



**TECHNICAL SPECIFICATIONS FOR  
REMEDIAL WORKS FOR ONSITE WASTE WATER TREATMENT PLANT AT LORESHO RIDGE  
ESTATE DEVELOPED ON L.R.NO.21080/63 (ORIGINAL NO. 21080/38)**

**TENDER NO. KPPF/PROC/2-A/06/2020**

## **SPECIFICATIONS OF MATERIALS AND WORKS**

### **7.1 GENERAL SPECIFICATIONS OF MATERIALS ANDWORKS**

#### **7.1.1 GENERAL**

This specification is to be read in conjunction with the drawings which are issued with it. Bills of quantities shall be the basis of all additions and omissions during the progress of the works.

#### **7.1.2 STANDARD OF MATERIALS**

Where the material and equipment are specifically described and named in the Specification followed by approved equal, they are so named or described for the purpose of establishing a standard to which the contractor shall adhere.

Should the contractor install any material not specified herein before receiving approval from the proper authorities, the Engineer shall direct the contractor to remove the material in question immediately. The fact that this material has been installed shall have no bearing or influence on the decision by the Engineer.

All materials condemned by the Engineer as not approved for use, are to be removed from the premises and suitable materials delivered and installed in their place at the expense of the contractor. All materials required for the works shall be new and the best of the respective kind and shall be of a uniform pattern.

#### **7.1.3 WORKMANSHIP**

The workmanship and method of installation shall conform to the best standard practice. All work shall be performed by a skilled tradesman and to the satisfaction of the Engineer. Helpers shall have qualified supervision.

Any work that does not in the opinion of the Engineer conform to the best standard practice will be removed and reinstated at the contractor's expense.

Permits, Certificates or Licences must be held by all tradesmen for the type of work; in which they are involved where such permits, certificates or licences exist under Government legislation.

#### **7.1.4 PROCUREMENT OF MATERIALS**

The contractor is advised that no assistance can be given in the procurement or allotment of any materials or products to be used in and necessary for the construction and completion of the work.

Contractors are warned that they must make their own arrangements for the supply of equipment/materials and/or products specified or required.

#### 7.1.5 SHOP DRAWINGS

Before manufacture or Fabrication of the sieves, trash racks and reverse gravity filter is commenced, the contractor will furnish the Engineer with two copies of shop drawings of the same for the approval of the engineer.

#### 7.1.6 AS-BUILT DRAWINGS AND OPERATION MANUAL

These diagrams and drawings shall show the completed installation including sizes, runs and arrangements of the installation. The drawings shall be to scale not less than 1:50 and shall include plan views and section.

The drawings shall include all the details which may be useful in the operation, maintenance or subsequent modifications or extensions to the installation.

Three sets of diagrams and drawings shall be provided, all to the approval of the Engineer.

One coloured set of line diagrams relating to operating and maintenance instructions shall be framed and, mounted on a suitable location in the control room.

On completion will be required to develop an operation and maintenance manual of the entire Onsite Wastewater Treatment Plant after the remedial works. This shall be submitted in three copies to the Employer through the Engineer.

#### 7.1.7 REGULATIONS AND STANDARDS

All work executed by the contractor shall comply with the current edition of the "Specifications for Civil Engineering Works, issued by the MINISTRY OF PUBLIC WORKS, or the relevant Local Authority by-Laws.

Where two sets of regulations appear to conflict, they shall be clarified with the Engineers. All materials used shall comply with relevant Kenya Bureau of Standards Specification or the appropriate British Standard.

#### 7.1.8 SETTING OUT WORK

The contractor at his own expenses; is to set out works and take all measurements and dimensions required for the erection of his materials on site; making any modifications in details as may be found necessary during the progress of the works, submitting any such modifications or alterations in detail to the Engineer before proceeding and must allow in his Tender for all such modifications and for the provision of any such sketches or drawings related thereto.

## 7.1.9 TESTING ON SITE

The contractor shall conduct during and at the completion of the installation and, if required, again at the expiration of the maintenance period, tests in accordance with the relevant section of the current edition of the Regulations or the standards for Civil engineering Works or the latest Kenyan or Local Authority By-Laws.

- a) The Contractor shall provide accurate instruments and apparatus and all labour required to carry out all the necessary tests. The instruments and apparatus shall be made available to the engineer to enable him to carry out such tests as he may require.
- b) The Contractor shall generally attend on other Contractors employed on the project and carry out such tests as may be necessary.
- c) The Contractor shall test to the engineer's approval and as specified elsewhere in this specification or in Standards and regulations already referred to, all equipment, plant and apparatus forming part of the works and before connecting to any other setting or work.
- d) Where such equipment, etc. forms part of or is connected to a system whether primarily or of whatever nature or otherwise, the Contractor shall carry out balancing, regulating testing and commissioning, or if primarily an electrical or the system forming part of works, shall balance, regulate, test and commission the system to the engineer's approval.

## 7.2 TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

### 7.2.1 GENERAL SPECIFICATIONS

1.1 The detailed specifications given hereafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards.

1.2 It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.

1.3 In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence.

1.4 In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.

### 7.2.2 TESTS AND SAMPLES

Samples of all materials shall be deposited with the Engineer and approved prior to ordering or delivery on site. The Engineer reserves the right to test any sample to destruction and retain samples until the end of the maintenance period. All materials delivered to site shall be at least equal in all respects to the samples delivered to the Engineer.

All sampling of materials on the site must be done by or in the presence of the Engineer. All other samples will be deemed to be not valid under the Contract.

### 7.2.3 KENYA STANDARDS

All materials and goods supplied for incorporation in the works must comply with any relevant current standards issued by the Kenya Bureau of Standards. Where these are not established or are unclear the latest British Standards and Codes of Practice shall apply.

### 7.2.4 PROTECTION OF EXISTING "MANHOLES AND CHAMBERS

Where it is necessary to remove existing manhole covers and gulley gratings for adjustment thereof, or in connection with any other work, the Contractor shall take all necessary precautions to prevent the entry of debris into such manhole or chambers.

### 7.2.5 WATER SUPPLY, LIGHT AND POWER

The Contractor shall provide for all-purpose of the work, an adequate supply of water. He must pay the water charges and make all arrangements for supply, transport and distribution.

In addition, the Contractor shall make his own arrangements for the supply of light and power required by him for the construction of the Works and shall pay all fees and charges in connection therewith.

