M55 or equivalent on approval of the Engineer. The grade of wire shall be W4 in accordance with AASHTO M32 or equivalent on approval of the Engineer unless where otherwise noted on the Drawings. The grid shall be 100 mm x 100 mm unless where otherwise noted on the Drawings.

8 CONCRETE FOR STRUCTURES

This Section covers the manufacture, transport, placing and testing of concrete used in the Works where plain, reinforced or prestressed concrete is specified.

a) Mix Design

The Contractor shall submit, for approval, a proposal for materials, additives and the mix design for specified concrete class that is to be used in the different works.

b) Construction Requirements

Equipment and tools necessary for handling materials and performing all parts of the work shall be supplied by the Contractor.

c) Workmanship

Concrete works shall be accomplished by personnel experienced in this type of work. The experience shall be relevant to anticipated conditions and to the special techniques required. The Contractor shall demonstrate to the satisfaction of the Engineer evidence of the above required experience and dependability of equipment and techniques to be used and shall submit documentation of past projects on which this type of work has been performed.

8.1 MATERIALS

a) Cement

Cement used for concrete shall be any of the following:

a. Ordinary Portland cement or rapid-hardening Portland cement complying with the requirements of TZS 177:1999, BS 12 of the latest issue or equivalent standard on approval of the Engineer.
b. Portland blast-furnace cement complying with the requirements of AASHTO M240-97 or equivalent standard on approval of the Engineer.
c. Sulphate-resistant cement, but only where shown on the Drawings or instructed by the Engineer.
d. In pre stressed concrete members or units the use of Portland blast-furnace cement will not be permitted. A 50/50 mixture of ordinary Portland cement and ground granulated blast-furnace slag may be used only if authorised in the Special Specifications or by the Engineer, in writing.

b) Aggregates

Both coarse aggregate (stone) and fine aggregate (sand) shall comply with the requirements of CML Materials Testing Manual or equivalent, subject to the following:

i) The drying shrinkage of both the fine and coarse aggregate when tested in accordance with CML Laboratory Testing Manual or equivalent shall not exceed the following limits:

   a. For use in prestressed concrete, concrete bridge decks and slender columns the shrinkage of both fine and coarse aggregate shall not exceed 130 % of that of the reference aggregate.
   b. For use in other reinforced concrete members the shrinkage of the fine aggregate shall not exceed 175% and of the coarse aggregate 150% of that of the reference aggregate.
   c. For use in mass concrete substructures and unreinforced concrete head walls and wing walls, the shrinkage of both the fine and coarse aggregate shall not exceed 200% of that of the reference aggregate.
   d. Where there is any doubt about the shrinkage characteristics of aggregates, the Contractor shall submit a certificate by an approved laboratory which gives the shrinkage characteristics of the aggregate.

e. The drying shrinkage of concrete samples made from each of the required three concrete mixtures for preparing the compressive-strength and flexural-strength samples shall not exceed 0.04%.

ii) The flakiness index of the stone as determined by CML Method 2.4 shall not exceed 35%.

iii) Aggregates shall not contain any deleterious amounts of organic materials such as grass, timber or similar materials.

iv) Where there is any danger of a particular combination of aggregate and cement giving rise to a harmful alkali-aggregate reaction, the particular combination shall be tested in accordance with the testing method as described in CLAUSE 7105, and, where the result points to such reaction, either the aggregate or the cement or both shall be replaced so that an acceptable combination may be obtained.

v) The fineness modulus of the tine aggregate shall not vary by more than ±0.2 from the approved modulus.

c) Plums

Plums used in concrete shall comply with the following

i) The plums shall be clean, durable and inert.
ii) The aggregate crushing value may not exceed 25%.
iii) The mass of each plum shall be between 15 kg and 55 kg.
iv) No dimension of any plum shall be less than 150 mm or exceed 500 mm.

d) Water

Water shall be clean and free from detrimental concentrations of acids, alkalis, salts, sugar and other organic or chemical substances that could impair the durability and strength of the concrete or the imbedded steel. The Contractor shall prove the suitability of the water by way of tests conducted by an approved laboratory. The water used for concrete shall comply with the requirements in CLAUSE 7113 unless otherwise approved by the Engineer. For reinforced and prestressed concrete, the chloride content of the mixing water shall not exceed 500 mg/l when tested in accordance with SABS 202 or equivalent.

e) Admixtures

Admixtures shall not be used in concrete without the approval of the Engineer who may require that tests be conducted before the admixtures be used to prove their suitability. Admixtures, if their use is allowed, shall comply with the following requirements:

(i) Admixtures shall be used only in liquid form and shall be batched in solution in the mixing water by mechanical batcher capable of dispensing the admixture in quantities accurate to within 5% of the required quantity.
(ii) All admixtures shall comply with the requirements of ASTM C-494 or AASHTO M-194 and shall be of an approved brand and type.
(iii) Air entraining agents shall comply with the requirements of ASTM C-260 or AASHTO M-154.
(iv) Admixtures shall not contain any chlorides.

f) Curing agents

Curing agents shall be tested in accordance with ASTM C-156 and shall comply with the requirements of ASTM C-309, except that the loss of water within 72 hours shall not exceed 0.40kg/m^2. Approved curing agents only shall be used.

8.2 STORING THE MATERIALS

a) Cement

Cement stored on the site shall be kept under cover which provides adequate protection against moisture and other factors which may promote deterioration of the cement.

When the cement is supplied in bags, the bags shall be closely and neatly stacked to a height not exceeding 12 bags and arranged so that they will not be in contact with the ground or the walls and can be used in the order in which they were delivered to the site.

Cement in bulk shall be stored in waterproof containers so designed as to prevent any dead spots from forming, and the cement drawn for use shall be measured by mass.

Cement shall not be kept in storage for longer than eight weeks without the Engineer's permission, and different brands and/or types of the same brand of cement shall be stored separately.

b) Aggregates

Aggregates of different nominal sizes shall be stored separately and in such a manner as to avoid segregation occurring. Intermixing of different materials and contamination by foreign matter shall be avoided. Aggregates exposed to a marine environment shall be covered to protect them from salt contamination.

Where concrete is batched on site the aggregates shall be stored in bins with a 3 m wide concrete apron slab constructed around the outer edge of the aggregate stockpile area to prevent contamination during the process of tipping and hoisting the aggregate. The aggregates shall be tipped on the concrete apron slab. The storage bin shall have a concrete floor of 150 mm thickness.

c) Storage capacity

The storage capacity provided and the quantity of material stored (whether cement, aggregates or water) shall be sufficient to ensure that no interruptions to the progress of the work will be occasioned by any lack of materials.

d) Deteriorated material

Deteriorated or contaminated or otherwise damaged material shall not be used in concrete. Such material shall be removed from the site without delay.

8.3 CONCRETE QUALITY

a) General

Concrete shall comply with the requirements for strength concrete or prescribed-mix concrete or as specified by the Engineer.

b) Strength concrete

The Contractor shall be responsible for the design of the concrete mix and for the proportions of the constituent materials necessary for producing concrete which complies with the requirements specified below for each class of concrete.

The class of concrete is indicated by the characteristic 28-day cube crushing strength in MPa and the maximum size of coarse aggregate in the mix.

E.g. **CLASS 25/20** concrete means concrete with a characteristic cube crushing strength of 25 MPa after 28 days and a maximum sized coarse aggregate of 20 mm.

Before starting with any concrete work on the site, the Contractor shall submit, for approval, samples of the constituent materials of the concrete and a statement of the mix proportions which he proposes to use for each class of concrete indicated in the Bill of Quantities.

Where any change occurs in the material sources, the aggregate sizes, or any other components of the concrete, the above procedure shall be repeated.

The samples submitted shall be accompanied by evidence that they comply with the requirements for the various materials specified. The statement regarding the mix proportions shall be accompanied by evidence establishing that concrete made from the materials in the proposed proportions will have the specified properties.

Evidence shall be in the form of:

(i) a statement regarding the test results, which shall be furnished by an approved laboratory; or

(ii) an authoritative report on previous use of and experience in regard to the material.

The actual mix proportions used as well as any changes thereto shall be subject to the Engineer's approval, but such approval shall not in any way relieve the Contractor of his responsibility for producing concrete with the specified properties.

The Contractor is cautioned that the quality of cement may vary considerably from consignment to consignment so as to necessitate adjustments in the cement content of mixes. In order to ensure a uniform quality of concrete, the Contractor shall obtain from the manufacturer the data regarding the relevant cement quality for each consignment with a view to ascertaining the required adjustment in the cement content. This information shall be submitted to the Engineer.

8.4 MIXING

Mixing the material for concrete shall be conducted by an experienced operator. Unless otherwise authorised, mixing shall be carried out in a mechanical batch-mixer of an approved type which will be capable of producing a uniform distribution of ingredients throughout the batch.

8.5 PLACING

Concrete shall be transported and placed in a manner that will prevent segregation or loss of constituent materials or the contamination of the concrete Whenever possible, concrete shall be deposited vertically into its final position. Where chutes are used, their length and slope shall be such as not to cause segregation, and suitable spouts and baffles shall be provided at the lower end to minimise segregation. The displacement of concrete by vibration instead of by direct placing shall be done only when approved by the Engineer

8.6 COMPACTION

Concrete shall be fully compacted by approved means during and immediately after placing. It shall be thoroughly worked against the formwork, around reinforcement bars, tendons, ducts and embedded fittings and into corners to form a solid mass free from voids.

The concrete shall be free from honeycombing and planes of weakness, and successive layers of the same lift shall be thoroughly bonded together.

Unless otherwise permitted by the Engineer, concrete shall be compacted by means of vibrators. Internal vibrators shall be capable of producing not less than 10000 cycles per minute and external vibrators not less than 3000 cycles per minute. Sufficient standby vibrators shall be kept available in case of breakdowns.

Vibration shall be applied by experienced labourers, and over-vibration resulting in segregation, surface water and leakage shall be avoided. Contact with reinforcement and formwork shall, in so far as is practicable, be avoided when internal vibrators are used. Concrete shall not be subjected to disturbance by vibration within 4 to 24 hours of it having been compacted.

Whenever vibration is applied externally, the design of the formwork and positioning of vibrators shall be such as to ensure efficient compaction and avoidance of surface blemishes.

Special attention shall be given to the compaction of concrete in the anchorage zones and behind the anchor plates and in all places where high concentrations of reinforcing steel or cables occur.

Where the placing and compaction of concrete is difficult, a mix containing smaller sized aggregate may be used but only with the approval of the Engineer and after a mix containing such aggregate has been designed and tested

8.7 CURING AND PROTECTING

Formwork shall be retained in position for the appropriate times and as soon as may be practicable, all exposed concrete surfaces shall be protected from loss of moisture by one or more of the following methods:

a) Method 1

Retaining formwork in place for the full curing period.

b) Method 2

Ponding the exposed surfaces with water, except where atmospheric temperatures are low, i.e., less than 5^0C.

c) Method 3

Covering it with sand or mats made from a moisture-retaining material, and keeping the covering constantly wet.

d) Method 4

Constantly spraying the entire area of the exposed surfaces with water (only on surfaces where sand cover or ponding is impossible).

e) Method 5

Covering with a waterproof or plastic sheeting firmly anchored at the edges.

f) Method 6

Using an approved curing compound applied in accordance with the manufacturer's instructions, except that, where the surface has to be subsequently waterproofed, coated or gunited, this method may not be used.

g) General

The method of curing adopted shall be subject to the Engineer's approval and shall not cause staining, contamination, or marring of the surface of the concrete.

The curing period shall be continuous for at least seven days for concrete made with ordinary Portland cement or ordinary Portland cement 15, rapid-hardening Portland cement or rapid-hardening Portland cement 15, and at least 10 days if Portland blast-furnace cement or a 50/50 mixture of Portland cement and ground granulated blast-furnace slag is used. When the temperature of concrete falls below 5^0C, these minimum curing periods shall be extended by the period during which the temperature of the concrete was below 5^0C.

When sliding formwork is used, the concrete shall be protected against the weather and rapid drying out by means of a 4 m wide skirt attached to the lower perimeter of the formwork and hanging over the working platform. The skirt shall consist of hessian in summer months and of canvas or other suitable material in winter. The skirt shall be weighted at the bottom to prevent it flapping in windy conditions.

The concrete shall be cured by means of a fog spray to keep it wet constantly for the periods stated above or until a curing compound is applied. Wetting the concrete by spraying shall be by means of a fixed spraybar along the full length of the sliding formwork. The spraybar shall be connected to a suitable high-pressure water supply. Wetting shall be discontinued when the ambient air temperature drops below 5^0C, and care shall be taken by the Contractor to ensure that the water will not erode the surface of the fresh concrete.

8.8 ADVERSE WEATHER CONDITIONS

(a) Cold weather

Concrete shall not be placed during falling temperatures when the ambient air temperature falls below 7^0C or during rising temperatures when the ambient air temperature is below 3^0C. When concrete is placed at air temperatures below 5^0C the concrete temperature shall not be below 10^0C, for which purpose heating of the water and/or the aggregate shall be permitted. The Contractor shall make all the necessary arrangements for heating the material. Heated water and aggregate shall first be mixed and the cement shall then be added only while the temperature is below 30^0C.

The temperature of placed concrete shall not be allowed to fall below 5^0C until the concrete has attained a strength of at least 5 MPa, and the Contractor shall be responsible for all protective measures necessary to this end. All concrete damaged by frost or by the formation of ice in the concrete shall be removed and replaced by the Contractor at this own expense.

(b) Hot weather

When the ambient air temperature exceeds 30^0C during concreting, the Contractor shall take measures to control the temperature of the concrete ingredients so that the temperature of the placed concrete will not exceed 30^0C unless otherwise determined by the Engineer. Such measures include spraying aggregate stockpiles with water to promote cooling down by evaporation and, where feasible, shading the stockpiles and the area where concreting is carried out. Curing shall commence immediately after concrete has been placed to prevent an excessive loss of moisture.

8.9 QUALITY OF WORKMANSHIP AND MATERIALS

(a) Routine inspection and quality control will be done by the Engineer as specified in respect of the Contractor's obligation to institute and implement a control system for monitoring the quality of the work and curing of concrete. If the Engineer is satisfied that the requirements of the Contractor's process control have been met, the Engineer may decide at his discretion to use the Contractor's test results in the evaluation of the concrete.

(b) Procedure in the event of non-compliance with the requirements

Any lot represented by test cubes failing to comply with the criteria specified for the characteristic strength shall be rejected, or the Engineer may at his discretion allow the following tests to be conducted in order to decide whether the concrete may be left in position. at further reduced payment:

i) The Engineer may allow the elements or units concerned to be cured for an additional period not exceeding 56 days. Thereafter the Contractor shall drill cores in accordance with SABS 865 or equivalent, and the Engineer will evaluate these cores in accordance with SABS 0100 - Part II or equivalent.
ii) Where the Engineer so directs, full-scale load tests shall be conducted in accordance with SABS 0100 Part II or equivalent to determine whether any particular structure or member can be left in position. The cost of such tests shall be for the Contractor's account regardless of the outcome of the tests.

In all cases where concrete has been supplied which fails to comply with the strength requirements, the Contractor shall immediately take the required remedial action by changing the mix proportions to obtain the required strength.

(c) Tests ordered by the Engineer

Where the routine testing of concrete cubes is not conducted on the site by the Engineer, he may order the Contractor to have the concrete cubes, which have been made by the Engineer with the same mix proportions, tested at an approved testing laboratory, in which case no separate payment will be made for such tests.

9 ANCILLARY WORKS

9.1 FENCING

This Section covers the moving of existing fences where necessary and erecting new fences as specified and elsewhere indicated on the Drawings or as directed by the Engineer.

It shall also include the erection and later removal of temporary fences. Except when the Engineer allows otherwise, new and temporary fences shall be erected during construction.

This Section also covers the dismantling of existing fences and the stacking of the fencing material.

9.2 GABIONS

This Section covers the construction of gabion walls and aprons for constructing retaining walls, lining channels, revetments and other anti-erosion structures.

Gabions shall be PVC –coated mesh cages packed with rock. shall be of an acknowledged make which shall be subject to approval by the Engineer.

9.2.1 Materials

a) Rock

Rock used as filling for cages shall be clean, hard, un-weathered boulders or rock fragments. No rock fragment shall exceed the maximum size given in TABLE 9/ 1, and at least 85% of the rocks shall be of a size equal to or above the average least dimension size in TABLE 9/1.

ROCK SIZES TABLE9/1

Depth of cage (m)	**Rock size according to the largest dimension of rock**	
	Average least dimension (mm)	Maximum (mm)
0.2	125	150
0.3	125	200
0.5	125	250
1.0	125	250

b) Wire

All wire for making the gabions and for tying during the construction of the gabions shall comply with the requirements of SABS 675 or equivalent for mild- steel wire.

c) PVC- coated wire

The gabions of PVC –coated mesh shall be of an acknowledged make which shall be subject to approval by the Engineer.

d) Galvanising

All wire used in the making of gabions shall be galvanised in accordance with the provisions of SABS 675 or equivalent for Class A heavy galvanised mild- steel wire.

e) Wire mesh

Wire mesh shall comply with the requirements of SABS 1580 or equivalent.

9.2.2 Constructing Gabion Cages

(a) General

Gabion cages shall be made from wire mesh of the size and type and selvedge as specified below. The cages shall be subdivided into cells by wire mesh diaphragms and will be of two types.

(i) Boxes which are generally used for the construction of gabion walls. These boxes are subdivided into cells by diaphragms spaced at 1.0 m intervals. No diaphragms are required for a box of which the length does not exceed 1.5 m.

(ii)Mattresses which are generally used as single-layer aprons only in revetments, channel linings, etc and in which the maximum width shall be subdivided by diaphragms into cells with a width of 600 mm or 1.0 m as specified in the Bill of Quantities.