### 7.2.6 PROVISION OF INSTRUMENTS AND LABOUR

The Contractor shall provide at his own expense all instruments, materials, tools and other things which the Engineer considers necessary for his proper supervision of the Works and shall maintain the same in good order. He shall also provide labour for attendance on the Engineer and his representative in carrying out operations connected with the supervision of the Works.

### 7.2.7 PROTECTION OF WORKS FROM RAINS

The Works shall be so executed that should it be necessary to suspend work due to rain, no part thereof is left in such a state as to be liable to damage thereby. No claim by the Contractor arising out of the reinstatement of any damage caused by or accidental to rain shall be accepted.

### 7.2.8 WORKMANSHIP

Notwithstanding anything mentioned to the contrary in this Specification, the whole of the Works shall be carried out in a thoroughly competent manner.

### 7.2.9 LEAVE WORKS CLEAN

On completion of the Works, or if directed by the Engineer, on completion of any portion thereof, the Contractor shall carefully restore to the original condition the ground, fences and other structures that may have been interfered with in any way by him or his employees and shall remove all rubbish, tools and materials which are not required, so as to leave the Works and site in a clean

and orderly condition, such work being carried out by the Contractor without extra charge over and above his scheduled rates for the execution of the Works.

#### 7.2.10 NO BORROW PITS

No borrow pits will be allowed to be opened on site unless with written approval from the Engineer.

### 7.3 PARTICULAR SPECIFICATIONS

#### 7.3.1 SITE CLEARANCE

##### CLEARING SITE

The Contractor shall remove buildings, walls, gates, fences and other structures and obstructions, grub up and remove trees, hedges, bushes and shrubs and clear the site of the Works at such time, and to the extent required by the Engineer, but not otherwise, the materials so obtained shall so far as suitable be reserved and stacked for further use; all rubbish and material unsuitable for use shall be destroyed or removed from the site.

##### BUSHES, SMALL TREES AND FELLING TREES

All bushes and small trees, the main stem of which is less than 100mm girth at 1 metre above ground level shall be uprooted (unless otherwise directed by the Engineer) and burnt or otherwise disposed off as directed by the Engineer.

Where directed by the Engineer, trees shall be uprooted or cut down as near to ground level as is possible, and No such trees shall be cut down without the express permission of the Engineer.

Where pipes are passing through any of the existing bushes or trees, authority should be sought from the landscape designer.

The engineer and the landscape designer to work in coordination to ensure as many trees as possible are preserved. According to the landscape designer's decision, special dispositions can be taken for important trees.

##### GRUBBING UP ROOTS

Stumps and tree roots shall, unless otherwise directed, be grubbed up, blasted, burnt or removed and disposed of in approved dumps, to be provided by the Contractor where directed by the Engineer, the holes resulting from grubbing up shall be filled with approved materials, which shall be deposited and compacted in layers not exceeding 225mm loose depth, to the same dry density as that of the adjoining soil.

##### UNDERGROUND CHAMBERS, ETC. TO BE CLEANED

Demolition of pits, walls etc shall be to a depth of 1 metre below ground level and the remainder shall be properly cleaned out and filled with approved materials, which shall be deposited and

compacted in layers not exceeding 225mm loose depth to the same dry density as that of the adjoining soil. Soil and surface water drains, lying within the site of the Works, shall, where directed by the Engineer, be sealed off, and all other services satisfactorily severed and sealed to the satisfaction of the appropriate authorities and/or owners. Disused soil and surface water drains within 1 metre of formation level shall if required by the Engineer be removed and trenches shall be backfilled as necessary.

## WEED CONTROL

The Contractor shall take all necessary precautions against the growth on the site of weeds and remove them as necessary throughout the period of works and maintenance.

The formation level and finished surface of base of all footways and elsewhere as directed shall be sprayed with an approved persistent total herbicide at the rate recommended by the manufacturer. The application shall be by an even spray in a high volume of water at about 0.07 to 0.11 litres per square metre. After this application the footways shall receive at least two further waterings before the surface is sealed.

## 7.3.2 SEWERS, DRAINS AND MANHOLES

### EXCAVATION FOR PIPELINES, SEWERS AND MANHOLES

The ground shall be excavated to the lines and depths shown on the Drawings or to such other lines and depths as the Engineer may direct. Excavations taken out to greater depth than is necessary shall be filled in to the required level with concrete of the appropriate class as specified for the pipe bed at the Contractor's own cost. Trenches shall be of sufficient widths to enable the pipes to be properly laid and jointed. Special care shall be taken to provide a solid and even bed for the barrels of the pipes and, where a concrete bed is not specified, the floor of the trench shall be properly shaped to receive the sockets.

Excavations will be considered to be from ground level at the centre line of the pipe measured to the invert level of the pipe. The Contractor must allow in his prices for all extra excavation required to allow for thickness of pipes and concrete beds.

### SUPPORTS FOR PITS, TRENCHES AND OTHER EXCAVATIONS

The sides of pits, trenches and other excavations shall where necessary be adequately supported to the satisfaction of the Engineer by timber or by other approved means, and all such excavations shall be of sizes sufficient to enable the pipes and concrete to be laid accurately, and proper refilling and compaction to be carried out.

The Contractor shall take all precautions necessary for the safety of adjoining structures and buildings by shoring, opening in short lengths or otherwise, during the time the trenches are open.

Where directed by the Engineer, the supports shall be left in trenches or other excavations, and such supports so left will be measured and paid for at the prices entered in the Bills of Quantities except where in the opinion of the Engineer the necessity for leaving the supports in has arisen from carelessness or neglect on the part of the Contractor.

#### ROCK CUTTING IN TRENCHES FOR PIPES

Where solid rock is met with in trenches, it shall be cut out to a depth of 100mm below the intended level of the bottom of the pipes, and replaced with 100mm of concrete of the appropriate class specified elsewhere. In measuring such rock excavation the Contractor will be allowed width of 300mm more than the external diameter of the pipes to a level of 100mm below the bottom of the pipes. The price inserted in the Bills of Quantities shall be held to cover all expenses in connection with excavation of the rock and disposing off surplus material as directed by the Engineer.

#### WATER IN TRENCHES FOR THE PIPELINES AND SEWERS

Trenches shall be kept free from water until, in the opinion of the Engineer, any concrete or other works therein are sufficiently set, and the Contractor shall construct any sumps or temporary drains that the Engineer may deem necessary.

#### PUTRESCENT MATTER

The Contractor shall include in his excavation prices for the removal of all filth or putrescent matter met with in the excavation of the Works to suitable places to be provided by the Contractor clear of the works, and on no account shall it be so replaced as to allow its gaining admission into the pipes, laid or un-laid. Such material shall be replaced as required by surplus excavated soil.

#### SIGHT RAILS

Before trenches are excavated sight rails shall be provided and erected by the Contractor at convenient intervals not exceeding the distance between those manholes for whichever an invert level is given in the Drawings or 50 metres whichever is the less. Rails shall be of substantial construction and shall be painted in alternate contrasting colours in such a manner as to indicate clearly the lines and levels, and, for use in conjunction with them, suitable boning rods shall be provided by the Contractor. The posts shall be firmly planted on either side of the trench. The Contractor will be held responsible for any errors, which may occur in the execution of the Works through sight rails being disturbed, faulty setting out there from, or from any other cause whatsoever and shall make good at his own expense.

The sight rails shall be fixed with the upper edge an integral height in metres above the level of the invert of the pipe being laid.

#### INSPECTION OF TRENCHES

Before any pipes are laid in a trench the trench shall be inspected and passed as satisfactory by the Engineer.



## CLEANING OF PIPES

Before being laid in the trench, each pipe and fitting shall be inspected and any dirt or foreign matter inside the pipe or fitting shall be removed. Spigots and sockets shall also be examined for cleanliness to ensure proper joints.

## PIPE LAYING

In any length of drain, laying shall always be carried out from the lower end of the length to the higher. In case of spigot and socket pipes the socket shall always be at the upper end of the pipe. Pipes shall be laid true to line and grade or as directed by the Engineer. In order to prevent stones or soil from entering the pipe suitable cover or plug shall be provided which is to be used for covering the mouth of the last laid pipe at all times while pipe laying is not proceeding.

## JOINTING OF P.V.C. PIPES - GLUED JOINTS

The following procedures must be strictly followed:-

- The spigot end shall be chamfered and cut square.
- Clean spigot and socket with wet cloth and let dry.
- Un-grease spigot and socket with acetone.
- Mark length of joint on spigot.
- Apply first a relatively thick layer of glue onto spigot, then a thin layer into socket.
- Push home the joint to the mark quickly and give at once a 90degrees twist.
- Remove pressed out cement.
- Do not disturb the joint for five minutes whilst the glue is hardening. It is essential that the glue used is the correct type, i.e. it shall be purchased from the same factory which delivers the pipes.

## JOINTING OF P.V.C. PIPES - RUBBER RING JOINTS

The joints can be either tie tyton type which incorporates only one rubber ring or loose couplets, in any case the fittings used shall be purchased from the same factory which delivers the pipes. Jointing procedure is:-

- The end of pipes shall be cut' square and shall be chamfered.
- Coupler rubber ring and pipe end shall be cleaned and dry.
- The rubber ring(s) shall be placed in the groove (s) or other socket (coupler).
- Rubber ring (s) and end of pipe shall be lubricated with a lubricant delivered by the pipe manufacturer.
- Mark clearly on the pipe ends the distance from the edge of the coupler to centre of coupler. Push home pipe end to within a few millimetres from centre of coupler.

## PROTECTION OF PIPES

The concrete used for bedding, haunching and surrounding the pipes shall be concrete class 15 (20) unless otherwise ordered by the Engineer.

All concrete pipes will normally be laid with one of the alternative means of protective concrete hereinafter specified.

In all cases where concrete protection is adopted, a concrete mat at least 75mm thick shall first be laid on the bottom of the trench and shall be allowed to set before pipe laying is commenced. Individual pipes shall be firmly supported on bricks or pre-cast concrete blocks or wedges placed immediately behind the socket and in such a manner that each pipe is accurately positioned in both line and level. After the pipe joints have been made and the pipelines satisfactorily tested the remainder of the bedding concrete (and haunching and surrounding concrete where required) shall be placed.

In cases where pipes are not required to be laid on a concrete bed the Contractor shall ensure that each pipe is supported throughout its length by the bottom quarter of the barrel and is bedded on a firm foundation of sand which does not contain any hard lumps.

Joint holes are to be formed in the sand to enable joints to be made and inspected as they are to be as short as practicable.

In all cases the concrete protection shall be thoroughly worked around the undersides of the pipes, and into the joint holes, if any, and shall be thoroughly compacted during the operation of placing and in the case of pipes 450mm or more in diameter, the concreting operations shall be so organized that the vertical faces of the concrete shall bear upon the sides of the excavations, the trench supports being withdrawn as required to achieve this or additional concrete shall be placed between the concrete protection and the sides of the excavation.

Where concrete raft protection is required, the pipe shall be completely surrounded (minimum 150mm) with hand compacted sand up to the prescribed level. The raft shall then be cast and the next 0.5 metres backfilling shall be carried out with sand spread in 150mm layers each layer being well compacted by hand.

#### TEMPORARY SEALING OF DRAINS

During progress of the Works, all open ends of drains to be temporarily sealed off with hardwood plugs.

#### PIPES PASSING THROUGH WALLS

A lintel or arch to be provided through walls to allow 50mm clearance around pipes unless otherwise shown.

Foundation concrete to be lowered where necessary to allow drains to pass over and be adequately supported.

#### uP.V.C. UNDERGROUND DRAIN PIPES

uP.V.C. underground drain pipes and fittings shall be golden brown colour underground pipes and shall comply either with ISO/DIS 4435 'Unplasticised P.V.C. pipes and fittings' for buried drains or with B. S. 4660 or B. S. 5481 and to be obtained complete with coupling rings and relevant sealing compound from an approved manufacturer and laid and jointed strictly in accordance with the manufacturer's printed instructions.

## BACKFILLING OF TRENCHES

Trenches shall be backfilled with suitable excavated material but not before the work has been measured and approved by the Engineer. For pipes which are not surrounded with concrete, the first layer of filling material shall be free from stones and shall not be thrown directly onto the pipes, but shall be placed and packed with care under and round them. All filling shall be deposited and compacted in layers, not exceeding 225mm loose depth, to a dry density not less than that of the adjoining soil.

## BACKFILLING OF MANHOLES

Backfilling around manhole walls will not be started earlier than 3 days after the building or making of the wall nor sooner than 14 days over the cover slabs of manholes, after these are cast.