The standard sizes of boxes and mattresses are as follows:

(1) Boxes:
- Length. 1, 2, 3 and 4 m
- Width 1.0 m
- Depth. 0.3 m, 0.5 m and 1.0 m
- Diaphragm spacing 1.0 m

(2) Mattresses:
- Length 6 m
- Width 2 m
- Depth 0.2 m, 0.3 m and 0.5 m
- Diaphragm 600 mm or 1.0 m as specified

Other gabions may be supplied, provided that the Engineer's prior permission has been obtained

(a) Preparing the foundation and surface

The surface on which the gabion cages are to be laid prior to their filled with rock shall be levelled to the depth shown on the Drawings or as directed by the Engineer so as to present an even surface. Where required, a foundation trench along the toe of the revetment or wall shall be excavated to the dimensions shown on the Drawings or indicated by the Engineer.

(b) Filter fabric

One layer of Grade 3 filter fabric shall be placed where indicated on the Drawings or ordered by the Engineer. The material shall be placed, in accordance with the instructions, in strips with a minimum overlap of 300 mm at the joints, and shall be properly fastened to prevent any movement or slipping while the gabions are being placed.

(c) Assembly

The methods of constructing, stretching, placing in position, wiring and filling the gabions with rock shall generally be in accordance with the manufacturer's instructions which have been approved by the Engineer, but nevertheless sufficient connecting wires shall be tensioned between the vertical sides of all the outer visible cells to prevent the deformation of boxes as they are being filled with stone.

It is essential that the corners of gabion cages be securely wired together to provide a uniform surface and ensure that the surface does not resemble a series of block or panels.

The layout and the tolerances for the layout of the boxes shall be as shown on the Drawings or as instructed by the Engineer.

(d) Rock filling

(i) Boxes in retaining walls

Particular care shall be taken in packing the visible faces of gabion boxes, where only selected stone of

the specified size shall be used so as to obtain as even–faced finish. The boxes shall be filled in layers to prevent deformation and bulging. Boxes shall be filled to just below the level of the wire braces, after which the braces shall be twisted to provide tension. Care must be taken to ensure that consecutive layers of cages are filled evenly to a level surface ready to receive the next course.

(ii) Mattresses used in revetments and aprons

The 0.2 m, 0.3 m and 0.5 m gabions forming aprons and revetments shall be filled by random stones being packed in the first layer and selected stones being used for the top layer so as to resemble normal stone pitching.

9.2.3 Measurement and Embankment

The unit of measurement shall be the cubic metre of the rock – filled cages and the quantity shall be calculated from the dimensions of the gabions indicated on the Drawings or prescribed by the Engineer, irrespective of any deformation or bulging of the completed gabions.

The bid rates shall include full compensation for supplying all the materials, including rock fill, wire–mesh cages, tying and connecting wires, loading transporting and off-loading, the assembling and filling of the cages, and any other work necessary for constructing the gabions

9.3 PAINTING STRUCTURAL STEEL

(a) General

This Section includes the painting of steel guard rail posts, steel road sign supports and steel sign face frames, where required.

The surface preparation, priming and application of an undercoat shall be carried out under cover at the fabricator's works. Where possible, all painting shall be done at the fabricator's works but, where this is not feasible, the Engineer may permit the application of the finishing coats on the site, in which case an undercoat shall be applied at the fabricator's works prior to the members being despatched to the Works.

Unless otherwise specified, the protection described in (c), (d) and (e) shall be applied to aII steel work. Corrosion protection of steel work exposed to aggressive or severe conditions shall comply with the requirements of the Special Specifications.

(b) Surface preparation

(i) New structures

After all, cutting, drilling, welding and punching have been completed, it shall be ascertained that all sharp edges have been uniformly rounded off and smoothed down. All physically adhering contaminants shall be removed and the surface shall then be abrasive-blasted to Sa 2½ finish in accordance with the Swedish Standard SIS 05/59/00 or equivalent. The profile limit of the surface finish shall be between 30 μm and 60 μm. The abrasive-blasting profile shall be measured in accordance with SABS Method 772 or equivalent and shall comply with SABS Code of Practice 064 or equivalent.

No abrasive-blasting shall be done during rainy weather or when corrosive air conditions prevail.

Unless the application of a primer follows within four hours of abrasive blasting and before any oxidation of the prepared surface takes place, the abrasive-blasted surface shall immediately after abrasive blasting be given one coat of a wash primer.

(ii) Existing structures

The surface preparation of existing structures shall be carried out on site in accordance with SABS 064 or equivalent.

(c) Primer

The prepared surface shall be given two coats of a zinc-chromate primer in accordance with SABS 679, Type 1, Grade II or equivalent. The first coat shall be applied within 12 hours in the case of wash-primed surfaces and within four hours, but before any oxidation of the surface takes place, in the case of abrasive-blasted surfaces that have not been wash-primed. A fast-drying zinc chromate in accordance with SABS 679, Type II, Grade II or equivalent, may be used as primer. In all cases the dry-film thickness shall not be less than 30 μm per coat.

When steel has to be welded after the primer has been applied, the steel shall be left unpainted for a distance of 75 mm from the weld joint unless a weldable type of paint has been used.

(d) Undercoat

Where the finishing coats are to be applied on the site, the primed surfaces shall be given one coat of a universal undercoat with a suitable colour in the fabricator's shop before despatch. The undercoat shall be applied as soon as the prime coat has dried sufficiently. The dry-film thickness shall not be less than 25 μm.

(e) Finishing coat

Two finishing coats of high-gloss structural paint (SABS 684, Type A or equivalent) of the specified colour shall be applied to leave a dry-film thickness of not less than 25 μm per coat.

Where the finishing coats are applied on the site, the undercoat shall be lightly sanded and the members washed and cleaned of all contaminants. The first finishing coat shall be applied as soon as the structural members are dry.

Where specified in the Special Specifications, the second finishing coat shall consist of a micaceous iron-ore-pigmented structural paint of the specified colour to a dry-film thickness of not less than 30 μm. Unless otherwise specified, the second finishing coat shall be applied within 48 hours of the application of the first finishing coat.

The dry-film thickness of the total paint system shall not be less than 110 μm when no undercoat is used and not less than 135 μm when an undercoat is used. Where the second finishing coat is an iron-ore-pigmented paint, these thicknesses shall be increased by 5 μm.

(f) Mating surfaces

When mating surfaces are brought together, both surfaces shall already have been covered with all the specified coats of paint, but, where this is impossible, each surface shall be given a copious coating of primer and the surfaces drawn up while the paint is still wet.

(g) Back-to-back members and areas not easily accessible

Back-to-back members and areas not easily accessible shall be fully coated with all the specified coats of paint up to and including the finishing coats before erection.

(h) Damaged areas

Damaged areas shall be treated as follows:

Sand down to bright metal and clean. Spot prime with two coats and sand down lightly when hard. Rinse off with water and allow to dry. Apply two finishing coats.

(i) Structural steel to be embedded below ground

Those parts of structural-steel members to be embedded in soil and all bases to a height of 500 mm shall be given two coats of an epoxy-tar prime instead of the zinc-chromate prime specified for other surfaces

10 STANDARD SPECIFICATIONS FOR BUILDINGS

10.1 INTRODUCTION

This Part of the Specifications indicates the requirements of the Contract in respect of building and appurtenant work.

Throughout the Drawings, and in this Specification, all reference to British Standard Specifications shall be deemed to be the latest edition of the British Standard to which the Clause refers at the time of tendering.

The Specification is to be read in conjunction with other Parts covering the entire Works.

Details on Drawings and in the Bills of Quantities and instructions given on Site by the Engineer will take precedence over the Specifications given herein.

10.2 EARTHWORKS

The Contractor shall keep a photographic record of surfaces to be reinstated, before the commencement of the works, and after completion of the reinstatement. Before the commencement of works that will damage surfaces, and will therefore need reinstatement, the Contractor shall inform the Engineer in writing, one week in advance of date of carrying out the works and the anticipated date of reinstatement.

10.3 BUILDING AND CONCRETING

10.3.1 Sand

All sand for making mortar shall be clean, well graded siliceous sand of good, sharp, hard quality equal to samples, which shall be deposited with and approved by the Engineer. It shall be free from lumps of stone, earth, loam, dust, salt, organic matter and any other deleterious substance, sieved through a fine sieve and washed if so directed.

10.3.2 Lime

Lime for mortar shall be non-hydraulic or semi-hydraulic quicklime or hydrated lime in accordance with BS 890, Class B.

Quicklime shall be run to put it immediately after delivery to Site in a pit dug on the Site or in an approved container. The water to be first run into the pit or container and the lime to be added, until it is completely submerged, and stirred until all lumps are disintegrated. The resulting milklime shall then be run through a 3 mm square mesh sieve and into a pit or other container and kept clean and moist for not less than 4 weeks before use.

Hydrated lime shall be added to water in a clean receptacle, thoroughly mixed to the consistency of thick cream and allowed to stand, and be kept clean and moist, for not less than 16 hours before use.

10.3.3 Cement Mortar

Cement mortar shall be 1:5, composed of 50.0 kg of Portland cement to 0.15 cu metres of sand, measured in specially prepared gauge boxes and thoroughly mixed in an approved mechanical mixer or mixed dry on clean and approved mixing platforms, with water added afterwards, until all parts are completely incorporated and brought to a proper consistency. Retempering of wholly or partially set mortar will not be allowed.

10.3.4 Gauged Cement Motor

Gauged cement mortar shall be composed of 50.0 kg cement to 0.085 cu metres of lime to 0.34 cu. metres of sand, measured in specially prepared gauge boxes and thoroughly mixed dry on clean and approved mixing platforms, with water added afterwards, until all parts are completely incorporated

and brought to a proper consistency. No partially or wholly set mortar will be allowed to be used or remixed.

10.3.5 Gauged Lime Mortar

Gauged lime mortar shall be composed of 2 parts by volume of lime putty to 9 parts by volume of sand, measured in specially prepared gauge boxes and mixed dry on clean and approved mixing platforms, with water added afterwards, until all parts are completely incorporated and brought to a proper consistency.

The mortar shall be mixed 7 to 10 days before it is required for use and shall be stacked in a neat heap well smoothed off, covered with wet sacks and allowed to mature.

Immediately before use, 1 part by volume of Portland cement shall be added to 9 parts by volume of lime mortar, the whole being remixed, with the addition of extra water, until all parts are completely incorporated and brought to a proper consistency.

The gauged mortar must be used within 45 minutes of being mixed. Retempering of wholly or partially set mortar will not be allowed.

10.3.6 Protection

All walling shall be properly protected while mortar is settling, as the Engineer shall direct.

10.3.7 Setting out Rods

The Contractor shall provide setting out rods and set out all work on same for courses, openings, heights, etc. and shall build the walls, piers, etc. to widths, depths and heights indicated on the Drawings. Setting out rods to be gauged to allow an average height of 22.5 cm for each course.

10.3.8 Bonding of Blockwork and Stone Walling

Blocks or stone for general walling shall be bedded and jointed as described, properly bonded together in such manner that no vertical joint, in any one course, shall be within 125 mm of a similar joint in the courses immediately above or below. All walling of 300 mm thickness or less shall be built in single thickness of blocks or stone.

Walling exceeding 300 mm in thickness shall be built in two thicknesses of blocks or stones with through blocks or stones no more than 1.0 m (approximately) apart in each course as directed by the Engineer.

Alternate courses of walling at all angles and intersections shall be carried through the full thickness of the adjoining wall. All walling shall be built entirely solid in blocks, without voids and all perpends, reveals and angles built strictly true and square. The walling shall be flushed up and grouted solid as the work proceeds.

Stone blocks shall be wetted before being laid and the walling kept wet while the mortar is setting. The top of walling, where left off, shall be well wetted, before recommencing work, as the Engineer shall direct.

All putlong holes shall be not less than one course deep and carefully filled with concrete block or stone, cut to fit the size of opening, with beds and joints filled with mortar, well tamped in, after scaffolding is removed and, if in faced wall, to match facings.

10.3.9 Parging and Coring

All flues shall be parged and cored in lime and sand mortar (1:4)

10.3.10 Quarry Tile Cills

Quarry tiles for cills shall be throated, red, size 150 x 150 mm in accordance with BS 2871 type A. The tiles shall be set sloping and bedded in cement mortar (1:3) and neatly flush pointed with cement and sand grout (1:1) tinted to match tiles.

10.3.11 Damp Proof Course

The bituminous felt sheet for damp proof courses shall be three-ply approved membrane in accordance with BS 743, weighing not less 0.5 kg per square metre. The sheeting is to be lapped 150 mm at running joints and the full width of walls at angles. Only the net area covered is measured and the Contractor shall allow in his prices for all cutting and waste and extra material in laps as joints, angles, etc.

10.3.12 Reinforced Walling

Walls of less than 200 mm thickness shall be reinforced with one row of 20 gauge hoop iron, minimum 20 mm wide, built into every third course, well lapped at junctions and joints and carried at least 125 mm into abutting walls at intersections.

10.3.13 Fixing of Timber Door Frames

All door frames are to be bedded, and pointed in mortar and are to be securely fixed to reveals means of 25 mm mild steel cramps 300 mm long, bent and screwed to backs of frames, with a flanged end built 225 mm into joints of walling, three cramps to each side frame of each door. Where the door is provided with fanlights, four cramps are to be used to each side frame.

10.3.14 Holes for Timbers in Walling

Holes for timber built into or passing through a wall shall be squared out to suit the timber size and line with 3 ply roofing felt cut flush to finished wall surfaces.

10.3.15 Concrete Blockwork Walling

Concrete blocks shall be solid, hard, true to size and shall have sharp arises in accordance with BS 6073 Type “A” and be approved by the Engineer.

They shall be obtained from an approved manufacturer or manufactured on Site in an approved block making machine. The mix used shall be not less than (1:9) by volume and the maximum size of aggregate shall not exceed 1.2 mm.

All concrete blocks used in walling must be capable of withstanding a crushing pressure not less than 0.280 kg/mm^2 after 28 days.

The blocks, on removal from the machine, shall be carefully deposited, on edge on racks under sheds, erected by the Contractor, and left for 3 days, during which period they shall be kept constantly wet. After this period, they shall be placed on edge, in the open on racks and protected by sacking, or other approved covering, and kept wet for a further 5 days. Thereafter, the blocks shall be left in the same position without wetting for a further 20 days.

No blocks will be allowed to be used in the work until 28 days old and until samples have been taken and approved by the Engineer.

They shall be laid dry except for the top surface, which shall be wetted immediately before mortar is applied. After laying no further water shall be applied.

The concrete blocks shall be 225 mm high to bond in satisfactorily with all other walling.

Except where plaster finish is required internally, the internal faces of wall shall be finished fair with beds and joints neatly flush pointed as the work proceeds.

All walls to be plastered to have the joints raked out 12 mm deep as keys for plaster.

The concrete blocks shall be bedded and jointed in gauged lime mortar, as described, with beds and

joints not more than 12 mm or less than 6 mm thick, all flushed up and grouted solid as the work proceeds, or pointed as required.

10.3.16 Hollow Clay Partition Blocks

Hollow clay partition blocks are to be hard, well burnt, true to size and shape, with sharp arrises and keyed faces and joints in accordance with BS 3921. They are to be equal in every respect to a sample to be deposited with and approved by the Engineer.

Hollow clay partition blocks shall be laid in courses 225 mm high to break joint in alternate courses and shall be bedded and jointed in cement mortar as before described.

10.3.17 Stone Walling

The stone for walling shall be sound and hard throughout, free from all defects, and shall be obtained from a quarry approved by the Engineer. It shall be chisel dressed into true rectangular blocks, with each surface even and at right angles to all adjoining surfaces.

Stone blocks for general walling shall nominally be 225 mm high and 100 mm, 150 mm, 225 mm, or 300 mm thick as required for the work, the maximum permissible variation of any of the foregoing dimensions being 1.0 cm.

Stones shall not be less than 450 mm long but a proportion of 20% will be permissible in lengths between 300 mm and 450 mm long. Samples shall be submitted to the Engineer for approval when so approved shall become the standard for the work.

The stone blocks shall be bedded and jointed in cement mortar, as described, with beds and joints not more than 12 mm or less than 6 mm thick, all flushed up and grouted solids as the work proceeds, or pointed as required.

10.3.18 Brick Walling

The brick shall be 225 x 115 x 75 mm (nominal) and shall be sound, hard, square, well burnt and of uniform size, shape and colour with sharp straight arrises. The bricks shall comply with BS 3921 and shall produce a clear ringing sound when struck against one another. No brick shall absorb more than twenty per cent of its dry weight during twenty-four hours immersion in water.

The Contractor shall be responsible for the transportation of the bricks to the Site in good condition and for ensuring that they are carefully unloaded and stacked on the Site. On no account will bricks be tipped from the vehicles. No broken or damaged bricks will be permitted to be used in the work.

All brickwork shall be built in English bond, consisting of alternate courses of headers and stretchers, all as detailed. Half brick walls shall be built in stretcher bond.

All bricks shall be well soaked with water immediately before being laid. Joints shall be not more than 10 mm thick and shall be bedded and jointed in cement mortar as described. All joints shall be solidly flushed up as the work proceeds. Bats shall not be used except where required for bond.

All brickwork shall be set out and built to the respective dimensions, thicknesses and heights specified or shown on the Drawings, and shall be built in a uniform manner, no one portion of two being raised more than 1.00 m above the other, at any one time, and, in such cases, the joints between the portions shall be in long steps to prevent cracks arising. All courses shall be truly horizontal and all perpends, quoins, jambs etc. shall be kept strictly vertical and square. All junctions of walls, etc. shall be formed in the correct bond as the work proceeds.

When walls are to be faced, only selected and approved facing bricks shall be used, the facing bricks shall be kept perfectly clean and no rubbing down of brickwork will be allowed. Walls must be protected against splashing caused by rain, paints or other causes.

All putlong holes shall be formed by leaving out headers in header courses or stretchers in stretcher courses as required, carefully filled up with headers or stretchers, as necessary, with beds and joints

filled with mortar, well tamped in, after scaffolding is removed.