## CONNECTIONS OF EXISTING SEWERS AND DRAINS

Where shown on the Drawings, existing sewers and drains shall be properly extended, connected and jointed to new sewers, culverts, drains or channels. All such connections shall be made during the construction of the main sewer, drain or other work and a record of their positions kept for future use or reference. Where pipe connections are made to a sewer, culvert, stone pitched or lined channel, the pipes shall be well and tightly built into the concrete or masonry work and be so placed as to discharge in the direction of flow of the main sewer, drain or channel and with the end of the pipe carefully cut to the necessary angle. Where the connections are between pipe sewers or drains, special connection pipes as shown on the Drawings shall be supplied and be truly laid and properly jointed.

## MANHOLES AND INSPECTION CHAMBERS

Manholes and inspection chambers shall be constructed in accordance with the Drawings and in the positions shown on the Drawings or as directed by the Engineer.

Benching to manhole floors shall have a minimum fall of 1 in 12 from the manhole walls and shall be finished tangentially vertical to the bore of the channels, providing a gross channel depth not less than the channel diameter. The intersection of the channel sides and the benching shall be finished in a sharp curve not greater than 30mm in diameter.

The benching shall be formed of concrete, as specified, floated to a hard smooth surface with a coat of cement-sand mortar (1:1).

If required half channel pipes, bends and junctions shall be laid and bedded in cement-sand mortar (1:3) to the required lines and levels, and both sides of the channel pipes shall be benched up with concrete of the appropriate class and finished smooth to the slopes and levels as shown on the drawings or directed by the Engineer. The ends of all pipes shall be neatly built in and finished flush with cement-sand mortar (1:3).

Walls of manholes and access shafts shall be constructed of concrete block work as specified elsewhere and in accordance with the Drawings.

Walls shall be rendered internally for the full height with a cement-sand mortar (1:3) of at least 12mm thickness and finished with a completely smooth surface.

Cast iron manhole covers and frames as specified shall be provided and the frames shall be bedded in cement-sand mortar (1:3) and so set that the tops of the covers shall be flush at all points with the surrounding surface of the footway, verge or carriageway, as the case may be. Any slight adjustment of the cover level which may be necessary to accomplish this shall be affected by topping the side walls with concrete integral with the slab.

Manhole covers and frames: bed and point frames in cement-sand mortar 1:3. Apply two coats of bitumen paint internally and externally. Bed covers in grease-sand mixture to make them airtight.

The manholes shall be covered by high density coated cast iron (where there is a road atop) and medium density coated cast iron covers.

Reinforced concrete manholes shall have 50mm thick concrete blinding, 1000 gauge polythene sheeting, 225mm thick reinforced concrete over slab, concrete benching trowelled smooth with main and branch channels formed in the same.

Step irons shall be laid at 225mm vertical centers for manholes over 1.20m Deep.  
All sizes shown on the drawings are internal sizes.

All manholes when completed shall be watertight and to the satisfaction of the Engineer.

#### PROVISION FOR FUTURE CONNECTION TO MANHOLES

Inlet pipes of the required diameters shall be built into the walls of manholes and elsewhere for future use and shall be of the diameters shown on the Drawings. The external ends of all such connections shall be sealed off with temporary stoppers, or otherwise sealed off as approved by the Engineer.

#### GRANULAR BEDDING TO PIPES

Immediately following excavations of the trench, pipes shall be laid and jointed except when shown otherwise on the Drawings on pipe bedding material as specified elsewhere in this Specification. Brick or other hard material shall not be placed under the pipes for temporary support.

After jointing of the pipes the bedding shall be brought up equally on both sides of the pipe, first to the level of the centre of the pipeline and then up to height 225mm above the top of the pipe barrel. The bedding material shall be carefully compacted for the full width of the trench with hand tools. Pipes shall be laid so that each one is in contact with the bed throughout the length of its barrel, bedding material being scooped away at each socket in the case of socketed pipes so that the socket does not bear on the bed.

#### AIR TEST

All branches and openings in the length of drain under test shall first be sealed with approved expanding plugs and appropriate lids in the case of access fittings. After sealing, an air pressure of 100mm of water as measured on a manometer tube shall be applied. The drop in pressure after pumping has ceased shall not exceed 25mm of water in five minutes. Should the rate of pressure drop exceed that specified, a smoke

test shall be applied for the purpose of locating the fault. Any failure of the drains to withstand these tests and any defect which may be found while they are under test must be made good to the satisfaction of the Engineer and at the Contractor's expense, and the test repeated. Upon the successful completion of the test, the pipes shall be backfilled in accordance with this Specification.

## WATER TEST

All branches and openings in the lengths of drain under test shall first be sealed with approved expanding plugs and appropriate lids in the case of access fittings. The pipes shall be filled with water in such a manner as will give rise to no shock and prevent any accumulation of air in the sewer. When all air has been expelled and the pipes saturated, the pressure in the drains shall be raised by means of a force pump or standpipe so that the length under test is subjected to a hydrostatic pressure of at least 1.2 metres head of water. The drop in pressure after pumping has ceased shall not exceed 25mm head of water in 10 minutes. Should the rate of pressure drop exceed that specified, the Contractor shall thereupon, at his own expense, search for and rectify any weakness or defect in the pipes and fittings under test to the satisfaction of the Engineer. The pipes shall then be subjected to the specified water pressure again and re-tested and repaired until a satisfactory test is obtained. The Contractor shall allow for supplying all water required for such tests and shall make provision for its disposal after use.

## TESTING OF MANHOLES

Manholes shall be tested by filling to the adjacent ground level with clean water. After allowing a 60 minutes period of initial absorption, no measurable subsidence in the water level shall occur during the next 30 minutes. The Contractor shall correct any leaks in the manhole at his own expense.

The Contractor shall, at his own expense, provide the water and everything necessary for the carrying out of the manhole test.

## PROTECTION OF WORK

The drains are to be laid to suit the general progress of the Works and at such times and in such a manner as to be adequately protected against damage and deterioration. The whole of the work is to be maintained and handed over in a sound clean condition on completion of the Contract.

## SOAK PITS

Where the collected surface water is to be discharged to a soak pit, the suitability of the natural ground to receive and dispose of the water without causing damage or nuisance to neighbouring property shall be demonstrated to the satisfaction of the territorial authority. If required, field testing of soakage can be carried out as follows:

- a) Bore test holes of 100mm to 150mm diameter to the depth of the proposed soak pit. If groundwater is encountered in the bore test hole then this depth shall be taken as the depth of the soak pit.
- b) Fill the hole with water and maintain full for at least 4 hours (unless the soakage is so great that the hole completely drains in a short time).