10.3.19 Precast Concrete Air Bricks

Unless otherwise stated precast concrete airbricks are to be 225 mm wide, 150 mm high and 40 mm thick of approved pattern.

The air bricks shall be fixed double, one flush with the outer face of the wall and having approved copper mosquito gauze cut to size and fixed by folding over the edges of air bricks before building in. The other brick fixed flush with the inner face of the wall. Include for rendering around sides, top and bottom of brick opening in cement and sand mortar (1:4).

10.3.20 Built-in Services

Particular care shall be exercised by the Contractor to ensure that all pipes, ducts, drains, conduits, junction boxes, anti-static installations, etc., are laid before the concrete for the floor and roof slabs is poured, and the Contractor will be held responsible for the cost of any additional cutting etc., and making good which becomes necessary through his failure to make proper arrangements for all work to be done in close cooperation.

10.3.21 Precast Concrete

The mixes for precast concrete units shall be as follows unless otherwise stated on the Drawings.

UNIT	CONCRETE
Lintels	C20-20 mm nominal aggregate
All other Units	C20 – 12 mm nominal aggregate

10.3.22 Entrance Steps

Entrance steps, as required, to suit ground and floor levels shall be formed in concrete (C15/20), with suitable foundations as directed by the Engineer. Treads shall be not less than 250 mm wide and risers not more than 175 mm high. All exposed surfaces shall be finished in cement and sand rendering (1:4), trowelled smooth with a wood float, 18 mm thick on treads and 12 mm thick on risers and finished with Carborundum dust on treads.

10.3.23 Concrete Apron

To all buildings where directed, provide a 50 mm thick concrete (C20/12) apron, 1.0 metre wide around the perimeter, laid on a 100 mm bed of hard-core, shall be provided.

10.3.24 Savings

Where required, these shall be size 600 x 600 x 50 mm thick of vibrated (C20/12) concrete finished on top with a wood float, clean cut edges and free from all cracks, chips or broken corners. The slabs shall be laid on a 75 mm thick consolidated bed of sand or stone dust, laid to falls where necessary and jointed and pointed in cement mortar (1:4).

The jointing mortar to be worked well down into the joints and the pointing to be key drawn and all excess mortar cleaned off.

10.3.25 Concrete Shelves

All suspended precast or in-situ concrete shelves, pot slabs, etc., shall be reinforced with B.R.C. Ref. NO. A252 or other equal and approved fabric reinforcement.

10.4 WOODWORKS

10.4.1 Quality of Timber

The qualities of timber are stated hereinafter:

All timber described as “sawn podo” shall be Grade 11 (Select Grade) sawn podocarpus.

All timber described as “wrot podo” shall be Grade 1 (Prime Grade) wrot podocarpus.

All timber described “cedar wrot” shall be first (Prime Grade) wrot cedar.

All Musharagi, Mvule, Mahogany, and all other hardwoods, shall be selected quality, kiln seasoned or air dried and, when delivered to Site, shall have a moisture content of not more than 14% of its dry weight.

All timber for permanent work in the building shall before use, be approved by the Engineer for quality in accordance with the foregoing specification for its respective grade.

10.4.2 Treatment of Timber

All structural timber used in the Works shall be treated with an approved preservative. Such timbers shall be impregnated under pressure before fixing with Tanalith, Celcure, or other approved medium, toxic termites, crypotermes and other timber pests. All cut end of timber so impregnated are to be treated with two coats of “B” crystals or other approved method.

10.4.3 Tolerance of Scantlings

Variations from specified dimensions of scantlings shall not exceed the tolerance agreed with the Engineer. Boards 25 mm thick or less shall hold up to the specified sizes. All timber shall be as long as possible and practicable to eliminate joints.

10.4.4 Sizes and Thickness

Sizes and thickness of wrot carpentry and joinery are nominal, that is to say a 3 mm reduction off specified sizes will be allowed for each wrot face, except where described as finished sizes in which case no reduction from the stated thickness or size will be permitted.

10.4.5 Insulation Board

Insulation board shall be 12.5 mm thick “CELOTEX”, or other equal and approved fibreboard, in accordance with BS 1142. Insulation board ceilings shall be fixed to a symmetrical pattern in each room.

10.4.6 Soft Board

This board is similar to insulation board but having high moisture absorbing properties.

10.4.7 Block Board

Block board shall be of approved local or imported manufacture, to BS 3444, softwood or hardwood faced, as specified, equal to a sample to be deposited with the Engineer for approval and which, when so approved, shall form the standard for the work.

10.4.8 Plywood

Plywood shall be of approved local or imported manufacture, in accordance with BS6566, and of approved first or second grade softwood faced, unless otherwise described. “Exterior Quality” plywood shall be exterior moisture resistant type.

10.4.9 Hardboard

Hardboard shall be suitable for painting, in accordance with BS 1142 and shall be used, prepared and fixed strictly in accordance with the manufacturer’s printed instructions.

10.4.10 Chipboard

Chipboard shall be approved, or local softwood, faced in accordance with the manufacturer's printed instructions.

10.4.11 Plastic Sheets

Laminated plastic sheeting shall be "Formica", or other equal approved, in accordance with BS 3794 of the type and grade specified. It shall be used, prepared and fixed strictly in accordance with the manufacturer's printed instructions.

10.4.12 Wood Wool Slabs

Wood wool slabs shall be approved Normal Quality to BS 1105 and fixed in accordance with the manufacturer's printed instructions.

10.4.13 Defects

Should any of the carpentry or joinery shrink, warp, wind or develop any other defects within six months after the completion of the work, the same shall be removed and new fixed in its place, together with all other work, which may be affected thereby, all at the Contractor's cost and expense.

10.4.14 Carpentry

All carpentry work shall be left with sawn surface except where particularly specified to be wrot. Scantlings and boarding shall be accurately sawn and set out, in strict accordance with the Drawings, and shall be framed together and securely fixed in the best possible manner with properly made joints. Provide all beads, nails, screws, etc. as necessary and directed and approved.

10.4.15 Wall Plates

Wall plates are to be bedded on walls in cement mortar and secured with 12 mm diameter bolts, 300 mm long at 1.00m centres, built 225 mm deep into walling. Plates to be in long lengths, halved and spiked at joints and angles.

10.4.16 Valley Rafters

Valley rafters to be fixed double and bolted or spiked together as directed or as shown on the Drawings.

10.4.17 Gang Boarding

Gang boarding 25 mm thick, butt jointed and securely nailed to ceiling joists, shall be provided to form an access floor 450 mm wide between ceiling opening and water storage cisterns unless otherwise specified.

10.4.18 Fascia and Barge Boards

Fascia and bargeboards shall be in wrot cedar or as specified and according to detailed Drawings.

10.4.19 Bat Proofing

The underside of projecting eaves to buildings with ceilings shall be bat proofed by means of 50.0 x 25.0 mm wrought podo framing filled in with stout galvanised coffee tray mesh.

The framing shall be nailed on one edge to ends of rafters to butt up against fascia board and, on other edge, 50.0 x 25.0 mm sawn podo bearers plugged to wall.

10.4.20 Building in of Timbers

Timbers such as purlins, etc., required to be built into or through inner and outer walls, shall have 12 mm air space between same and walling.

10.4.21 Joinery

All joinery shall be executed with workmanship of the best quality and in strict accordance with the detailed Drawings. All mouldings shall be accurately run and all work planed, and papered and finished to the approval of the Engineer. All finishes shall be slightly rounded. All framed work shall be cut out, properly tongued, shouldered, etc., and framed together, as soon after the commencement of the work as is practicable, but should not be wedged up until required for fixing in position. Any portions that warp, wind, develop shakers, or other defects, shall be replaced with new ones.

As soon as required for fixing in position, the framing shall be glued together with best quality glue and properly wedged or pinned, etc. as described.

Oval or round brads or nails shall be used for fixing all face work. All heads shall be properly punched in and puttied.

The quality of all workmanship shall conform to Part 11 of BS 1186.

10.4.22 Plugs

All fixing for joinery etc. shall be approved and plug fixed into holes of a recommended size. The holes shall be drilled with special masonry drills and not cut with a cold chisel and hammer. Under no circumstances will wooden plugs be permitted. The expression “plugged” shall be taken to mean fixed with and including plugs as last described to stone or concrete.

10.4.23 Protection

Any fixed joinery which, is liable to become bruised or damaged in any way, shall be properly cased and protected by the Contractor until the completion of the work.

10.4.24 Setting out of Joinery Work

All joinery work shall be accurately set out on boards to full size, for information and guidance of artisans before commencing the respective work, with all joints, ironwork and other items connected therewith fully delineated. Setting out will be required to be submitted to the Engineer and approved before the respective work is commenced. All joinery work shall be wrot unless otherwise described.

10.4.25 Ceiling Joists

Where ceilings are shown on the Drawings, ceiling joists shall be fixed at 600 mm centres and around walls and the undersides shall be perfectly level.

Brandening is to be 50 x 50 mm, fixed to and level with the underside of ceiling joists, at 600 mm centres, maximum, in both directions. The Contractor shall include for cutting and fitting at trusses.

10.4.26 Ceilings

Where shown on the Drawings, ceilings to all rooms shall be formed of approved insulation board not less than 12 mm thick

Ceilings shall be fixed to brandering in a symmetrical pattern with edges chamfered to form “V” joints, all to the approval of the Engineer.

10.4.27 Priming of Woodwork

Where intended to be in contact with stone, concrete blocks, concrete, cement or plaster, the backs and other surfaces of all door, window or other frames and linings, posts, architraves, skirting, fillets and fascias, and cornices etc. shall be treated with one coat of aluminium priming paint applied before fixing.

10.4.28 Cornices

The Contractor shall provide 100 x 25 mm cedar moulded cornices, securely fixed to rafters and brandering, at the junction of walls and fibreboad ceilings in all rooms or provide 75 mm wide strips of insulation board, planted on to the junction of walls and fibreboard ceilings, as shown on the Drawings.

10.4.29 Doors, Frames and Finishings

(a) Flush Doors

Flush doors shall be in hardwood and obtained from an approved local manufacturer, sizes of members and method of construction shall be to the approval of the Engineer.

(b) Framed, Ledged and Braced Doors

Framed, ledged and braced doors shall be 5.0 cm (nominal) thick 830 x 2,030 mm overall, or to size specified on the Drawings, and shall consist of 100 x 25 mm stiles and top rail, 225 x 25 mm lock and bottom rails and 100 x 25 mm diagonal braces filled in with 25 mm tongued, grooved and "V" jointed both sides boarding, in matched width, and shall include chamfers on edge of stiles and adjacent boarding to form "V" joints.

(c) Ledged and Braced Doors

Ledged and braced doors shall be 50 mm (nominal) thick 830 x 2,030 mm overall, or to sizes stated on the Drawings, and shall consist of 100 x 25 mm top rail and diagonal braces, 225 x 25 mm lock and bottom rails and covered on one face with 25 mm thick tongued, grooved and "V" jointed both sides boarding in matched widths.

(d) Door Frames

Door frames shall be in rebated and moulded cedar 100 x 75 mm. Wardrobe door frames shall be in rebated cedar 75 x 50 mm. Cupboard doorframes shall be in rebated cedar 75 x 38 mm.

(e) Wardrobe and Cupboard Doors

Wardrobe and cupboard doors shall be 25 mm thick flush doors constructed of approved blockboard and hardwood lipped on all edges.

(f) Architraves

The finishings of doorframes to all doors shall consist of 75 x 20 mm wrought cedar splayed architraves plugged to walling and mitred at all angles. When the doorframe is set against the face of the wall or where there is insufficient room for the architrave, the finishing shall consist of a 20 mm wrought cedar quadrant moulding planted on the frame.

(g) Door Stops

40 mm diameter rubber doorstops shall be provided to all door and securely plugged and screwed to floors with screws 40.0 mm long.

(h) Shelves

Slatted shelving shall consist of 50 x 25 mm wrought podo slats 20 mm apart screwed to bearers.

All board shelving exceeding 225 mm wide shall be cross-tongued.

Blockboard shelving shall be 25 mm thick with hardwood or softwood veneer, as stated or shown on the Drawings, with 132 x 25 mm softwood or hardwood edge strip to match, tongued in on all edges and the shelving screwed bearers.

(i) Pelmets and Curtain Track

Pelmets shall be in cedar and mm bearers plugged and screwed to concrete lintol or stone wall. The whole to be formed of 100.0 x 25.0 m twice rounded at front and ends. The top, 125.0 mm rounded, screwed to 50.0 x 25.0 properly tongued, grooved, glued and screwed together, fitted with, and includ-

ing, approved curtain track cut to length, and screwed to pelmet and fitted with 4 no. rollers per 300 mm run and all fittings.

(j) Window Boards

Window boards shall be formed in cedar and shall be 25 mm thick, rounded on edge to project 40.0 mm beyond jambs, notched at ends and plugged and pelleted to walling under.

(k) Trap Doors

Where shown, or directed, in fibreboard ceilings, the Contractor shall trim ceiling, joints and brandering for and form access door size overall 1000 x 850 mm. At hanging side of opening provide and fix 75.0 mm splayed frame and plant 75.0 x 50.0 mm stop on top of trimmer. Form the door with 50.0 x 25.0 mm frame covered with fibreboard to match ceiling and hang on pair of approved strong 75 mm steel butts and finish around opening with 40 x 25 mm rebated fillet screwed to trimmers to form stop.

(l) Panelling to Bath

The bath casing shall be provided with a removable access panel 300 x 450 mm of approved tempered hardboard, fixed to 38.0 mm x 38 mm sawn podo framing plugged to concrete floor and walls.

10.5 METAL WORKS

10.5.1 Ironmongery

All ironmongery shall be of the description and manufacture described and shall be fitted and fixed in an approved manner. All locks shall be provided with two keys and shall have a sufficient number of differs to ensure that no two external locks may be opened with the same key. The Contractor shall include for all cutting, sinking, boring, mortising, fitting and for supplying all necessary and suitable matching screws. The Contractor shall also include for removing door furniture, during painting operations, and afterwards refixing and for labelling all keys with door references and handing to the Engineer on completion. Master keys shall be provided and properly labelled where directed. Face plates with all locks shall match the door furniture.

All locks, springs and other items of ironmongery with movable parts shall be properly tested, cleaned and adjusted where necessary to ensure they are left in perfect working order by the Contractor.

Samples of all ironmongery specified shall be submitted to the Engineer for approval, and the approved samples shall thereafter be regarded as the standard for the work. Ironmongery which in the opinion of the Engineer, does not conform to this standard, shall be removed from the Site.

Alternatively, ironmongery of an equal standard will be acceptable provided samples are submitted to and approved by the Engineer before orders for such ironmonger are placed.

10.5.2 Structural Steel and Metal work

Mild steel shall be sound, of approved manufacture and comply with the requirements of BS 4360 and have full threads to all screw works. With welds neatly executed, filled smooth and left clean. Prices for all mild steel shall include for removing all rust and scale and applying one coat of red oxide or other approved priming paint to all surfaces before fixing. Cast iron shall be best quality cast clean and sharp and free from all cracks, vents, holes and other defects.

10.5.3 Galvanized Sheet Iron

Galvanised sheet iron shall be No.24 B.W. gauge of approved manufacture, free from all defects and hold up to the gauge as specified.

Flashings, gutters etc. shall be lapped 75 mm minimum and riveted and soldered at joints where required.

Where applied to walls, the side overlaps shall be seam bolted at 300 mm centres maximum with 6 mm diameter seam bolts 19mm long, each with diamond shaped bitumen washer, galvanised steel

washer and galvanised steel nut.

10.5.4 Burglar Protection

All windows, external doors and openings shall be burglar protected. Mesh window guards shall be provided to all ground floor bedroom windows. Window guards shall be galvanised “Weldmesh”, or other equal, of approved welded steel with 50 mm square mesh with No.8 gauge galvanised wires in each direction.

Burglar bars, which shall be provided to all but bedroom windows, shall consists of 19 x 5 mm high yield steel flats or hollow sections as directed by the Engineer, behind the line of the glazing bars to the casements, with the ends of the bars welded to metal or sunk into the timber frames, whichever is applicable. Louvre windows and openings shall be provided with an external grill of 20 mm twisted high yield bars or hollow sections as directed by the Engineer, built all round into the walling at intervals not exceeding 0.12 m. The bars shall be welded at 150 mm centres horizontally and 450 mm centres vertically.

External doors shall be provided on the outside with similar grills hinged to 50 x 50 mm angle iron frames built into the walling as previously described. One pair of butt hinges shall be used and hinge pins welded, after fixing the grill, so that the grill cannot be lifted off the hinges. The grill shall, on the inside, be provided with a 20 mm barrel bolt, welded to a 5 mm thick backing plate, 200 mm square, and secured by an approved padlock with hardened steel shank. The grill and frame shall further be provided with staples at the top and bottom to accommodate additional padlocks if required.

10.5.5 Metal Windows

Metal windows shall be of standard type of approved manufacture with plastic or bronze fittings, lugs, glazing clips and other accessories all in accordance with BS 6510. Windows shall be delivered to Site after correct selection of the windows, with red oxide dipped finish. Care shall be taken in the transportation, handling, storing and building into their requirement positions. Special attention to the care of the various window accessories shall also be given as no badly fitting, damaged or incomplete windows will be accepted by the Engineer. All such windows and accessories shall be replaced at the Contractor's own expense.

10.5.6 Louvre Windows

The vertical side members for louvre windows shall be profiled from 18-gauge aluminium strip to BS 1470. Blade holders and operating components shall be of injection-moulded polypropylene, or similar approved, with the blade holders sized to accommodate 152,4 mm (6 in) deep glass louvre blades, and pivoted on the vertical side members at centres of blades. They shall be linked together by 18-gauge aluminium section, specially profiled to form weathering links when the louvres are closed. The louvres should be capable of being locked in any position by means of plastic knob and steel bolts used in conjunction with a quadrant or in any other approved manner. Head and cill stops shall be either of 20-gauge aluminium or of suitable wood.