- c) Fill the hole with water to within 750mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.
- d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

Soak pits must be located at least 10 metres away from any waterways in saturated soil conditions.

A well-sized soak pit should last for about 3 to 5 years without maintenance. To extend the life of a soak pit, care should be taken to ensure that the effluent has been clarified and/or filtered well before they are discharged in to the pit. This prevents an excessive build-up of solids.

The soak pit should be kept away from high-traffic areas so that the soil above and around it is not compacted. When the performance of the soak pit deteriorates, the material inside the soak pit can be excavated and refilled.

To allow for future access, a removable (preferably concrete) lid should be used to seal the pit until it needs to be maintained. Particles and biomass will eventually clog the pit and it will need to be cleaned or moved. As long as the soak pit is not used for raw sewage, and as long as the previous collection and storage/treatment technology is functioning well, health concerns are minimal. The technology is located underground and thus, humans and animals should have no contact with the effluent.

It is important however, that the soak pit is located a safe distance from a drinking water source (ideally at least 30 m). Particles and biomass will eventually clog the pit and it will need to be cleaned or moved.

## SEPTIC TANKS

Septic tanks shall receive all wastewater (black and grey water), from toilets, baths, showers, wash basins, sinks and washing machines. Water that must be excluded, includes run-off water from roofs, yards, foundation drains, and other sources not considered to be wastewater.

**LOCATION** – Septic tanks and sewage holding tanks shall be located so as to be readily accessible for the pumping out of liquid sewage and sludge.

Septic tank covers shall always be accessible. Where manholes are more than 300mm below final grade, an extension collar shall be provided over each opening. Extension collars shall not be brought flush with the ground surface unless the cover can be locked to prevent tampering. Driveways or other facilities shall not be constructed above septic tanks unless specially designed and reinforced to safely carry the load imposed.

Tanks must be watertight, constructed of durable material not subject to corrosion, decay, frost damage, or cracking

Tanks shall have inlet and outlet baffles, sanitary tees or other devices to prevent the passage of floating solids and to minimize disturbance of settled sludge and floating scum by sewage entering and leaving the tank

There shall be a minimum drop in elevation of 60mm between the inverts of the inlet and outlet pipes.

### 7.3.3 CONCRETE

#### NOMINAL MIX PROPORTIONS FOR CONCRETE

The nominal mix proportions shall comply with the requirements of Table 4.1 below

Table 4.1

Class of Concrete	Nominal Mix Proportions by Weight	Sum of the Volumes of Each Size of Aggregate per 50 Kg. Concrete (m3)	Minimum Compressive Strength 28 days after mixing	
			Preliminary Test (N/mm <sup>2</sup> )	Works Test (N/mm <sup>2</sup> )
30	1:1:2	0.105	42	32
25	1 : 1'2:3	0.16	35	26
20	1:2:4	0.21	28	21
(Q)15	1:3:6	0.29	21	14
P	1:4:8	0.4	4	3

The minimum compressive strength of concrete of a particular class after 7 days of mixing shall not be less than 0.67 times the corresponding strength of concrete of the same class after 28 days of mixing.

#### ADMIXTURES

Admixtures shall not be used without the specific approval, in writing, of the Engineer.

#### MIXING CONCRETE

The weight of fine and coarse aggregate shall be adjusted to allow for the free water contained in it. The water to be added to the mix shall be reduced by the quantity of free water contained in the fine coarse aggregates. This shall be determined by a method to be approved by the Engineer, each day immediately before mixing begins, and further as he requires. Unless approval is obtained from the Engineer to batching by volume, the aggregates for all classes of concrete shall be batched by weight in separate fractions, allowance being made for the amount of water contained in the aggregate. When volume batching is permitted due allowance shall be made in addition for the bulking effect in the fine aggregate. Cement shall be added as a number of whole bags or weighed separately in purpose-made cement batching equipment.

Concrete shall be mixed in a power-driven batch mixer which has been approved by the Engineer. The quantity of material in each batch shall not exceed the rated capacity of the mixer and the speed of rotation shall be within  $\pm 1$  revolution per minute of that recommended by the manufacturer.

For drum type mixers mixing shall continue for not less than 2 minutes after all materials are in the drum. When concrete is mixed in a truck mixer, all water shall be added at the site and mixing carried out for a period of at least 5 and not more than 30 minutes. Each batch shall be homogenous and completely discharged without segregation. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

### SAMPLING CONCRETE

The Contractor shall take samples of the concrete in accordance with British Standard 1381: Methods of Testing Concrete, for the purpose of making test cubes and/or testing its consistency in accordance with Clause 12.03. The number, frequency and location of samples shall be decided by the Engineer.

### TRANSPORT AND PLACING

Concrete shall be transported and placed as near to its final position as possible so that segregation or loss of the constituent materials does not occur.

#### Placing of Concrete - General:

All concrete shall be compacted and in its final position within 30 minutes of the water being added to the dry materials, and when carried in purpose-made agitators the time shall be not more than 1 1/2 hours after the introduction of the cement to the mix. If the temperature of the cement entering the mixer exceeds 66° C. the concrete shall be placed within 15 minutes.

### COMPACTION OF CONCRETE

Concrete shall normally be compacted by vibration to produce a dense homogeneous mass. Mass concrete only may be hand-tamped. The method of applying vibration and the type of vibrator shall be approved by the Engineer.

### CURING OF CONCRETE

Concrete shall be protected during initial hardening from the harmful effects of sun, wind, low temperature, rain and running water.

It shall be kept moist and protected in a manner approved by the Engineer for at least 7 days. No loading of any description will be allowed on concrete until permitted by the Engineer, who may then require supporting calculations to be submitted by the Contractor.



## CONSTRUCTION JOINTS

Construction joints shall be formed at right angles to the axis of the member. Vertical joints shall be formed by the insertion of rigid stopping off forms. The position of any construction joints not shown on the Drawings shall be subject to the approval of the Engineer. In the absence of specified details, construction joints shall be at places of minimum shear stress and with joggle joints a right angles to the main reinforcement.

Bonding Concrete to that which has been in position for more than 4 hours but no longer than 3 days

The laitance film and porous layer shall be removed and the surface of the concrete cleaned with a wire brush and thoroughly washed with clean water. Immediately before the fresh concrete is deposited the surface shall be covered with a layer of cement mortar of similar richness and consistency to that embodied in the concrete mix.