For louvre windows, glass to BS 952, with exposed edges bevelled, shall be used as follows: -

Glass widths not exceeding 600 mm: 4.0 mm clear sheet glass

Glass widths from 600 to 750 mm: 5.0 mm polished plate glass

Glass widths from 670 to 1000 mm: 6.5 mm polished plate glass

10.5.7 Open Mesh Steel Flooring

Open mesh flooring shall be to BS 4592 and shall be painted black in accordance with the Specification. Kicking plates, 100 mm high shall be provided around all openings unless otherwise stated.

10.5.8 Ladders

Ladders shall be galvanised mild steel, with 20 mm diameter solid rungs and 75 mm by 10 mm stringers turned over at top and bottom, flanged and drilled for 12 mm diameter rag bolts.

Rungs shall be set at 230 mm centres and stringers shall be 420 mm apart. Stays shall also be of mild steel, heavily galvanised, 75 mm by 10 mm with length to suit, bent to shape, drilled for 12 mm diameter bolts for fixing to stringers and walls etc, with maximum distances between fixing points of 2.5 m. Ladders shall generally conform to BS 4211 “Steel Ladders for Permanent Access”.

10.5.9 Handrailing

Handrailing shall consist of 25 mm internal diameter water tubing, galvanised after being cut to length. The standards shall be of best quality forged steel, heavily galvanised after manufacture, 900 mm high, having two 80 mm balls drilled to suit the tubing and position of standard. The shanks of the standards shall be 30 mm diameter and of a type suited to their position. The movable hook bars 750 mm long shall be 25 mm diameter solid mild steel round bars heavily galvanised, with suitable hooks and eyes, complete with appropriate fixings to standards and walls. Handrailing shall generally conform to BS 499.

10.5.10 Rolling Shutters

These shall be in galvanised steel, slatted, manually operated, with a locking device and prime coated. Frame size, type and fixing details shall be to the Engineer’s approval.

10.5.11 Fencing

Galvanised chain link fencing shall comply in all respects with BS 1722 Part 1.

Boundary fencing shall be 1.8 m high, topped by three strands of best quality barbed wire or razor wire as directed by the Engineer. The fencing shall comprise steel or precast concrete straining posts 2.6 m or 2.67 m long respectively, topped by a cranked extension piece 450 mm long, and set 750 mm in the ground in concrete Class C15/40 with all necessary struts.

Straining posts, intermediate posts and struts shall all be of either steel or precast concrete, corresponding to fence type LS 72A Table 4 or LC 72A Table 3 respectively of BS 1722 Part 1.

The chain link cladding shall be 50 mm mesh by 3 mm diameter, complete with three strands of 3.5 mm galvanised iron write, to which cladding shall be secured, at 150 mm centres on the top line wire and 450 mm centres on the middle and bottom-line wires.

Straining posts shall be provided at all ends, corners, junctions and changes in direction, and at intervals not exceeding 45 m on straight stretches. Intermediate posts shall be provided at intervals not exceeding 3 m.

10.5.12 Gates

Gates to boundary fencing shall be constructed at 25 mm diameter galvanised mild steel pipe frame, with rounded corners and covered with wire mesh. Each gauge shall be complete with all hinges and ironmongery.

Keeps for drop bolts shall consist of 25 mm diameter galvanised pipe, 250 mm long, embedded 150 mm deep in Class C 15/40 concrete.

10.5.13 Wrought Iron Gates

The manufacturer, pattern, locking devices and fixings shall be approved by the Engineer.

10.5.14 Reservoir Roof Vents

Roof vents for reservoir shall be doubled swan-neck type, manufactured from fibreglass or stainless steel. The vent internal diameter shall be 50 mm and corrosion resistant wire mesh guards shall be fitted to cover the ventilator openings. The vent shall project no less than 500 mm above the reservoir structural roof level and shall be cast in the positions indicated on the Drawings.

10.5.15 Reservoir Access Covers

Access covers for reservoirs shall be hinged, lockable, single seal, light duty manufactured from fibreglass or stainless steel. The clear access opening provided when the cover and frame are in position shall be as indicated on the Drawings. The seals shall be filled with non-toxic grease on commissioning of the reservoirs.

10.5.16 Reservoir Level Gauges

Level gauges shall be fitted externally to all reservoirs. Where reservoirs are covered by earthen embankments, gauges shall be fitted to roof slabs. The gauges shall be float operated with an external pointer travelling along a calibrated scale to read the depth of water in the reservoir at 100 mm intervals. Pointer and float shall be connected by nylon or corrosion-resistant cables. Calibrated gauges shall be fabricated from suitably treated mild steel components with each 100 mm depth point.

10.6 PLASTERING AND TILING

10.6.1 Plaster and Rendering

All surfaces to be plastered or rendered shall be brushed clean and be well wetted before the plaster is applied. All plaster and rendering shall be kept continuously damp for seven days after application.

All arrises shall be finished true and slightly rounded, except where otherwise stated, and shall be run at the same time as the adjoining plaster. No partially or wholly set plaster or rendering will be allowed to be used or re-mixed.

The Contractor shall prepare samples of the plastering and rendering, as directed, until the required quality, texture and finish is obtained and approved by the Engineer, after which, all plastering executed in the Works shall conform to the respective approved samples.

The Contractor shall cut out and make good all cracks, blisters and other defects and leave the whole of the work perfect on completion. When making good defects, the plaster or rendering shall be cut out to a rectangular shape, with edges undercut to form a dovetailed key, and finished flush with the face of the surrounding plaster or rendering. “Gypsum”, or other equal and approved plaster, shall be used when remedying defective work.

Gauged plaster internally shall consist of a first or rendering coat composed of one part cement, two parts lime, and nine parts sand and a finishing coat composed of one part cement, three parts lime, and six parts sand. The first or rendering coat shall be laid to a uniform surface, finished with a wood float, well scored and allowed to dry out for at least seven days before applying the finishing coat. The second or finishing coat shall be thoroughly worked and finished hard and smooth with a steel trowel.

Great care shall be taken in applying the finishing coat to obtain uniformity of the surface, smoothness and hardness. The total finished thickness of plaster shall be not less than 12 mm.

Cement plaster internally shall be composed of one part cement to five parts sand applied in two coats, the first coat well scratched to form a key and allowed to dry out at least 24 hours before applying the second coat. The second coat shall be finished with a steel trowel. The total finished thickness of plaster shall not be less than 12 mm.

Where the wall plaster is carried over wall plates, a strip of expanded metal shall be spiked to the wall plate to form a key.

Particular care shall be taken to ensure that plaster is made good around plumber’s water, soil and

waste pipes and around electrician's conduit, fittings and switches.

The Contractor shall include in his rates for dubbing out as necessary in cement and sand (1:7), hacking concrete to form a key and for all internal angles, arrises, other labours and for making good up to windows, door frames or other openings.

10.6.2 Wall Tiling

Glazed wall tiles shall comply with BS 6431, be free from all blemished and defects and true to size shape and colour. Wall tiles shall be obtained from an approved manufacturer and shall be supplied in 150 x 150 x 6.5 mm units of an approved design and colour.

The bedding for wall tiles shall be a 12 mm thickness of 1:3 cement sand mortar rendering finished to a true plumb surface. Before it has hardened, this surface shall be scratched to provide a key for the tile bedding. Tiles shall be set on the rendering in a bed of parian cement or alternatively an approved adhesive. Joints between tiles shall be uniform in width and exactly in line and these joints shall be pointed up with parian cement.

The rates shall include for all radi-used and special tiles and for cutting and fitting around doors, reveals and pipes.

10.6.3 Floor Finishes

Cement and sand pavings and finishings shall include for finishing surface perfectly smooth and hard, with a steel trowel, dead level or to true falls if so described, all temporary rules and formwork, to stop pavings at openings or edges as required; all knife edges, or slightly rounded arrises, for preparing concrete beds to receive paving by thoroughly brushing surface clean with a steel wire brush, well wetting and painting the same with cement and sand (1:1) grout immediately before paving is laid, for any additional thickness of paving required, beyond the thickness specified, due to irregularities in the concrete bed, and for keeping paving damp for at least 7 days after laying.

At the junctions of different floor finishings, fix in position 3 x 25 mm plastic or aluminium jointing strips cut to lengths bedded in and finished flush with pavings. All pavings shall be laid with joints set out in accordance with a detailed pattern approved by the Engineer.

The Contractor shall protect the floor finish with heavy quality building paper, sheeting or sawdust, to the satisfaction of the Engineer, as each area is completed.

10.6.4 Terrazo Flooring

The Contractor shall arrange for the terrazo work to be executed only by experienced personnel.

Before commencing the application of these finishings, the surface to receive the same, shall be thoroughly cleaned by wire brushing and left free of all dust, oil, grease, or any other deleterious substances, well wetted and painted with cement and sand (1:1) grout immediately before work commences.

All terrazzo finish shall conform in every respect to the colour and texture of a sample of the work, which must be approved by the Engineer.

The rates for terrazzo finishes shall include for surfaces perfectly smooth, dead level or to true falls as specified, for all temporary rules, formwork to stop pavings at opening and edges, all knife edges, or slightly rounded arrises as required, and for any additional thickness beyond that specified or required due to irregularities in the surface to receive such finish.

Terrazo work shall be polished to an approved texture by mechanical means. The floors shall be first thoroughly washed clean and then rough polished and all holes etc. filled in with an approved filler and left for a 24-hour period. Finally the work shall be washed down and given a final polish to the texture approved by the Engineer.

All skirtings, corners, working round pipes, door frames and sanitary fittings etc. shall be thoroughly hand polished to a similar texture by Carborundum block.

10.7 PLUMBING AND DRAINAGE

10.7.1 Eaves Gutters and Rainwater Pipes

Eaves gutters and rainwater pipes shall be made from No.24 B.W. gauge galvanised sheet iron. The eaves gutters shall be lapped and soldered at joints, have beaded edges and be fixed to falls with approved 25 x 6 mm galvanised iron brackets, with a galvanised sheet iron clip, riveted on outer edge and bent around the beaded edge of the gutter, 900 mm apart, bent to the shape of the gutter and each screwed to fascia boards or rafters with two stout steel screws. The gutters shall be half round and 150 mm diameter.

The rainwater pipes to be 100 mm diameter and have beaded shoulders, 100 mm distant from the lower ends, and fitted so that each length rests on the pipe section below. The upper part of the 100 mm long shoulder to be wrapped in hemp or yarn and coated with linseed oil putty to form a tight sealed joint with the length below. Any surplus putty is to be neatly cleaned off. 150 mm diameter ball gratings are to be fitted at gutter outlets.

All rainwater pipes to be fixed 40 mm clear of the extreme outer face of walls with strong, galvanised, malleable iron holderbats having a 120 mm long ragged tail and circular strap, in two pieces to form galvanised bolted connections.

The rainwater pipes are to be fixed in locations as shown and, unless otherwise stated, provided with 3.0 m length of open concrete drain channel. The Contractor shall provide proper purpose made swan neck bends, plinth bends, shoes, stoppered ends, etc., where required.

10.7.2 Flashings, Aprons, Valleys etc., in Galvanized Sheet Iron

Cover flashings, cover turn up of gutter linings, etc. to be 150 mm wide, minimum, lapped and soldered at angles, bent and turned into chases in walling 25 mm deep, wedged with metal wedges at not more than 150 mm centres and pointed in cement mortar (1:3).

Apron flashings to be 250 mm wide, minimum, dressed over roof coverings, turned up chimney stacks, lapped, soldered and turned into chases all as last.

Valley linings to be 600 mm width minimum, lapped not less than 150 mm and soldered at joints, dressed to shape of boarding and turned up 25 mm minimum, dressed over splayed tilting fillets, both sides, laid loose on boarding to allow for free movement in expansion and contraction.

10.7.3 Pipe Material and Installation

Galvanised mild steel tubing shall be of medium thickness in accordance with BS 1387.

Fittings for the same shall be galvanised malleable iron in accordance with BS 4609. Joints are to be screwed and socketed and put together in approved jointing compound. Long screws and any other untapered threads shall have yarn as well as jointing compound incorporated in the joints or be jointed with PFTE tape.

Polythene tubing for cold water services shall be normal or heavy gauge, as required or specified in accordance with BS 6572 and 6730. Joints and fittings shall be in accordance with the manufacturer's printed instructions.

All brasswork and fittings shall be in accordance with BS 1010 for draw off taps and stop valves and BS 1212 for ball valves. Plastic float valves to be in accordance with BS 2456, and high or low pressure as directed by the Engineer.

Soil, waste and vent pipes and their fittings shall be coated medium grade cast iron spigot and socket pipes. Pipes, fittings and accessories shall be in accordance with BS 16. All joints shall be made with P.C.3 compound or other similar and approved jointing compound.

Where directed, pies shall be fixed in chases in walling and secured with approved holderbats built into walls, not more than 1.30 metres apart.

All surface fixings, unless otherwise specified herein, shall be carried out in “Philplug” or “Rawl-plugs”. The fixing holes shall be drilled with special masonry drills and not cut with a chisel. Under no circumstances will wooden plugs be permitted. Lavatory basin brackets shall be fixed to solid walls with 6 mm diameter bolts 100 mm long with head nut and washer.

Tubing for hot water services, waste and overflow pipes, etc. shall be galvanised mild steel.

The Contractor shall make arrangements with the water undertaking for connection to the existing water main including supplying all fittings and paying all dues.

10.7.4 Plumbing

Pipes and tubes shall be cut by hacksaw or other method, which does not reduce the diameter of the pipe or form a bead or feather, which might restrict the flow of water. Bends shall be formed on an approved machine and in no case to an internal radium of less than eight times the outside diameter of the pipe. Elbows may only be used on pipes of 12 mm and 19 mm diameters and not on hot water systems of any description. All tubing, exposed on faces of walls, shall be fixed at least 25 mm clear of adjacent surfaces with approved holderbats built into walls not more than 1.30 metres apart. Polythene tubing must be supported throughout its entire length in horizontal positions as directed.

Pipes fixed in roof spaces or to joinery shall be fixed with approved clips screwed to timber members, not more than 1.30 metres apart. Easy bends in the line of piping shall be made with an approved bending machine. No firebends will be permitted. Where elbows are allowed, they will be of the rounded pattern.

10.7.5 Cold Water Storage Tank

The cold-water storage tank shall be by an approved manufacturer and shall conform with the requirements of Class A cisterns to BS 417.

It shall be of the capacity shown on the Drawings. Where tanks are required to sit on concrete slabs, 25 mm timber boarding must be provided under the tanks.

10.7.6 Hot Water Storage Tank

Connect expansion pipe to water heater and run through ceiling to discharge over cold-water tank in roof including all necessary fittings etc. as detailed on the Drawings, or as directed by the Engineer.

Connect to cold water storage tank and run cold supply to water heater and make connection hereto. Provide low pressure gate valve at a point immediately before the cold supply enters the hot water cylinder or water heater.

10.7.7 Connection of Pipes and Tanks

Each connection of tubing to cold water storage tanks shall be made by drilling a hole in the tank side and using a long screw union and two back nuts all well screwed up in red lead. Joints of tubing to glanded and bossed connections of hot water cylinders or boilers shall be made with a long screw, union and backnut screwed up in red lead.

Connections to sanitary fittings shall be made with a 450 mm length of copper tubing bent to shape as required, with copper to iron couplings at each end, and red lead joints to union of fitting and tubing.

10.7.8 Sanitary Fittings

The descriptions entered in the Bills of Quantities, intended to outline the scope of the work and drawings indicate the general arrangement and approximate sizes and locations of equipment, piping and outlets. Where Site conditions require reasonable changes in indicated locations and arrangements, these shall be made without extra cost.

The Contractor shall submit, for approval by the Engineer, a complete schedule of all sanitary fittings he proposed to supply and install. The schedule shall name and describe each item and the name of the

manufacturer.

Once the schedule has been approved, no departures from it may be made without the written consent of the Engineer. No orders for sanitary fittings shall be placed until the schedule has been approved.

10.7.9 Stop Cock Pit

Construction stop valve pit size 250 x 250 x 600 mm deep internally consisting of 100 mm thick concrete sides, 75.0 mm concrete base size 600 x 600 mm, precast concrete cover slab size 450 x 450 x 50 mm thick reinforced with 75 mm mesh, no. 10 gauge “Weldmesh” or other equal and approved fabric reinforcement, with two 10 mm diameter mild steel rod lifting handles cast in the cover slab. Allow for holes through the sides for pipes.

10.7.10 Concrete Drain Pipes

Concrete drain pipes shall be spigot and socket pipes of approved manufacture in accordance with BS 5911 and be totally immersed in water for at least 3 hours immediately preceding laying.

The joints, for concrete drain pipes shall be made by first wrapping three turns of cement slurried yam to the end of the socket, then caulking well home so that the consolidated width of the yarn does not exceed one quarter of the depth of the socket. The yarn shall be best quality, white spun, long staple yam, soaked in water for 24 hours before use and inserted in the joint while still wet.

The remaining portions of the socket shall be filled solidly and homogenously with cement mortar (1:2) and finished with a neat cement fillet on the outside at an angle of 30 degrees. Immediately after jointing, a tight-fitting wad or scraper shall be drawn several times through the bore of the pipe to ensure it is left clean and free from obstruction. The joints shall be protected from injury until they have set hard.

10.7.11 Pitch Fibre Drain Pipes

Pitch fibre pipes, coupling and fittings shall be of approved manufacture in accordance with BS 2760 for pitch impregnated fibre drain and sewer pipes. The laying, cutting and jointing of pitch fibre pipes, and the jointing to pipes of other materials, shall be carried out strictly accordance with the manufacturer’s printed instructions.

10.7.12 Cast Iron Pipes and Fittings

Cast iron drainpipes shall be coated spigot and socket pipes of approved manufacture in accordance with BS 437. All joints shall be made with P.C.3, or other similar and approved jointing compound, in accordance with BS 5292.

Cast iron soil fittings shall comply in all respects with BS 416. Those of spigot and socket type for drains to BS 437 and will be used as drain connectors to manholes.

10.7.13 Step Irons

Step irons shall be provided to manholes and septic tanks and shall be approved malleable galvanised cast iron to BS 1247.

10.7.14 Concrete Beds and Surrounds

All drain pipes shall be laid on a concrete bed, or blinding, as directed by the Engineer.

Beds shall first be laid to correct falls and levels with recesses formed for the pipe sockets so that the whole of the soffit of the pipe barrel bears evenly on the bed. When the concrete has set, sufficient mortar (1:5) shall be spread on the bed to receive the pipe barrel, and ensure a surplus is squeezed out when the pipe is laid and finally adjusted to level. After jointing, the recesses around sockets shall be filled with concrete of the same mix as the bed and the haunching or surrounding completed.

Where pipes are laid under driveways and parking areas, the pipes shall be bedded and surrounded

with concrete if the cover on the pipe is less than 1.0 m.

10.7.15 Laying of Pipes

Pipes shall be laid in straight lines to even gradients and to the required depths commencing at the lowest end.

Before each pipe is laid, it shall be examined to ensure that the barrel is clean and all foreign material removed. Any cracked or damaged pipes shall be rejected.

10.7.16 Gulleys

Gulleys shall be approved 100 mm salt glazed stoneware or cast iron trapped gulleys with 150 x 150 mm cast iron gratings to receive the wastes from waste fittings. Bed the gulleys on and surround with concrete (C15/20) 100 mm minimum thickness, carried up to form 75.0 x 75.0 mm curb, with all exposed surfaces finished in cement and sand (1:2), trowelled hard and smooth and all angles rounded. Make good cement joint to drain pipe and run drains to adjacent manholes.

10.7.17 Manholes

Manholes shall be constructed in stone, concrete, or concrete blocks in the positions and to the depths shown on the Drawings or as directed by the Engineer. Construction in stone and concrete blocks is only allowed to depth of 1.5 m.

Cast iron manhole covers and frames shall be provided to all manholes, and shall be manufactured in accordance with BS 497 and approved by the Engineer, size 60.0 x 45.0 cm single seat, minimum 23.42 kg weight, as shown on the Drawings or as directed by the Engineer. Where wheeled traffic is liable to pass over the manholes, the Contractor shall provide medium or heavy-duty covers and frames as directed by the Engineer.

Covers shall be bedded in grease and sand in the rebates and painted with two coats or black bituminous paint on completion.

Internal rendering to manhole walls and benching shall be 12 mm thick minimum, composed of one part of Portland cement to two parts of sand.

The surface is to be trowelled hard and smooth, coved at all internal angles and rounded on all arrises. The Contractor is to include for all coves, rounded angles, making good to pipes etc. and all other labours. The rendering to benchings is to be applied whilst the concrete is green.

10.7.18 Testing

Each length of drain and manhole shall be tested, as described hereinafter, and approved by the Engineer before any backfilling of the trench takes place.

Testing shall not be carried out until at least 12 hours have elapsed after jointing takes place.

The test shall be as follows: -

- The lower end of the pipe and all junctions shall be securely stoppered and the whole length under test filled with water.
- When full, a further stopper shall be inserted at the top leaving a pipe attached to the drain plug. This pipe shall be bent through 90 deg., and shall terminate in a header tank 150 mm square. The vertical distance between the centre line of the drain plug and the top of the header tank shall be not less than 900 mm.
- Water shall then be poured into the header tank, which shall be kept full for a minimum period of 3 hours to allow absorption to take place. At the expiration of this period, the header tank shall be topped up and the testing of the drain commenced. If, after a further period of 30 minutes, the water level in the header tank has not fallen by more than 12 mm the test will be considered satisfactory.

- In the event of a pipeline failing to withstand the test, the point of failure shall be completely surrounded, at the Contractor's expense, with concrete 1:3:6, using 19 mm aggregate, so there is a minimum cover of 15.0 cm in all directions. The length shall then be retested.
- Immediately a length of drain has been approved, the trench shall be backfilled for a depth of at least 30.0 cm above the top of the pipes.
- Air testing of drains may be used with the approval of the Engineer.

10.8 ELECTRICAL WORKS

10.8.1 Electrical Installations

All work in connection with the electrical installations shall only be carried out by an experienced and approved personnel.

All wiring shall be single core P.V.C. insulated copper conductors. Standard colour codes must be adopted viz: Red - Live, Black - Neutral, Green - Earth. The wiring shall be carried out by looping cables from point to point. No tee joints or any other joints shall be permissible.

Cables shall be drawn after installation of the conduit systems and any plaster has dried. Cross entry of cables and more than 6 cables in a conduit shall not be acceptable. Draw wires shall be threaded in at the time of installation of the conduits.

All electrical installations shall comply with UEB Regulations, with fittings of a type readily available in Uganda and approved by the Engineer.

10.8.2 Conduits for Electric Cables

Best quality unplasticized, rigid, heavy gauge Class "A" P.V.C. conduits shall be used everywhere. The conduits shall be suitable for plain connections. On wooden trusses the conduits shall be secured at intervals of not more than 3 metres. Deformed, misshaped and bent conduits must not be used under any circumstances. At all bends and curves, the effective cross-sectional area shall not be reduced below the normal cross-sectional area. Conduits less than 19 mm nominal diameter shall not be used.

All conduits shall be laid in straight horizontal and vertical lines. In case of straight runs of conduits exceeding 50 m, suitable inspection boxes shall be placed at intervals of not more than 15 m. No more than 4 easy bends and 2 right angle bends shall be allowed between two such inspection boxes. The conduits shall be secured to reinforcement bars at intervals of not more than 3 m.

10.9 PAINTING AND GLAZING

10.9.1 Glazing

All glass shall be of approved manufacture, in accordance with BS 952, free from flaws, bubbles, specks and other imperfections, cut to size to fit the opening for which it is intended, with not more than 1.6 mm play all round.

The glass for glazing generally shall be clear and flat drawn and shall be Ordinary Quality (O.Q) sheet glass of the required thickness to suit the size of sheet and position. 5 mm semi obscured glass shall be fitted to windows of toilets and bathrooms. Glass louvre blades shall not exceed 750 mm in length.

Putty for glazing shall be tropical putty of approved manufacture suitable for glazing to metal or wood frames as appropriate. Putty shall be delivered to the Site in the original manufacturer's sealed cans or drums and used directly therefrom with the addition only of pure licensed oil if necessary. No mineral or other oils be used.

The rebates of all windows shall be painted one under coat before puttying.

The putty shall, within 14 days, dry and harden without wrinkling of the surface or caking and shall adhere satisfactorily to the surface of the glass and the frame.

All glazing to wood frames shall be sprigged and to metal frames fixed with clips. All glass shall be properly back - puttied, and the front putty finished neatly and cleanly in line with back putty. Glass to glazed doors shall be fixed with glazing beads, secured with brass screws.

The Contractor shall clean all glass inside and out, remove all paint and putty marks replace any broken scratched or cracked panes and leave all glazing sound and perfect at completion.

10.9.2 Painting and Decorating

Before commencing the painting work, the Contractor shall submit to the Engineer, for approval, a list of all the brands of paints and finishings including the necessary primers and undercoats to be used. Immediately upon being approved orders shall be placed and the total requirements obtained for the work. Once approved, no other brand of materials shall be used without the permission of the Engineer expressed in writing.

All materials shall be delivered to the Site intact in the original containers and shall be mixed and applied strictly in accordance with the manufacturer's printed instructions. No addition will be allowed to be made locally without the permission of the Engineer.

The priming, undercoats, and finishing coats shall each be of different tints. The priming and undercoats shall be the correct brands and tints to suit the respective finishing coats, in accordance with the manufacturer's instructions. All finishing coats shall be to the colours and types specified by the Engineer.

The Contractor shall include for the preparation of surfaces, rubbing down between each coat, stopping, knotting and all other work as previously described and as necessary to obtain a first-class finish.

Plaster, finished with a steel trowel and fair face concrete surfaces, shall be well rubbed down, filled and made good as necessary, and thoroughly cleaned down, immediately before decoration is applied.

Cast in-site concrete, with a rough textured surface, shall be made good as necessary, and thoroughly wire brushed clean, immediately before decoration is applied.

Insulation board or similar surfaces shall be filled, and made good as necessary and lightly brushed down to remove all dirt, dust and loose particles.

Metal work to be painted shall be scaled clean and thoroughly wired brushed and wiped clean with white spirit (using rag or brush) to ensure that all loose particulars of rust and scale are removed completely.

Galvanised surfaces shall be treated with approved calcium plumbate primer applied strictly in accordance with the manufacturer's printed instructions.

Aluminium and other non-ferrous metal shall be primed with an approved zinc chromate primer.

Ironwork coated with bituminous solution shall receive an isolating coat of aluminium metal primer.

All exposed cast iron or asbestos cement, waste and vent pipes shall be primed with two coats approved aluminium metal primer before further treatment.

Woodwork to be painted shall be well rubbed down and primed with aluminium wood primer well brushed into the wood. All knots shall be covered with good shellac knotting before priming and all defects shall be filled with a hard stopping after priming.

Plywood to receive finishes other than paint shall have all stains removed, be well rubbed down and have all defects levelled up with hard stopping of a colour to match the adjoining surfaces.

After each coat, the work shall be allowed to dry and shall then to be well rubbed down with fine glass paper on blocks, or other means as required for the particular work, before the next coat is applied. The paintwork shall be finished smooth and free from brush marks.

All door furniture and other ironmongery shall, during painting operations, be removed and afterwards refixed.

10.9.3 Distemper and Limewash

Distemper shall be oil or case in bonded and washable. It shall be thinned only with petrifying liquid made by the manufacturer of the approved distemper to be used, and in accordance with the printed instructions.

Limewash shall consist of slaked lime and coarse salt mixed in the following manner:

To 25.0 kg of slaked lime add water into which has been dissolved one kilogram of coarse salt. Add clean water until the required consistency is obtained.

All materials for external use shall be of exterior quality recommended by their manufacturers for such use.

10.9.4 Covering up

Sweep clean and cover up all floors, etc. with dust sheets when executing all painting and decorating work.

Paint splashes, spots and stains, shall be removed from floors, woodwork, etc. Any damaged surfaces shall be touched up and the whole of the work left clean and perfect upon completion.

11 STANDARD SPECIFICATION FOR PIPEWORK AND VALVES

11.1 GENERAL

The pipework shall be laid out and designed so as to facilitate its erection, painting in situ, dismantling of any section for maintenance and to give a constant and uniform flow of working fluid with a minimum loss in head. Where steel pipework is used the number of flanges is to be kept to a minimum with the size of each unit of pipework determined by the ease of handling, installation and general appearance of the completed pipe system.

Flexible joints shall be provided on pressure pipes where necessary to facilitate installation and removal of Plant or to allow for differential movement. Where required, flexible joints shall be provided with tie bolts or other means to transfer longitudinal thrust along the pipework as a whole.

Wherever possible, standard fittings shall be used in preference to fabricated or special fittings.

Valves, strainers and other devices mounted in the pipework shall be supported independently of the pipes to which they connect.

All metal brackets, or other forms of support, shall be rigidly built up of steel by bolting or welding in preference to the use of castings.

Facilities shall be provided for draining the pipe system and releasing air. The period for drainage shall not exceed 30 minutes and there shall be suitable means of disposal for the drained fluid.

11.2 MARKING AND PROTECTION OF PIPES AND FITTINGS FOR SHIPMENT

Except where otherwise specified all items shall have received their complete protective coatings before dispatch from the manufacturer's works and shall be additionally protected by approved means for the period of transit, storage and erection, against corrosion and accidental damage.

For the protection of pipe linings and in particular for protecting cement mortar linings from drying out, protective metal or timber discs shall be fitted over the ends of pipes and fittings. Similar timber protective discs shall be attached to all flanges of pipes and fittings, by means of bolts specifically provided for the purpose and which shall be discarded when the item is incorporated in the Works. The sleeves and flanges of flexible joints shall be wired together in suitable bundles.

11.3 STORAGE OF PIPELINE MATERIALS

Pipes and fittings shall be stored raised off the ground, and shall be carefully supported, cushioned and wedged. Pipes shall not rest directly on one another and shall not be stacked more than four pipes high or two pipes high in the case of pipes of 500 mm diameter or over. Special care shall be taken to ensure that flexible pipes are cradled and supported in a manner that prevents any distortion of the pipes.

Flexible pipes shall be stored in sheds or covered areas.

Couplings and joints (and all components thereof) and other similar items shall be stored in dry conditions, raised from the ground in sheds or covered areas.

Storage areas shall be carefully set out to facilitate unloading, and checking of materials with different consignments stacked or stored separately with identification marks clearly visible.

Where items to be stored have a limited shelf life or require special storage arrangements, the method of storage shall be to the approval of the Engineer and in accordance with the manufacturer's instructions.

All pipes and fittings supplied as spares shall have end covers, which are proof against the entry of sand and vermin. Mortar lined pipes and fittings shall have end covers, which form a complete seal, provision being made to accommodate the effects of temperature changes. Pipes and fittings supplied as spares shall have a temporary white external finish and shall be stored sheltered from the direct rays

of the sun.

End covers and protection shall not be removed until incorporation of the pipes and fittings into the Works.

11.4 TRANSPORTATION OF PIPES AND FITTINGS

Any vehicle on which pipes are transported shall have a body of such length that the pipes do not overhang. Large pipes shall be placed on cradles and the loads properly secured during transit. The pipes shall be handled in accordance with the manufacturer's recommendations.

Approved slings shall be used and all hooks and dogs and other metal devices shall be well padded. Hooks engaged on the inner wall surface at pipe ends shall not be used. Steadying ropes shall be employed. The positions of lifting slings shall ensure that stresses and tendency towards deformation in the pipes are kept at a minimum.

Pipe handling equipment shall be maintained in good repair and any equipment which in the opinion of the Engineer may cause damage to the pipes shall be discarded.

Under no circumstances shall pipes be dropped, be allowed to strike one other, be rolled freely or dragged along the ground.

11.5 INSPECTION OF PIPES AND FITTINGS

Before incorporating into the Works each pipe shall be brushed out and carefully examined for soundless. Damaged pipes, which in the opinion of the Engineer cannot be satisfactorily repaired, shall be rejected and removed from Site.

Damage to pipe coatings or linings shall be repaired to the satisfaction of the Engineer.

11.6 BUILT-IN PIPEWORK AND OTHER PLANT

The pipes and other Plant in water retaining structures shall, wherever possible, be built in as the work on the structure proceeds. The Contractor shall ensure that delivery of the requisite pipework and other Plant is in accordance with the requirements of the programme.

Where a pipe subject to thrust passes through a concrete structure or where an external seal is required, a puddle flange shall be used. The puddle flange dimensions shall be to BS 4504 but shall be undrilled. The exterior of the pipe shall be cement washed symmetrically about the puddle flange by the manufacturer for a length at least equivalent to the thickness of the wall through which it passes.

The Contractor shall be responsible through every stage of the Works for checking the correctness of the setting of built-in Plant and shall satisfy himself they are positioned in accordance with his approved drawings.

11.7 MATERIALS

Each pipeline shall be constructed in a material compatible with the fluid conveyed through that pipeline, ie the materials used in the pipes which are or can be in contact with the untreated or treated water, shall not contain any matter which could impart taste or odour or toxicity or otherwise be harmful to health or adversely affect the water conveyed. Nor shall any pipe be adversely affected by the fluid being conveyed through that pipe.

Pipework and valve materials for the following duties shall be as follows or equivalent to the approval of the Engineer:

- Alum solution - rigid PVC-U
- Chlorine:

Drum connections - cadmium plated 70/30 copper nickel CN 107, BS 2871 : Part 1:

Chlorine gas or liquid	- flanged or welded carbon steel, CAF flanged joints.
Chlorine gas lines below atmospheric pressure	- polyvinylidene fluoride (PVDF) with solvent welded or flanged joints.
Chlorine solution	- Class E PVC-U in concrete covered dusts outside building. Inside building and in exposed areas, rubber lined carbon steel.

Valves shall be globe type with forged steel bodies, Monel spindles, stainless steel seats and PTFE gland packing or carbon steel, Monel plug, PTFE sleeved plug.

- Sulphuric Acid:

Concentrated acid	- flanged carbon steel and Hastaloy for diameters less than 50 mm.
Dilute acid	- Polyvinylidene fluoride (PVDF) with solvent welded or flanged joints.

- Lime:

Lime slurry transfer pump suction pipework	- steel, ductile iron or rigid PVC-U.
Lime slurry transfer pump delivery pipework	- EPDM covered, reinforced, natural rubber line tube, approved for use with potable water and with chemical resistance to chlorine solution (35 g/l) and sulphur dioxide solution (3.5 g/l) with quick release couplings.
Saturated lime dosing pipework	- steel, ductile iron or PVC-U.

- Water:

Raw water, backwash water, dirty wash water, supernatant and treated water	- steel or ductile iron.
Service water	- steel, ductile iron or PVC-U.

- Air:

Air scour	- steel or ductile iron.

11.7.1 Ductile Iron Pipes and Fittings

Ductile iron pressure pipes and fittings shall comply with clause 3.1.17

11.7.2 Steel Pipes and Fittings

Steel pipes and fittings shall comply with clause 3.1.17.

11.7.3 Grey Iron and Cast-Iron Drain Pipes and Fittings

Grey iron and cast-iron drain pipes and fittings shall comply with BS 4622 and BS 437, respectively. Pipes shall be protected to the same standards and have the same type of joint as ductile iron pipes.

11.7.4 Unplasticized PVC Pipes and Fittings

Unplasticized polyvinyl chloride pipes, fittings and specials shall be to clause 3.1.17
Where PVC pipes, fittings and specials are to be connected to cast iron, stainless steel or steel pipes, `Viking Johnson' type flange adaptors or stepped couplings shall be used.

11.7.5 Polyethylene Pipes

Polyethylene pipes shall comply with Clause 3.1.17

11.7.6 Rubber Hosing

Rubber hosing shall conform to BS 5119, Type 2. It shall be capable of handling chlorine and sulphur dioxide solutions at a working pressure of 12 bar.