Bonding Concrete to that which is more than 3 days old:

The surface shall be chipped to expose the aggregate and thoroughly rinsed with clean water to remove loose particles. Immediately before the fresh concrete is deposited a slurry of neat cement with the consistency of thick cream shall be applied and well worked into the interstices of the prepared surface and followed by a layer of cement mortar of similar richness and consistency to that embodied in the concrete mix.

## BENDING AND FIXING OF STEEL REINFORCEMENT

The bending and cutting of all reinforcement shall be entirely in accordance with British Standard 4466: Bending Dimensions of Bars for Concrete Reinforcement. Cold-twisted steel bars and hot roiled high tensile steel bars shall be bent cold; other reinforcement may be bent hot or cold, but the steel shall not be heated to a temperature exceeding 845°C.(cherry red heat), nor shall it be cooled by quenching. The written consent of the Engineer is required for hot bending.

All reinforcement shall only be welded with the permission of the Engineer. The workmanship shall conform to the requirements of British Standard 5135: General Requirements for the Metal-Arc Welding of MM Steel, or British Standard 693: General Requirements for the Oxyacetylene Welding of Mild Steel.

All reinforcement shall be placed and maintained in the position shown on the Drawings. Where intersecting bars are tied together, 1.5 mm soft annealed iron wire shall be used, the ends of the wire being turned into the main body of the concrete. It shall be entirely free, both before and after placing in position of loose scale, rust, oil, grease, dirt or other foreign matter. It shall be secured and supported in position so that no significant movement occurs during placing of concrete. Reinforcement's spacers shall be submitted to the Engineer for approval.

No splices shall be made in the reinforcements except where shown on the Drawings or where approved by the Engineer.

## FORMWORK FOR CONCRETE

Formwork shall include all temporary or permanent moulds for forming the concrete, together with all temporary construction required for their support. The form work must maintain the concrete in its correct position during placing, compaction, setting and hardening, without loss of any material, and provide against its own deformation under load. It shall be arranged to avoid overstressing any part of the existing structure from which it may be supported.

Immediately before concreting, the forms shall be thoroughly cleaned out, temporary openings being provided for the purpose. This inside surfaces shall then, if necessary, be coated with an approved material to prevent adhesion of the concrete, which must not come into contact with the reinforcement. Otherwise the surfaces shall be thoroughly wetted with clean water.

Removal of Formwork:

All formwork must be removed without damage to the concrete.

The minimum periods between concreting and the removal of formwork shall be as directed by the Engineer,

## CONCRETE SURFACE FINISH

Unless otherwise shown on the Drawings, all permanently visible concrete surfaces shall have a smooth and dense finish of uniform texture free from holes, fins and shutter staining. All arises shall be clean and true. Minor blemishes shall be removed immediately after striking the framework by rubbing clown and holes filled with a cement arid suitable fine aggregate grout to match the colour of the concrete. The grout shall be well worked into the voids and cured in accordance with the Clause 11.07. Honeycombed concrete shall not be made good until inspected by the Engineer who shall give his consent to the proposed method of repair.

Faces of concrete intended to be rendered shall be chipped or roughened in an approved manner to provide a bond.

On no account may any finishing work to concrete surfaces be postponed to a later stage in the Works.

## 7.3.4 MASONRY AND BLOCKWORK

### GENERAL

All masonry work shall be constructed from building stone as specified in Clause11.13.

For culvert headways and other small works, the stone shall, unless otherwise specified, be rough dressed. For walls, facing and other exposed works the stone shall, unless otherwise specified, be medium chisel-dressed.

### WORKMANSHIP

The Contractor shall provide and use proper setting-out rods for all work.

Stones and blocks shall be well soaked before use and the tops of walls shall be kept wet as the work proceeds. The stones and blocks shall be properly bonded so that no vertical joint in a course is within 115mm of a joint in the previous course. Alternate courses of walling at angles and intersections shall be carried through the full thickness of the adjoining walls. All perpendes, reveals and other angles of the walling shall be built strictly true and square.

The stones and blocks shall be bedded, jointed" and pointed in cement - sand mortar (1:3) in accordance with Clause 11.07 with beds and joints 9 mm thick flushed up and grouted solid as the work proceeds.

All work shall be cured in accordance with the relevant requirements for concrete works.

### 7.3.5 MATERIALS

#### CEMENT

Ordinary Portland cement and rapid-hardening Portland cement shall comply with the requirements of British Standard 12: Portland Cement (Ordinary and Rapid-hardening).

Sulphate resisting cement shall comply with the physical requirement of British Standard 12: Portland Cement (Ordinary and Rapid-hardening).

High alumina cement shall comply with the requirements of British Standard 915: High Alumina Cement.

White or coloured cement shall be of approved quality and chemical composition, and shall comply with the physical requirements of British Standard 12: Portland Cement (Ordinary and Rapid-hardening).

Cement shall be delivered in unbroken bags, barrels or by an approved bulk delivery vehicle.

Cement shall be stored in a dry weatherproof shed with a raised wooden floor, or in a silo, and shall be delivered in quantities sufficient to ensure that there is no suspension or interruption of the work of concreting at any time and if in sheds, each consignment shall be kept separate and distinct. Any cement which shall have become injuriously affected by damp or other causes shall at once be removed from the site. Cement should be used in rotation.

The Contractor shall furnish as directed by the Engineer test certificates relating to the cement to be used on the work. Each certificate shall indicate that the sample has been tested and analyzed by an approved laboratory and that it complies in all respects with the requirements of the appropriate Specification for the particular type of cement.

#### AGGREGATES FOR CONCRETE

Aggregates for concrete shall consist of naturally occurring material complying with the requirement of British Standard 882: Concrete Aggregates from Natural Sources.

A certificate as to compliance with the British Standard shall be provided by the supplier of the aggregate. Tests for the determination of impurities in the sand shall be made once daily until the Engineer is satisfied that the specified compressive strength is being regularly obtained, when, with his approval, such tests shall be made once weekly and at other times as directed by the Engineer.

The coarse aggregate, unless otherwise authorized by the Engineer, shall be delivered to the site in separate sizes, (two sizes when the maximum size is 20 mm and three sizes when the maximum size is 38 mm or more).

The Flakiness Index when determined by the sieve method described in British Standard 812 shall not exceed 35 for 65 mm and 38 mm aggregates nor shall it exceed 35 for 20mm and 10mm aggregates.

All aggregates brought upon the site shall be kept free from contact with deleterious matter and in the case of aggregate passing a 5mm sieve they shall have been deposited on site of mixing for not less than 16 hours before further use; aggregates of different sizes shall be stored in different hoppers, or different stacks on a clean hard surface and shall be separated from each other as approved by the Engineer.

#### SAND FOR MORTAR

- a) Sand for mortar shall be natural or crushed stone sand and shall be in accordance with British Standard. 1198 -1200 where applicable to sands for general purpose mortars.
- b) The source of the sand is to be approved by the Engineer.
- c) At the Works the sand is to be stored on a clean, hard surface.

#### STONE DUST

Stone dust for blinding shall be blacktrap screened to the following grading:-

Passing 10mm sieve	100 %
Passing No. 4 sieve	85%-100%
Passing No. 100 sieve	5%- 25%

#### MURRAM

Murram shall be from an approved source quarried-so-.as to exclude vegetable matter, loam, top soil or clay and shall comply with, unless otherwise specified in this Specification, the requirements for gravel wearing course of the current Standard Specification for Road and Bridge Construction of the Ministry of Public Works and Housing of Kenya. The California Bearing Ratio (C.B.R.) of the Murram, as determined for a sample compacted to maximum density (as defined under British Standard. 1377) and allowed to soak in water for four days, shall not be less than 30. This C.B.R. is a guide to quality only and compaction in the work will be judged by density.

In the event that murram is not readily available in the immediate vicinity of the Works, the Contractor will be required to provide it and to pay for all haulage. The source of supply shall be approved by the Engineer before any material is brought to site.

## WATER FOR CEMENT TREATED MATERIALS

If water for the work is not available from the public mains, the Engineer's approval must be obtained regarding the source of supply and manner of its use. Water to be used with cement or lime shall be free from salt, oil, alkali, organic matter and other deleterious substances. If the water is required to be tested, this shall be done in accordance with the requirements of British Standard 3148: Tests for Water for Making Concrete.

## CEMENT - SAND MORTAR

Cement - sand mortar shall consist of proportions by volume as specified of Portland cement and natural sand or crushed natural stone or a combination of both as specified in British Standard 1198 - 1200: Building Sands from Natural Sources. The constituent materials shall be accurately gauged and mixed in an approved manner.

Cement - sand mortar shall be made in small quantities only as and when required, and any mortar which has begun to set or which has been mixed for a period of more than one hour shall be rejected.

## HYDRATED LIME

Hydrated lime shall comply with British Standard 890: Building Limes, and shall be Class B of the semi-hydrated type.

## LIME MORTAR

Lime mortar shall consist of proportions by volume as specified of hydrated lime and natural sand or crushed natural stone combination of both as specified for cement mortar in Clause 10.07. The constituent materials shall be accurately gauged and mixed in an approved manner.

## CEMENT - LIME MORTAR

Cement-lime mortar shall consist of Portland cement, hydrated lime and natural sand or crushed natural stone or a combination of both, as specified for cement mortar in Clause 11.07. The constituent materials shall be accurately gauged and mixed by volume in an approved manner in the proportions specified.

Cement-lime mortar shall be made only in small quantities as and, when required and any mortar which has been mixed for a period of more than two hours shall be rejected.

## CEMENT GROUT

Cement grout shall consist of Portland cement and water mixed in the proportion of one part by volume of cement and one-and-a-half parts by volume of water. The grout shall be used within one hour of mixing.

## STEEL REINFORCEMENT FOR CONCRETE

Mild steel and hot-rolled high tensile steel rod reinforcement for concrete shall be as specified in British Standards 4449, 4482: Rolled Steel Bars and Hard Drawn Wire for concrete Reinforcements. Cold-twisted high tensile bars shall be as specified in British Standard 4461 Metric Units: Cold-twisted Steel Bars for

Concrete Reinforcement. Steel fabric reinforcement shall be as specified in British Standard 4483: Steel Fabric for Concrete Reinforcement, and shall be delivered to the site in mats, unless the Engineer allows otherwise, and free from any permanent set tending to make it curl under vibration.

The Contractor shall furnish the Engineer with copies of the manufacturer's certificates of tests for the steel reinforcement to be supplied. The Engineer may, however, order independent tests to be made and any steel which does not comply in all respects with the appropriate foregoing Specifications will be rejected.

#### CONCRETE SLABS FOR OPEN DRAINS

Precast concrete slabs for lining open drains shall be manufactured to the detail Drawings supplied from concrete class specified using maximum 12mm size aggregate. If required, cube test certificates shall be supplied by the manufacturer.

#### AGRICULTURAL TILES AND PIPES

Agricultural tiles and pipes shall be well burnt earthenware, true and circular in bore with an externally fiat bottom and plain ends suitable for laying with open or butt joints.

#### MANHOLE COVERS AND FRAMES

Manhole covers and frames shall be basically in accordance with the requirements of British Standard. 497: Cast Manhole Covers, Road Gully Gratings and Frames for Drainage Purposes, except that the manhole covers shall be constructed of mild steel, concrete filled, in accordance with detail Drawings.

Foul water sewer manholes shall have triangular Grade 'A' heavy duty covers and frames. Circular manhole covers and frames shall be used on surface water sewer manholes.

#### MANHOLE STEP - IRONS

Step-irons shall be galvanized malleable iron and shall comply with the requirements of British Standard 1247: Malleable Step - irons. Step-irons to be built into in-situ concrete shall be of general-purpose type and weighing not less than 2.2kg. Those to be built into precast concrete manholes shall be of pre-cast concrete manhole pattern.

#### TIMBER

Timber shall be sound, well seasoned and entirely free from worm, beetle, warps, shakes, splits, and all forms of rot and deadwood. Where required, all timber shall be treated with creosote, as specified in British Standard 144: Coal Tar Creosote for the Preservation of Timber, or an alternative approved timber preservative.

## uPVC PIPES

P.V.C pipes shall comply with British Standard 3505 and shall be of the type and class as specified on the Drawings or the Bills of quantities. The joint shall employ a flexible rubber ring which shall meet the requirements of British Standard 2494. Laying, jointing and testing shall generally be carried out according to the relevant Clauses of this Specification and all as per the manufacturer's instructions.