11.7.7 Copper Tubes and Fittings

Copper tubing and fittings for work above ground level shall comply with BS 2871 and BS 864 : Part 2 respectively and be jointed with capillary joints. For underground location the copper pipe shall be to BS 2871: Part 1.

11.8 FLANGED JOINTS

All flanges shall comply with Clause 3.1.17 or Clause 6.9 for steel pipes. The nominal pressure rating for particular flanges shall be at least equal to the highest-pressure rating of the pipes or fittings to which they are attached, but with a minimum nominal pressure of PN 16. All flanges shall be provided with all necessary nuts, bolts, washers and gaskets. In general, valves shall have flanged body ends.

All flanged joints that are buried or in chambers shall be protected with Densomastic and Densotape wrapping, applied in accordance with the manufacturer's instructions.

Flanges shall be installed on the pipes in the factory and field welding of flanges shall only be allowed with the approval of the Engineer.

Where pipework outside pumping stations and surge vessel chambers is cathodically protected, an insulated flange shall be incorporated at the first flange inside the structure. These flanges shall be tested to ensure that electrical insulation is achieved.

11.8.1 Gaskets and Joint Rings

Joint rings shall be manufactured to conform with clause 3.1.17 and shall be of chloroprene rubber or other approved synthetic material suitable for temperatures up to 80^{o}C.

Joints shall be made in accordance with manufacturer's instructions or as specified herein.

Until immediately required for incorporation in a joint, each rubber ring or gasket shall be stored in the dark, free from the deleterious effects of heat or cold, and kept flat so as to prevent any part of the rubber being in tension.

Only lubricants recommended by the manufacturer shall be used in connection with rubber rings and these lubricants shall not contain any soluble constituent, shall be suitable for the climatic conditions at the Site and shall contain an approved bactericide.

After cleaning the flanges, the gaskets shall be fitted smoothly to the flange and the joint made by tightening the nuts to finger pressure first. Thereafter the final tightening of the nuts shall be made by gradually and evenly tightening bolts in diametrically opposite positions using standard spanners.

Graphite grease shall be applied to the threads of bolts before joints are made.

11.8.2 Welded Joints for Steel Pipes

Welding of joints in steel pipes shall be carried out manually by the metal arc welding process complying with AWWA Standard C206.

Before starting the welding of pipe joints in the Works the Contractor shall submit for the Engineer's approval details of the plant, methods and materials he proposes to use, including make and size of electrodes, number of runs, current strength and arrangements for air testing of individual joints.

Welding shall only be carried out by welders approved by the Engineer pursuant to the provisions of Clause 6.18 and each welder shall identify his work by means of a stencilled mark.

Welded joints other than for closing lengths shall be of the spherical spigot and socket type. For pipes of 675 mm diameter and smaller the pipe joint shall be welded externally. For pipes larger than 675

mm the pipe shall be welded internally and a sealing weld made externally.

All parts to be welded shall have loose scale, slag, rust, paint and other foreign matter removed by means of a wire brush and shall be left clean and dry. All scale and slag shall be removed from each weld run when it is completed. Pipes manufactured with longitudinal or spiral welds shall be lined up before jointing so that these welds are at least 15^{o} apart around the joint circumference.

For pipes larger than 900 mm diameter a triple run convex fillet weld shall be used. For pipes of 900 mm diameter or less a double run convex fillet weld shall be used. The minimum leg length of the fillet as deposited is to be equal to the full thickness of the pipe wall. The actual throat depth shall not be greater than 9/10th and not less than 7/10th of the minimum leg lengths as deposited. The depositing of the weld metal shall be carried out in such a manner as to ensure that all the welds have adequate root fusion and are of good clean metal free from cracks, gas holes, slag inclusions and all other impurities. The surface of the weld shall have an even contour with regular finish and shall indicate proper fusion with the parent metal. All slag shall be thoroughly removed after depositing each run of welding by light hammering with a chipping hammer followed by wire brushing. Any welds showing cracks or other cavities or in which the weld metal tends to overlap on to the parent metal without proper fusion or containing any other defects whatsoever shall be cut out and rewelded to the satisfaction of the Engineer at the Contractor's expense.

At closing lengths where two plain ended pipes are to be joined by a welded joint the gap between the two ends shall not exceed 75 mm. An external steel sleeve collar, of a thickness not less than that of the pipe itself and approximately 300 mm in length shall be placed centrally over the two ends to be jointed and the end of each pipe shall then be fillet welded to the sleeve collar in accordance with the above procedure.

No weld or adjacent parts of the pipe shall be painted prior to inspection by the Engineer.

11.8.3 Welder Performance Test

The Contractor shall submit for the Engineer's approval the names of persons whom he proposes to employ as welders with evidence that, as a minimum preliminary qualification, they have passed the qualifying tests prescribed in Clause 11 of BS 2633 and possessed certificates from an independent testing authority. The Engineer may further require any such person to perform satisfactory test welds under Site conditions and on pipes similar to those for use in the Works, before approving his employment as a welder. The Contractor shall maintain an up-to-date list of welders approved by the Engineer and if ordered by the Engineer he shall remove from the approved list any welder whose workmanship, as demonstrated by the results of air pressure tests on individual welded joints, is below a reasonable standard of quality of consistency in the Engineer's opinion.

11.8.4 Testing of Welded Joints

Where directed by the Engineer welded joints on pipes larger than 675 mm diameter shall be subject to a nitrogen gas test after welding.

A tapped hole (approximately 6 mm diameter) shall be made in the socket end of each pipe by the Contractor and shall be fitted with a suitable non-return valve. Nitrogen, at 400 kPa pressure, shall then be pumped into the annular space between the spigot and socket and the pump disconnected.

If no drop in pressure occurs over the ensuing period of 30 minutes the test shall be deemed to be successful. If the test pressure cannot be maintained for 30 minutes all defects in the weld shall be cut back and rewelded and the test reapplied until successful. The cost of initial and subsequent testing of defective welds shall be at the Contractor's own expense.

The Contractor shall provide all items necessary for the nitrogen tests including compressor, valves, gauges and tubing.

11.8.5 Flexible Couplings and Flange Adaptors

Flexible couplings and flange adaptors shall be of the Viking Johnson or similar approved pattern and be assembled in accordance with the manufacturer's instructions and protected, if buried or in chambers with Densomastic and Densotape wrapping applied in accordance with the manufacturers' instructions. Flexible joints shall be harnessed or tied where necessary.

11.9 VALVES

11.9.1 Pressure Reducing Valves

Pressure reducing valves shall be capable of maintaining a constant downstream pressure from a higher constant or variable upstream pressure and they shall be drop tight under no flow conditions.

The valve operation shall be achieved by the interaction of the inlet pressure, outlet pressure and an intermediate pressure produced by a pilot valve or relay system acting on the upper side of the main valve.

The pilot valve or relay system shall be actuated by a diaphragm connected to the outlet pressure on its underside and a constant pressure on its upper side derived either from weights or from a spring.

Body ends shall be flanged and drilled to BS 4504.

The materials for the valves shall be as follows:

Cast iron body and cover. Internal valve, gunmetal with bronze liner, cups and facing rings in leather. Relay valve, bronze with stainless steel spindle and nylon valve face. Diaphragm, reinforced synthetic rubber. Loading spring, if employed - spring steel. Cylinder and weights, if employed - cast iron. Lever, steel with gunmetal pins and links. Connecting pipework to cylinder - copper. Cylinder, mild steel epoxy lined with internal working parts gunmetal bushed.

11.9.2 Pressure Relief Valves

Pressure relief valves shall be capable of relieving pressure in the system to prevent the system being pressurised in excess of a preset maximum allowable pressure. The valves shall be drop tight under no flow conditions.

The valve operation shall be achieved by the interaction of the inlet pressure and an intermediate pressure produced by a pilot valve or relay system acting on the upper side of the main valve.

The pilot valve or relay system shall be actuated by a diaphragm connected to the inlet pressure on its underside and a constant pressure on its upper side derived either from weights or from a spring.

Body ends shall be flanged and drilled to BS 4505.

The materials for pressure relief valves shall be as specified for pressure reducing valves in Clause 6.21.

11.9.3 Gate Valves

Gate valves shall comply with BS 5150, BS 5163 with Clause 3.1.32

Certain clauses of BS 5150 are amplified as follows:

Clause 14 Operation

Manually operated valves shall not require a force of greater than 20 kg on the outer rim to operate with balance pressure across the valve, unless otherwise specified. To achieve this, gearing may be used in which case the time required to operate the valve under normal working conditions shall not exceed 20 minutes.

Clause 14.4 Indicators

Indicators showing both OPEN and SHUT positions shall be supplied.

Bypasses

Bypasses for valves 400 mm and over shall be fitted with integral bypasses as follows.
400 mm nominal diameter valve - 50 mm diameter bypass
500 mm nominal diameter valve - 80 mm diameter bypass
800 mm nominal diameter valve - 100 mm diameter bypass
Body ends shall be flanged and drilled to BS 4504

All valves shall be manually operated unless specified otherwise or to suit the system operation.

11.9.4 Butterfly Valves

Butterfly valves shall comply with BS 5155 or Clause 3.1.32

Body ends shall be flanged and drilled to BS 4504.

All valves shall be manually operated unless specified otherwise or to suit the system operation.

11.9.5 Check Valves

Check valves shall in general comply with BS 5153 or Clause 3.1.32

Certain clauses of BS 5153 are amplified as follows:

Clause 4 Type Swing type for either vertical or horizontal use.

The valve design shall ensure closure in the shortest possible time following deceleration of the water column, ideally reaching its seat without slamming at the instant forward motion of the column ceases.

Where specified the position indicators initiated by microswitches shall be provided to show when the gate is OPEN or SHUT, and provision made for initiating the operation of remote indicator lights and alarms.

Body ends shall be flanged and drilled to BS 4504.

For use with clean water and air duo-check type valves may be used and shall be of the flangeless type.

11.9.6 Diaphragm Valves

Diaphragm valves shall be of the full-bore type to suit the maximum working pressure ratings required. Body ends shall be flanged and drilled to BS 4504.

Indicators shall be supplied where specified showing both OPEN and CLOSED positions shall be supplied and provisions made for initiating the operation of remote indicator lights in the fully OPEN and CLOSED positions.

Valves used for toxic or hazardous fluids shall be provided with an additional `O' ring seal of nitrite rubber or other approved material.

Diaphragms shall be composed of moulded reinforced, flexible material attached by studs to the compressor. Diaphragm materials shall, where required, be composed of corrosion resistant material.

11.9.7 Penstocks and Flap Valves

Rising spindle penstocks shall be provided with headstocks and foot brackets as required. Guide brackets as necessary shall be included with the penstock. The handwheel with gunmetal rotating-nut shall have adequate diameter for the duty required and shall have cast on it the direction of closing which shall be clockwise.

Hand operated weir penstocks shall be lockable at any position.

Penstocks gates and frames shall be of cast iron and constructed of material of at least Grade 180 of BS 1452.

Seating faces shall be gunmetal or bronze, hand scraped, and securely fixed to the frame or door.

Frames shall be manufactured from continuously welded stainless-steel Grade 316 S16. All frames shall be suitably reinforced and include corner gussets. All fasteners shall be stainless steel Grade 304 S16.

Anchor bolts shall be in stainless steel.

Non-return flap valves shall be designed to suit the hydrostatic conditions at a particular location so that they will automatically open when the downstream level falls below the upstream level and will close when the water levels equalise.

Flap valves shall be heavy pattern type with body and flap of close-grained grey iron, watertight faces of cast iron or non-ferrous rings securely riveted on, machined and hand scraped to a watertight finish. The flaps shall be double hung with non-ferrous hinge pins. Frames shall be drilled for bolting to concrete or to suit flanged ends of pipework.

11.9.8 Headstocks

Mechanically remote operation of gate or butterfly valves shall be by the use of headstocks, or headstocks with operating spindle extension. Headstocks for direct connection to valves shall be for use with non-rising stem valves. They shall be of cast iron or fabricated carbon steel and fitted with a position indicator and handwheel, or bevel gear and handwheel to conform to the operational requirements. Stem bearings shall be gun metal bushed.

Where headstocks are structurally mounted above a valve chamber, or otherwise distant above a valve, then operating spindle extensions shall be used between the valve and headstock. These shall be suitable for length adjustment during assembly on Site and where necessary shall be fitted with universal couplings adjacent to the valve and to the headstock. Universal couplings need not be fitted on sluice valves. The two couplings shall be so orientated as to give a linear transmission of rotational movement between headstock and valve stems.

11.9.9 Air Relief Valves

Air relief valves shall be of the Apex type manufactured by Glenfield Neptune, Kilmarnock or equivalent approved.

11.9.10 Valve Operators

Valves for operation shall be so geared that under the operating conditions as specified herein, the maximum force on the rim of the handwheel, crank, or other necessary for operation shall not exceed 20 kg and the maximum torque shall not exceed 5.5 kg/m. A spur, bevel, or worm gear reduction unit, if required, shall be attached to the pinion shaft of the operating mechanism.

The reduction gears shall be made of steel with machined teeth and unless otherwise provided, they shall be enclosed in a cast iron or fabricated steel sealed housing with oil seals, and shall operate in an oil bath. The pinion shaft and screw stems shall be made of alloy steel. The pinion shaft shall be provided with bronze sleeves.

The thrust bearings at each end of the pinion shaft shall have external fittings to permit lubrication with grease. The screw stem shall have a thrust bearing of the ball or roller type, which can be lubricated with grease through an external fitting.

12 ENGINEER'S REQUIREMENTS

12.1 Office Accommodation for the Engineer

The Contractor shall provide a Site Office, for the use of the Engineer. The Contractor shall maintain, service and insure the offices for the Contract Period or for such additional or lesser time as the Engineer may direct. The offices shall be for the sole use of the Engineer's staff. On completion of the Works, or at such a time specified by the Engineer, the ownership of all furniture and equipment, except for survey equipment, shall be transferred to the Employer.

12.2 Location of the Buildings

The Site Office building shall be provided at a position within the Contract Temporary Works Area specified by the Engineer.

Surface water drainage facilities shall be provided to protect the buildings from surface run-off and to convey it away from the buildings.

12.3 Site Office Building

The Contractor shall construct or alternatively rent a Site Office building.

The Site Office building shall have a minimum floor area of 125 m^2. The Contractor shall submit his proposals for the office building to the Engineer for approval. The offices shall be constructed of new, durable, strong and weatherproof material to the satisfaction of the Engineer.

The building shall have lockable doors; burglar proof windows fitted with mosquito netting and shall be divided up by block work partitions into private offices and meeting rooms as required by the Engineer. Covered communal passageways shall connect separated units.

Each individual office shall have a toilet and washbasins in addition to a set of communal toilets to cater for the Engineer and his staff, and the office shall be provided with a kitchen.

The offices shall be detached completely from the Contractor's site offices although they may both be contained within one compound suitably fenced and guarded.

The Contractor shall provide all services and infrastructure. He shall light, clean and maintain the building and shall provide a water and a sanitary system. The Contractor shall provide an electricity supply of sufficient power for general use.

The office with all furniture, fixings, equipment, services, carport etc., all as detailed below, shall be provided complete within 60 days from the date of the Engineer's order to provide the same. The Contractor shall provide alternative accommodation to the satisfaction of the Engineer if he fails to provide as appropriate, the building within the above stated time.

The Contractor shall provide 24-hour security for the Office.

12.4 Access Roads and Parking

All accommodation shall be provided with temporary, well drained access roads 3 m wide and covered carports for 3 cars. Access roads and the surfaces of the carports shall be surfaced with a minimum thickness of 150 mm of well-compacted gravel.

12.5 Furniture, Fixings, Laboratory Equipment etc.

The Contractor shall supply the furniture, fixtures and equipment listed in Schedules 13.1, and shall install them in the offices as required by the Engineer. They shall be for the sole use of the Engineer and his staff. All furniture, fixtures and equipment shall be supplied new, following the Engineer's approval of a manufacturer's description or catalogue. The Contractor shall keep insured all furniture, fixtures and equipment to their full value (including duty where appropriate) and shall maintain them

in good order until the end of the maintenance period. On completion of the Works, the equipment shall be transferred to the Employer.

12.6 Stationery and Office Supplies

The Contractor shall supply all stationery and office consumables required for the normal functioning of the Engineer's offices, including inter alia survey books, drawing office supplies, computer CDs (Re-writable and Recordable) and diskettes, computer printout paper, but excluding headed correspondence paper. The Contractor shall continue this supply while the Engineer's office is on the Site. If the Contractor fails to provide supply, the Engineer shall be entitled to withhold the issue of a Payment Certificate until such time as the supply is provided.

12.7 Laboratory Supplies and Equipment

The Contractor shall supply all materials, chemicals and other laboratory consumables required for conducting the tests outlined in this Specification as directed by the Engineer for the full period that the Engineer's Site Office is on Site or for such greater or lesser period as required by the Engineer.

The Contractor shall provide and maintain the following items but not be limited to:

- Apparatus conforming to BS 1881 "Methods of Testing Concrete" to enable site compaction and slump tests to be performed and sufficient steel cube moulds, with base plates and tamping rods, to enable sufficient concrete cubes to be made.
- One complete set of BS sieves to comply with BS 410 for "Test Sieves" and all other apparatus necessary for the purpose of testing sand, ballast and stone.
- Sufficient equipment to carry out daily tests indicated in these Specifications, especially the equipment to test the soil compaction.

12.8 Water, Gas and Electricity

The Contractor shall supply or make provision for 24-hour water, gas and electricity supplies to the Engineer's Site Office and shall arrange for sewage and refuse disposal.
Whenever these supplies are not available from the public utility services, the Contractor must continue to provide the facilities from his own resources.

12.9 Communications

The Contractor shall arrange for the installation, commissioning and maintenance in use of two telephone lines to serve the Engineer's Site Office. The Contractor shall ensure that one of these lines has the facility for international telephone calls and full-time internet access facilities. Both shall have the facility for local telephone calls. Handsets shall be provided.

In addition, he has to supply and maintain two mobile phones with post-paid system.

The Contractor shall allow in his rates for paying all costs, charges and fees in connection with the provision, hire and use of these telephones and internet / email services.

All equipment shall be new and compatible for use with later Employer's requirements.

All necessary accessories, fittings, spares and maintenance for the telecommunications systems shall be provided by the Contractor who will be responsible for paying for the necessary licences for installing and operating these facilities. On completion of the Works, all communications equipment shall be transferred to the Employer.

12.10 Surveying Instruments and Equipment

The Contractor shall supply, for the sole use of the Engineer, survey and other instruments and equipment, as listed below. The instruments and equipment shall be new and shall be maintained in a good state of repair. In the event of loss or damage, they shall be replaced by items of a similar nature. On

completion of the Contract or at such a time as specified by the Engineer, all survey instruments and equipment shall revert to the ownership of the Contractor.

Technical Specifications for Surveying Instruments and Equipment

Table 1: Surveying Instruments and Equipment

Item Nr	Description	Unit	Quantity
	Supply the following items of surveying equipment to the Project Manager's office		
1	Total Station (Theodolit WILD T1000, Distomat WILD DI5, data recorder WILD GRE4 or similar approved), notebook with surveying software RIB STRATIS, complete with tripod, carrying case and all accessories	Nr	1
2	Level, Zeiss NI 2 automatic level, or similar approved, complete with tripod, carrying case and all accessories	Nr	1
3	Levelling staff, engine divided 4 m long, folding, including staff level	Nr	2
4	Staff levelling plate	Nr	2
5	Steel tape, 100 m length	Nr	1
6	Steel tape, 50 m length	Nr	2
7	Steel tape, 25 m length	Nr	2
8	Steel tape repair kit	Nr	1
9	Fibreglass, PVC coated tape, 30 m length	Nr	2
10	Steel hand tape, 3 m long	Nr	4
11	Steel hand tape, 5 m long	Nr	4
12	Ranging rod, 3 m length	Nr	10
13	Arrow, 400 mm length	Nr	25
14	Conical plummet, 200 g weight	Nr	1
15	Steel straight edge 1 m long	Nr	1
16	Spirit level with aluminium body, 1 m long	Nr	1
17	Torpedo level with aluminium body, 150 mm long	Nr	2
18	Pipe measuring tape with linear and diametric scales	Nr	2
19	String line, 50 m long	Nr	2
20	Optical square	Nr	1

Item Nr	Description	Unit	Quantity
21	Hammer, 3 kg weight	Nr	1
22	Hand shovel	Nr	2
23	Pedometer, measuring to 10 000 m at 0.1 m intervals	Nr	1
24	Pocket counter, counting to 9999 with push button for automatic return plus re-set knob	Nr	1
25	Thermometer, maximum and minimum graduated in ^{o}C and ^{o}F	Nr	1
26	Thermometer, wet and dry bulbs, graduated in ^{o}C and ^{o}F	Nr	1
27	Concrete thermometer	Nr	1
28	Rain gauge with measuring bottle	Nr	1
29	Flask with thermal insulation, 1 litre capacity	Nr	2
30	Water containers, 5 litre capacity	Nr	2
31	Schmidt Hammer for Concrete strength tests	Nr	1

12.11 Computers and Cameras

The Contractor shall supply computer hardware and software as detailed below for the sole use of the Engineer and his staff.

The Contractor shall supply high performance computer to be true IBM compatible desktop or tower computers of a reputable make with high specifications as follows:

12.11.1 High Performance Computer

Technical Specifications for High Performance Desktop Computers

Quantity: 3No. Desktop Computers

No.	Minimum technical Specification required by the Procuring Entity
Form Factor	All in One
Processor:	10th Gen Intel Core i9
OS, Software:	Microsoft Windows 11 Pro 64 bit Microsoft Office Professional 2021
Graphics:	Intel Integrated
Memory:	32 GB DDR4-2666
Hard disk drive:	SSD 1TB
Optical Drive:	Slim type ODD
Power:	150W Adapter
CPU:	65W
Camera & Mic:	1080p /RGB-IR Camera with Dual Mic Mic support noise cancelling feature

No.	Minimum technical Specification required by the Procuring Entity
Audio:	3W x 2 with Dolby solution
Display:	21.5" In-Plane Switching technology, FHD, 250nits (ES8.0) Multitouch, Ultra Flex III Stand, tilt with -5 -70 degree
Mechanical Peripherals:	Stand Handle, VESA wall mount, Full Function monitor stand
Speaker:	2W x 2 with Dolby Atmos
Connectivity:	**Side I/O** 1 x USB Type-C Gen1 (RC) 1 x USB 3.1 Type-A 1 rapid charge Headphone and Mic combo jack 3-in-1 Card Reader **Rear I/O** 4 x USB 3.2 Gen 1 1 x DP out 1 x LAN /Optional serial Port
LAN:	1 Gigabit (10/100/1000) on board
Wireless:	WiFi & Bluetooth
M.2 Slot:	1 x WiFi, 1 x PCIe SSD
VESA Mount:	Yes
Dimension:	USB optical wheel mouse and mouse pad 584mm X 505mm X 253mm
Accessories:	OEM Professional Wireless (keyboard and Mouse Combo)
Security:	Kensington Lock
Warranty:	3 Year Warranty

Each of the desktop computers are to be supplied with an automatic voltage regulator. Full documentation and backup discs for the software and the computers are to be provided.

Technical Specifications for Laptops

Quantity: 5No. Laptops

No.	Minimum technical Specification required by the Procuring Entity
Processor:	11th Generation Intel Core i7 vPro Processor
OS, Software:	Microsoft Windows 11 Professional Microsoft Office Professional 2021
Camera	HD + IR 720p camera with ThinkShutter
Display & Graphics:	14" FHD+ (1920 x 1200) Touch, IPS Privacy Guard, 500 nits, antiglare Intel Iris Xe
Memory:	32GB LPDDR4x
Storage:	2TB PCIe SSD
Battery:	18.5 hours 65W PSU or Higher
Power Supply Unit:	OEM 65W Rapid Charge support
Fingerprint Reader:	Yes
Audio:	Dolby Atmos Speaker System 4x 360- degree Microphones
Ports:	2x USB 3.2 2x Thunderbolt 4 1x HDMI 2.0

No.	Minimum technical Specification required by the Procuring Entity
	Nano SIM slot Headphone / microphone combo jack
Colour:	Deep Black **Not weave cover on top**
Keyboard:	Color-matched keyboard Spill resistant English backlit
Communications	Bluetooth 4.1 Combo with WiFi Card Ethernet port
Security	dTPM 2.0 Kensington lock slot Smart Power On fingerprint reader integrated with Power button ThinkShutter camera cover
Weight	Starting at 2.49 lbs (1.13 kg)
Dimensions (W x D x H)	12 x 8.5 x 0.59 inches 323 x 218 x 14.9 (mm)
Accessories	OEM Ethernet Extension adapter OEM Presenter Mouse Kensington Combination Cable Lock Active Noise Cancellation Headphones
Carry case	OEM Back pack
Warranty	3 Years Warranty

The computers shall be of a model and of a manufacturer approved by the Engineer. All hardware and all software shall be supplied new and fully licensed in the name of the Employer. The computers and the software shall be compatible with the computers of the Contractor.

Technical Specifications for Digital Cameras

Quantity: 3No. Digital Cameras

No.	Minimum technical Specification required by the Procuring Entity
Sensor type	1.0"-type (0.52" x 0.35") Exmor RS CMOS sensor, aspect ratio 3:2
Number of pixels	20.1MP
LENS	
Lens type	ZEISS Vario-Sonnar T* Lens
Focal length (f=)	f = 8.8-25.7 mm
Optical zoom	2.9x
Aperture type	Iris diaphragm (7 blades)
Digital zoom	[Still Image] 42M approx. 4x/18M approx. 6.2x/11M approx. 8x, [Movie] Approx. 4x
Screen type	2.95 in (3.0type) (4:3) / 1,228,800 dots / Xtra Fine / TFT LCD
Image processing engine	BIONZ X
Steadyshot	[Still Image] Optical [Movie] Intelligent Active Mode, Optical type with electronic compensation (Anti Rolling type)
Focus mode	Single-shot AF/Continuous AF / Direct Manual Focus (DMF)/Manual Focus
Camera	
Focus area	Wide/Center/Flexible Spot (S/M/L)/Expand Flexible Spot/Lock-on AF (Wide/Center/Flexible Spot (S/M/L)/Expand Flexible Spot)

No.	Minimum technical Specification required by the Procuring Entity
Lock on af	Yes
Iso sensitivity (still image)	Auto (ISO 125-12800, selectable with upper/lower limit), 125/160/200/250/320/400/500/640/800/1000/1250/1600/2000/ 2500/3200/4000/5000/6400/8000/10000/12800 (Extendable to ISO80/100), Multi-Frame NR: Auto (ISO 125-12800), 200/400/800/1600/3200/6400/12800/25600.
Image control	Contrast, Saturation, Sharpness, Creative Style, Color Space (sRGB/Adobe® RGB), Quality (RAW/RAW & JPEG/Extra fine/Fine/Standard)
Continuous shooting speed (maximum) (with max. Recording pixels)	Speed Priority Continuous Shooting: approx. 16fps, Continuous Shooting: approx. 5.5fps
Self-timer	10 s / 5 s / 2 s / 3 or 5 consecutive shots with 10 s 5 s or 2 s delay selectable/Bracketing shots with 10 s 5 s or 2 s delay selectable
Drive modes	Single, Continuous shooting, Speed priority continuous shooting, Self-timer, Self-timer (cont.), Cont.-bracketing, Single-bracketing, White balance bracketing, DRO bracketing, LPF bracketing
Panorama (shooting)	Sweep Panorama
RECORDING	
Compatible recording media	Memory Stick Duo; Memory Stick PRO Duo; Memory Stick PRO Duo (High Speed); Memory Stick PRO-HG Duo;
Storage capacity	16 GB Memory Stick PRO Duo
Recording format	Still Image: JPEG (DCF Ver 2.0, Exif Ver 2.3, MPF Baseline compliant), RAW (Sony ARW 2.3 format); Movie: XAVG S, AVCHD format Ver.2.0 compatible MP4
Recording format (movie audio)	XAVC S: LPCM 2ch/AVCHD: Dolby® Digital (AC-3) 2ch (Dolby® Digital Stereo Creator)/MP4: MPEG-4 AAC-LC 2ch
Still image number of recorded pixels (image size)	[16:9] 17M (5,472 x 3,080)/7.5M (3,648 x 2,056)/4.2M (2,720 x 1,528)
INTERFACE	
Input and output terminals	Hi-Speed USB (USB2.0), Micro HDMI, Multi/Micro USB Terminal
Wi-fi	Yes (IEEE802.11b/g/n (2.4GHz band))
Wireless capabilities	NFC forum Type 3 Tag compatible, One-touch remote, One-touch sharing, Wi-Fi
POWER	
Power source	DC 3.6 V (supplied battery)/DC 5.0 V (supplied AC Adapter)
Battery system	NP-BX1
Power consumption (camera mode)	Approx. 1.9W with LCD monitor and approx. 2.3W with viewfinder (CIPA standard)
Usb charge/usb power supply	Yes (Shooting, Playback)
Battery life (still images)	Up to 280 shots / 115 min
Supplied battery	Rechargeable Battery Pack NP-BX1 plus **1 extra spare battery pack**
Others	
Shooting functions	Eye AF; Face Detection; Face Registration; Still Image Recording (during movie recording); Smile shutter; Grid Line; Quick Navi; Digital Level Gauge (pitch and roll); WB Bracket; DRO Bracketing; MF Assist; Peaking; Zebra; Marker Display; Micref Level; Step Zoom/Quick Zoom; Self-

No.	Minimum technical Specification required by the Procuring Entity
	portrait timer; TC/UB; Photographer Name and Copyright; ISO Auto Minimum Shutter Speed; PC Remote Control
Playback functions	9/25-frame index view; Auto Orientation; Slide Show; Forward/Rewind (Movie); Delete; Protect; Motion Shot Video; Beauty Effect; TRILUMINOS Color; 4K image output
Index playback	9 / 25 images
SIZE & WEIGHT	
Dimensions (w x h x d) (approx.)	4 x 2.29 x 1.61 in
Weight	10.51 oz (With battery and media)
Carry case	Yes (Camera, Lens and Power/Battery Kit)

12.11.2 Printer and Color Printer/Photocopier

The Contractor shall supply one black & white Laserjet A4 printer and one A3 colour printer as specified below:

- Printer: HP Laserjet or equivalent
- Color Printer/Photocopier: HP Design 650C or equiv. (DIN A3 format)
- Scanner

On completion of the Contract or at such time as specified by the Engineer, the ownership of all computers and such like equipment shall be transferred to the Employer.

Technical Specifications for the Multifunctional Printer

Quantity: 3No. Multifunctional Printers

HP LaserJet Pro MFP M521dn

TECHNICAL SPECIFICATIONS

AIO functions	Print, copy, scan, fax; **AiO multitasking supported:** Yes
Duplex print options	Automatic (standard)
Print speed[1]	Up to 42 ppm (black, letter); Up to 40 ppm (black, A4)
First page out[2]	As fast as 13.4 sec
Print technology	Laser
Print resolution	**Black (best):** Up to 1200 x 1200 dpi; **Black (normal):** HP FastRes 1200 (1200 dpi quality), 600 x 600 dpi with HP Resolution Enhancement technology
Print resolution technologies	HP FastRes 1200 (600 x 600 dpi), HP ProRes 1200 (1200 x 1200 dpi), 600 x 600 dpi.
Print cartridges number	1 (black)
Printer smart software features	HP ePrint, Apple AirPrint™, Smart Install, HP Auto-On/Auto-Off technology
Digital Sending St Features	Scan- to-Email; Scan-to-Network Folder; Scan-to-USB drive
Mobile printing capability	HP ePrint, Apple AirPrint™, Mobile Apps
Standard print languages	HP PCL 6; HP PCL 5c; HP postscript level 3 emulation, PCLm
Printer management	**Windows:** HP Device Toolbox, Status Alerts (default install), SNP Alerts (minimum network install), HP Web Jetadmin (download); **Mac:** HP Utility
Scan type	Flatbed, ADF
Scan speed[3]	**Letter:** Up to 21 ppm (b&w), up to 15 ppm (color)
Scan resolution	**Hardware:** Up to 300 x 300 dpi (color ,gray scale and mono, ADF); Up to 1200 x 1200 dpi (color, gray scale and mono, flatbed) **Optical:** Up to 300, 600, 1200 dpi
Scan technology	Contact Image Sensor (CIS)
Scan file format	Windows Scan SW supports file format: JPG, RAW(BMP), PDF, TIFF, PNG; Mac Scan SW supports file format: TIFF, PNG, JPEG, JPEG-2000, PDF, PDF-Searchable, RTF, TXT.
Scan input modes	**From PC:** Solution Center Lite (Windows Vista®, Windows® XP) or Device Stage (Windows® 7); TWAIN-compliant or WIA-compliant software
Scan size maximum	8.5 x 11.7 in
Scanner advanced features	Duplex scanning from ADF; Scan to USB flash drive; Scan to network folder; Scan to email; Scan to cloud; Optimize text/picture; Selectable scan resolution 75 to 300 dpi
Twain version	V1.9
Bit depth/Grayscale levels	24 bit (8 bit for greyscale duplex jobs)/256
Copy speed[4]	Up to 42 ppm (black, letter); Up to 40 ppm (black, A4)
Scan Speed Duplex	letter : Up to 36 ipm (black & white), up to 14 ipm (color)
Copy resolution	**Black (text and graphics):** Up to 600 x 600 dpi; **Color (text and graphics):** Up to 600 x 600 dpi
Max number of copies	Up to 99 copies
Copier resize	25 to 400%
Copier settings	Number of copies; Reduce/Enlarge; Lighter/Darker; Optimize; Paper; Multi-page copy; Collation; Tray select; Two-sided; Draft mode; Image adjustment; Set as new defaults; Restore defaults
Fax speed[5]	Up to 33.6 kbps; 3 sec per page
Fax resolution	**Black (best):** Up to 300 x 300 dpi; **Black (standard):** Up to 203 x 98 dpi; **Black and White (fine):** 203 x 196 dpi, 256 levels of gray; **Black Photo Grayscale:** 300 x 300 dpi (halftone)
Fax smart software features	Permanent fax memory backup; Fax forwarding; Fax address book; TAM interface, Speed-dial; Group dial; Auto redial; Block junk faxes; Polling; Send a fax with confirmation; Private fax receive.
Fax memory	Up to 250 pages (letter)
Fax features	**Auto Fax Reduction Supported:** Yes; **Auto-Redialing:** Yes; **Fax Delayed Sending:** No; **Distinctive Ring Detection Supported:** Yes; **Fax Forwarding Supported:** Yes; **Fax Phone TAM Interface Supported:** Yes; **Fax Polling Supported:** Yes; **Junk Barrier Supported:** Yes, requires Caller ID; **PC Interface Supported:** Yes, software not included; **Telephone Handset Supported:** Yes; **Fax Telephone Mode Supported:** Yes
Standard connectivity	**Optional** : HP Jetdirect ew2500 802.11b/g Wireless Print Server J8021A; HP Jetdirect 2700w USB Wireless Print Server J8026A
Network capabilities	Via built-in 100/1000Base-TX networking
Modem	33.6 kbps
Memory	256 MB
Processor speed	800 MHz
Duty cycle (monthly, A4)[6]	Up to 75,000 pages
RMPV	2,000 to 6,000 pages rec. monthly page volume[7]

Paper handing	100-sheet multipurpose tray, 500-sheet input tray 2, 50-sheet automatic document feeder, 250-sheet output bin, 100-sheet rear output bin **Input:** Optional 500-sheet tray (add up to 1 trays) **Output:** Optional 500-sheet tray (add up to 1 trays).
Media type	Paper (bond, color, letterhead, plain, pre-printed, prepunched, recycled, rough); envelopes, labels, cardstock, transparencies, user-defined
Media weight	**Tray 1:** 52 to 199 g/m²; **Tray 2:** 52 to 120 g/m²; **Tray 3:** 52 to 120 g/m²
Media Sizes Custom	**Tray 1:** 3 x 5 to 8.5 x 14 in (76 x 127 to 216 x 356 mm); **Tray 2, optional 500-sheet tray (3, 4):** 4.1 x 5.8 to 8.5 x 14 in (105 x 148 to 216 x 356 mm)
Standard Media Sizes Supported	**Metric**: A4, RA4, Oficio 216 x 343 mm, Oficio 216 x 347 mm, 10 x 15 cm, B5(JIS), B6(JIS), Postcard(JIS), Double Postcard(JIS), A5, A6, 16K 195 x 270 mm, 16K 184 x 260 mm, 16K 197 x 273 mm
Auto doc. feeder capacity	Standard, 50 sheets
Dimensions (W x D x H)	18.3 x 18.3 x 20 in (465 x 465 x 508 mm) **Maximum:** 18.3 x 35.4 x 29.5 in (465 x 900 x 750 mm)
Weight	52.7 lb (22.3 kg)
What's in the box[8]	HP LaserJet Pro MFP M521dn; HP LaserJet Black introductory cartridge (~6000 pages); Printer documentation and software on CDs (Windows/Mac OS installation CD & Readiris CD including OCR software); Installation guide, Support flyer, Warranty Card; power cord; Fax Cable
Replacement cartridges	HP 255A Black LaserJet Toner Cartridge, CE255A HP 255X Black LaserJet Toner Cartridge, CE255X
Warranty features	One-year limited warranty, Onsite
Compatible operating systems	Full software installs supported on: Windows 8, Windows 7 32-bit and 64-bit, Windows Vista 32-bit and 64-bit, Windows XP 32-bit (SP2 or higher); Driver only installs supported on: Windows Server 2008 32-bit and 64-bit, Windows Server 2003 32-bit (SP3 or higher); Mac OS X v 10.6.8 and later; Linpus Linux (9.4, 9.5), Red Hat Enterprise Linux 5.0 (supported with a pre-built package); SUSE Linux (10.3, 11.0, 11, 11.1, 11.2), Fedora (9, 9.0, 10, 10.0, 11.0, 11, 12, 12.0), Ubuntu (8.04, 8.04.1, 8.04.2, 8.10, 9.04, 9.10, 10.04), Debian (5.0, 5.0.1, 5.0.2, 5.0.3) (supported by the automatic installer); HPUX 11 and Solaris 8/9.
Min. system requirements	**PC:** Windows 7 (32-bit/64-bit), Windows Vista (32-bit/64-bit): 1 GHz 32-bit (x86) or 64-bit (x64) processor, 1 GB RAM (32-bit) or 2 GB RAM (64-bit), 400 MB free hard disk space, CD/DVD-ROM or Internet, USB or Network port; Windows XP (32-bit) SP2: Pentium® 233 MHz processor, 512 MB RAM 400 MB free hard disk space, CD/DVD-ROM or Internet, USB or Network port **Mac:** Mac OSX v 10.6; PowerPC G4, G5, or Intel® Core™ Processor; 500 MB hard disk; CD-ROM/DVD-ROM or Internet; USB or Network port
Fonts and typefaces	84 scalable TrueType fonts. Additional Font Solutions available at **www.hp.com/go/laserjetfonts**.
Control panel	3.5-in intuitive touchscreen control panel with color graphic display; Buttons (Home, Cancel, Help, Right/Left Arrows, Back); LED indicator lights (Ready, Error)
Display	3.5-in (8.89 cm) touchscreen, LCD (color graphics)
Power[9]	**Power supply type:** Built-in power supply **Power supply required:** Input voltage: 110 to 127 VAC (+/- 10%), 50/60Hz (+/- 2 Hz) **Power consumption:** 760 watts (Printing), 520 watts (Copying from ADF), 18.2 watts (Ready), 4.3 watts (Sleep), 0.3 watts (Off).
Software included	**Windows:** HP Installer/Uninstaller, HP PCL 6 print driver, HP WIA Scan Driver, HP TWAIN Scan Driver, HP Scan, HP Fax Setup Wizard, HP Send Fax, HP Fax Print Driver, Status Alerts, HP Update, DXP, Readiris Software; **Mac:** HP Installer/Uninstaller, HP Postscript driver, HP Scan, HP Setup Assistant, HP Fax Print Driver, HP Utility, HP Alerts, HP Firmware Updater, Readiris Software
Acoustic[10]	**Acoustic power emissions:** 6.7 B(A) **Acoustic power emissions (active copy):** 6.8 B(A) **Acoustic power emissions (ready):** Inaudible **Acoustic pressure emissions bystander (active copy):** 54 dB(A) **Acoustic pressure emissions bystander (active, printing):** 54 dB(A) **Acoustic pressure emissions bystander (ready):** Inaudible
Operating environment	**Operating humidity range:** 10 to 80% RH **Non-operating humidity range:** 10 to 90% RH **Recommended operating humidity range:** 30 to 70% RH **Operating temperature range:** 50 to 90.5º F (10 to 32.5º C) **Recommended operating temperature range:** 50 to 90.5º F (10 to 32.5º C) **Storage temperature range:** -4 to 104º F (-20 to 40º C)
Security management	Password-protected network embedded Web server; enable/disable Network ports; SNMPv1/v2/ community password change, SNMPV3 password change.
Accessories	HP LaserJet 500-sheet Feeder/Tray, CE530A HP LaserJet MFP M525 Cabinet, CF338A
Care Packs	HP 3 year 4h 9X5 LaserJet Pro M521MFP HW Support, U6Z61E HP 3 year 4h 13X5 LaserJet Pro M521MFP HW Support, U6Z62E HP 3 year Next Business Day + DMR LaserJet Pro M521MFP Support, U6Z65E

12.11.3 Transport

The Contractor shall supply motor vehicles as detailed below:

1. station wagon:
2. pick-up:
3. motorbike:

These vehicles shall be for the sole use of the Engineer and his staff and shall be available at all times. Only those makes of vehicles having satisfactory permanent repair and maintenance facilities already well established in Kampala will be acceptable.

They shall be new right hand drive diesel powered vehicles for the exclusive use of the Engineer. They shall have four-wheel drive capability, high ground clearance, an engine capacity of at least 2,800 cc. The station wagon shall be fully covered with permanent roof and have adequate seating for a driver and eight passengers. The pick-up shall be double cabin type. The front seats of all vehicles shall be separate and all seats shall have headrests.

The vehicles shall be fitted with the manufacturer's tropical and off-highway extras including tow bars, bull bars and air conditioning. The vehicles shall be equipped with an alarm system, central locking system and radio and tape facilities. Each vehicle shall also be provided with a First Aid Kit. Kerb weight and tyre pressures shall be stated on each vehicle, and the vehicles shall conform in all respects to the regulations of the appropriate registration authority.

The motorbike shall have an engine capacity of 125cc and shall be delivered with helmet and weather jacket to the approval of the Engineer.

The Contractor shall provide competent English-speaking drivers to the approval of the Engineer for all vehicles used on the Site. Any driver found unsuitable by the Engineer shall be replaced immediately.

These drivers shall be available during all normal site working hours and when specifically required by the Engineer, outside those hours.

The vehicles provided shall be maintained at all times in good running order. Should any vehicles at any time become, in the opinion of the Engineer, unserviceable by normal use in the conditions and demands of the Site, the Contractor shall replace them without delay. If the Contractor fails to provide replacement transport, the Engineer shall be entitled to withhold the issue of a Payment Certificate until such time as a replacement is provided.

The Contractor shall provide all necessary fuel, oil, etc, and shall bear all expenses in connection with running, maintenance, upkeep, licensing and insurance. Service and repair costs shall only be carried out by the authorized car dealer.

Insurance for all vehicles shall be ‘comprehensive’ and include:

- cover for the Engineer and his staff driving the vehicle, and for any other persons that the Engineer requires to be included
- usage on the business of the Engineer and his staff for social, domestic and pleasure purposes
- liability to third parties (including passengers whether the Engineer, his staff or others) for an unlimited indemnity in respect of death or personal injury and for the maximum indemnity reasonable in respect of loss, destruction or damage to property

When not used by the Engineer the Contractor shall provide adequate and secure garaging for each vehicle and will not permit use of any vehicle other than that authorised by the Engineer.

The Contractor shall provide similar replacement vehicles whenever the original vehicles are not available for use for whatever reasons. On completion the Contractor shall first completely overhaul each vehicle to the satisfaction of the Engineer.

All the Contractor’s expenses and costs arising under this Clause shall be reimbursed against the rates

entered in the Bills of Quantities. Purchase costs will be paid after handing over of the vehicles to the Engineer. Standing costs are on a vehicle/week basis while operating costs will be paid according to the kilometres travelled as recorded on the vehicle odometers.

The vehicle/week rate should include for items such as insurance, registration, road taxes, delivery to site, garaging, provision of temporary replacement vehicles and provision of drivers and their over-time. The rate should also include for the cost of the final complete overhaul, transfer of ownership and registration in favour of, and delivery of all vehicles, to the Employer.

The kilometre rate will include all day-to-day running expenses such as fuels and lubricants, routine servicing, maintenance and repairs.

Detailed Vehicle and Motorcycle Specifications

a. Specifications for Station Wagon Vehicle (Manual)

Quantity: 1No. Station Wagon Vehicle

No.	Minimum technical Specification required by the Procuring Entity
1	Station wagon vehicle (right hand drive four-wheel drive) tropicalized
2	Year of manufacture: ≥ 2024–most recent and current model
3	Engine: Water Cooled Diesel Engine of a displacement not exceeding 3000cc. Turbo Charged with Intercooler
4	Power Output at rated rpm: Minimum; 150 KW
5	Transmission: manual transmission with minimum 6 speed forward and 1 reverse. Full Time 4x4, Rear Differential, Central differential
6	Tyres and rim size: minimum size 17 alloy rims with full-size spare tyre of alloy wheels
7	Fuel tank capacity: minimum 150 liters
8	Seating capacity: minimum 7 adults with seat belts
9	Ground clearance: minimum 220 mm measured from the lowest point of the rear axle
10	Minimum wheel base: 2790 mm
11	Air conditioner: automatic front and rear
12	AM/FM/CD Radio Data System (6-Speakers), Screen display with Rear Camera video feed
13	Driver & Front Passenger Airbags + CSA for 3rd Row
14	Heavy duty front bull bar
15	Brakes front and rear: ventilated discs with ABS
16	Keyless entry system with power windows
17	Vehicle security anti-theft system.
18	Telescopic steering with radio, and select functions
19	Tropicalized suspension system
20	Legal lighting with fog lights and rear light guards
21	Tool Kit: Fire extinguisher and essential tools for routine maintenance including at the minimum the following: Accident brake down triangles, Jack and lug wrench, open end spanner and offset ring spanner, Adjustable wrench, Spark plug wrench, Hex key, Screwdriver, Pliers, Cleaning liquid, Jumper cables, and Tow hooks.
22	Original Manufacturer's published technical brochures for a standard production model offered, and an Operator Manual 1No. per Vehicle
23	Warranty of minimum 100,000 km or 3 years whichever comes first.
24	Routine service/maintenance for maximally every 5,000Km, for the first 100,000 km.

b. Specifications for Double Cabin Pickup Vehicle (Manual)

Quantity: 3No. Double cabin (crew cab) pickup vehicles

No.	Minimum technical Specification required by the Procuring Entity
1	Double cabin (crew cab) pickup vehicle, right hand drive four-wheel drive and tropical-ized
2	Year of manufacture: ≥ 2024 – most recent and current model
3	Engine: Water Cooled Diesel Engine of displacement not exceeding 2800cc. Turbo Charged with Intercooler
4	Power output at rated rpm: Minimum; 150kW
5	Transmission: Manual, Minimum 6 speed forward and 1 reverse, part-time 4WD, rear dif-ferential lock, high/low transfer gears
6	Minimum ground clearance: 230 mm measured from the lowest point of the rear axle
7	Wheel base: minimum 3085 mm
8	Seat capacity minimum 5 adult persons with seat belts (front seat separated)
9	SRS Airbags: driver and front passenger air bags with side airbags
10	Adjustable Steering wheel (with tilt)
11	Antilock Braking System (ABS)
12	Automatic air-conditioning and cooler
13	Keyless central door locking system
14	Power windows, adjustable side rear view driving mirrors with retract and tilt
15	Heavy duty front bull bar
16	AM/FM DVD Radio Data System and Screen display with 4-Speakers + Rear Camera video feed
17	Rear step bumper with side steps
18	Fuel tank capacity: minimum 80 liters
19	Tyres: rim size minimum 18 inches and full-size spare tyre All with alloy wheels
20	Tropicalized Suspension system
21	Legal lighting with fog lights and rear light guards
22	Tool Kit: Fire extinguisher and essential tools for routine maintenance including at the minimum the following: Accident brake down triangles, Jack and lug wrench, open end spanner and offset ring spanner, Adjustable wrench, Spark plug wrench, Hex key, Screwdriver, Pliers, Cleaning liquid, Jumper cables, and Tow hooks.
23	Rear deck cabin guard frame
24	Original Manufacturer's published technical brochures for a standard production model offered, and an Operator Manual 1No. per Vehicle
25	Warranty of minimum 100,000 km or 3 years whichever comes first.
24	Routine service/maintenance for maximally every 5,000Km, for the first 100,000 km.

c. Specifications for Motor Cycles

No.	Minimum technical Specification required by the Procuring Entity
1	Title: On and off-road motor cycles
2	Year of manufacture: ≥ 2021 – most recent and current model
3	Engine: Minimum 4 stroke, 1- cylinder air cooled petrol engine with a displacement not exceeding 125cc
4	Power output at rated rpm: Minimum; 8.4 kW
5	Starting system: Capacitor Discharge Kick starter or electric or both
6	Gear box and drive train: Minimum 5 speeds constant mesh through roller chain
7	Suspension front – Telescopic oil dumpers, rear-swing arm and double shock absorbers
8	Front Guard Fender designed for off road capabilities
9	Odometer, in Km/hr and tachometer
10	Motorcycle ready to seat two with a rear carrier
11	Minimum ground clearance: 260 mm
12	Tyres: Front minimum 2.75 or 70/100 or 80/90 -21 spoke steel rims with wire spokes, rear 4.10 or100/90 or 110/80-18 steel rims wire spokes (or equivalent) with off road pattern
13	Brakes: Front and rear drum or disc
14	Electrical system: all legal lighting
15	Fuel tank: Minimum 11 liters
16	Rider Kit: Set of riding gear to include Crash helmet, riding leather gloves and rider trouser and shirt.
17	Manufacturer recommended tool kit
18	Original Manufacturer official published technical brochures for the motor cycles
19	Warranty for one year or 10,000 km whichever comes first

12.12 Residential Accommodation for the Engineer

The Contractor shall rent residential accommodation for the Engineer's staff to the satisfaction of the Engineer. Each house should have a minimum floor area of 100 m^2 and shall have at least a kitchen, a sitting room, 2 bedrooms, one of them self-contained bathroom with a separate bathroom. Each house shall have a compound with sufficient parking space and a garden. The contractor shall hand over the houses including the following items:

- Provision and maintenance of furniture and equipment for all rooms to the satisfaction of the Engineer. The Contractor is to allow in his rates for delivery to houses, unpacking and disposing to rooms and connecting up and testing electrical appliances. Technical equipment shall comprise a fridge, a freezer and a four-plate cooker. One house shall be equipped in addition to the other items, with a washing machine.
- Provision and maintenance of adequate potable water and electricity supplies, if necessary, from his own resources, water borne sanitation facilities and other essential services.
- Provision and maintenance of all temporary access roads, footpaths, fencing and gates.
- General maintenance including the garden and repair of the premises including complete external and internal redecoration before handing over to the Engineer and later on to the land lord.
- 24-hour security guarding.

Accommodation for the Engineer's staff shall be ready for occupation within one month after instruction is given by the Engineer. Until the accommodation is ready for occupation, the Contractor shall, at rates specified in the Bills of Quantities, provide hotel accommodation for the Engineer's staff in Lira. If accommodation for the Engineer's staff is not ready for occupation after one month after instruction is given by the Engineer, the Contractor shall continue to provide, at is own expense, hotel accommodation for the Engineer's staff in Lira. All alternative accommodation shall be acceptable to the Engineer in location, quality and accommodation.

12.13 Assistance to the Engineer

The contractor shall provide all driving equipment as may be required by the Engineer for the supervision of the works.

The Contractor shall provide a competent driver at the request of the Engineer during the offshore works.

The Contractor shall supply such labour, either continuously or from time to time, as may be required by the Engineer, to assist in the checking of materials on Site and in the laboratory, the setting out of the Works and in measuring the Works.

The Contractor shall provide one draftsman (excellent in AutoCAD) whenever required by the Engineer during the contract.

The Contractor shall provide all tools, protective clothing, wooden pegs, iron pins, water, concrete and transport for labourers as may be required by the Engineer and his staff for supervision of the Works.

The Contractor shall keep all buildings provided by himself or the Employer, for the use of the Engineer and his staff, in a well maintained, clean and fully habitable condition and shall maintain all access roads, car parks, footpaths, fences, gates, drains, potable water supplies and water-borne sewage disposal systems in a good state of repair, all to the satisfaction of the Engineer. The Contractor shall also provide an adequate refuse disposal service for all residences and offices. The Contractor shall maintain all furniture and equipment, provided by him, in a good state of repair and usable condition and shall replace any item which becomes unserviceable due to fair wear and tear.

The Contractor shall provide soap and towels in the offices of the Engineer, cleaning and sanitary staff, cleaning equipment and day and night watchmen.