## SCHEDULE OF CONTRACT DRAWINGS

DRAWING NO.	DRAWING TITLE
ECEL/KPPF/CIV01/04/20	COLLECTION UNIT PLAN AND SECTIONS
ECEL/KPPF/CIV02/04/20	TREATMENT UNIT PLAN AND SECTIONS

## SPECIAL SPECIFICATIONS OF MATERIALS AND WORKS

### 9.1 SPECIAL SPECIFICATION

#### SITE LOCATION

The site of the proposed works is in LORESHO RIDGE ESTATE - Nairobi County.

#### SCOPE OF WORKS

The works to be carried out under this contract comprise supply, installation, testing and commissioning of the work described under (ii) below.

#### DESCRIPTION OF WORKS

The main works involves completion of Civil Works. The main items of work are as follows:

Effluent quality tests  
Effluent flow (quantity and variability) tests  
Air quality tests

Remedial works for onsite waste water treatment plant which mainly consist of equipment repair, supply and installation of new equipment.

#### SITE VISIT

The contractor shall visit the site to acquaint himself with the location and the condition of site, periods during which execution of work will be possible etc. and no claims incurred due to lack of knowledge of the said and other site conditions will be considered. Access to site shall be granted by the Estate Management Agents through the Employer.

#### ACCESS TO SITE

The site can be approached by road to LORESHO RIDGE ESTATE by Kenya Sugar Board Road to Site through Gate A or by Lyons Eye Hospital Road to Site through Gate B.

#### DRAWINGS

All drawings are deemed to be self-explanatory. However, where doubts exist, the sub-contractor should liaise with the Engineer before proceeding with the works. The scales are as shown and only figured dimensions are to be applied.

#### SITE OFFICE

There will be no site office.



## LABOUR CAMP

The Contractor is not permitted to house labour on site. He will be responsible for the transportation of workmen to and from site at his own cost and risk.

### 9.1 THE MANAGEMENT OF THE CONTRACT

The Procurement Department, KENYA POWER PENSION FUND will be responsible for the contract management on behalf of the Employer.

THE ENGINEER will be in charge of construction supervision and project management, in close consultation with the Employer.

All materials and workmanship shall comply with the latest edition of the specifications for Works.

### 9.2 EXTENT OF CONTRACT AND ALTERATION OF DESIGN

- a) The works specified under this contract shall include all general work preparatory to execution of all matters, things, requisites and work of any kind necessary for the due and satisfactory construction, completion and maintenance of the work to the intent and meaning of the drawings and this specification and further drawings and orders, that may be issued by the Engineer from time to time. Compliance by the Contractor with all the General Conditions of Contract, whether specifically mentioned or not in the clause of this specification, all materials, apparatus, plant, machinery, tools, fuel, water, timbering and tackle of every description, transport, offices, stores, workshops, staff, labour, the provision of proper and sufficient protective works, temporary fencing, lighting and watching required for the safety of the public and protection of the works and adjoining lands: first aid equipment, sanitary , accommodation for the staff and workmen; the effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or other charges arising out of the execution of the works and the regular clearance of rubbish. re-instatement and clearing and leaving perfect on completion. The Contractor will be deemed to have included in his rates the cost of complying with the requirements of this Specification and General Conditions of the Contract unless otherwise specified.
- b) Should the Contractor have comments regarding soundness of the design of any part of the work, or should he consider that the execution of the design is impossible on any part of the, Contract, the Contractor is required to notify the Engineer in writing at the time of the tender and provide factual evidence substantiating his opinion when required to do so by the Engineer.
- c) Notices given by the Contractor in respect of the above after the tender is submitted will not be considered as the basis of a claim for additional costs or extensions of the time.

- d) The Engineer may require to alter the design of any part of the structure should site conditions warrant such a change and the rates entered in the Bill of Quantities should be applicable for the similar items. The rates for the items of the work not covered by the Bill of Quantities shall be established by the Engineer.

### 9.3 PROGRAMME FOR EXECUTION OF THE WORKS

- a) In accordance with the terms of Clause 14 of the General Conditions of the Contract, the Contractor shall submit to the Engineer within 14 days from the order to commence fully detailed programme showing the order, procedure and method by which he proposes to carry out the construction and completion of the works.
- b) The Order in which it is proposed to execute the permanent works is subject to adjustment and approval by the Engineer and the Contract Price shall be held to include for any reasonable and necessary adjustment required by the Engineer during the course of the Works.
- c) The Contractor will be deemed to have considered the effect of seasonal weather variations, when programming his operations it must be clearly understood, that rains of up to 75mm per day will be deemed to be normal and expected. No claims by the Contractor for extension of time due to rains or floods less than 75mm per day as measured by the Meteorological Department will be considered by the Engineer.
- d) The Contractor, when preparing his programme has to consider the time for the delivery of any imported material and the Engineer's normal working hours.
- e) The Engineer's normal working hours shall be defined as 8a.m. to 5p.m. on weekdays with Saturdays and Sundays set aside for rest. If the Contractor wishes to execute permanent works outside these hours, he shall obtain the written permission of the engineer to make provision for supervision of such works.
- f) The Contractor shall carry out the Contract in accordance with the Programme agreed with the Engineer, but he shall in no manner be relieved by the Engineer's approval of the programme of his obligations to complete the works by the prescribed completion date, and he shall from time to time review his progress and make such amendments to his rate of execution of the works as may be necessary to fulfil his obligations.
- g) If in the opinion of the Engineer the plant or the equipment used by the Contractor for any specific item of the work does not fulfil the requirements of the specifications in respect of the workmanship, quality and safety of structures, sum items of plant and equipment shall be replaced with similar or equivalent items of plant or equipment to the satisfaction of the Engineer. No extra payment will be made in respect of such replacements.

#### 9.4 TEMPORARY WORKS

- 1) After the Contract is placed and before the work commences, the Contractor shall submit to the Engineers drawings showing the general arrangement of his offices, quarters, workshops, etc and other temporary works with diagrams and descriptions showing how he proposes to execute such temporary works and how they fit into his programme for the permanent works, all to be subject to adjustment and approval by the Engineer.
- 2) The Contractor shall be fully responsible for the sufficiency, stability and safety of all temporary works and their care in accordance with the Conditions of Contract.
- 3) The Contractor shall at his own expense, supply in advance to the Engineer for his approval detailed drawings and calculations of stability of such temporary works as the Engineer may direct, but no approval given or implied by the Engineer shall relieve the Contractor of his responsibilities in connection with the temporary works
- 4) Unless otherwise instructed, upon completion of the contract and after receiving approval in writing from the Engineer, the Contractor shall take down and remove all structures forming part of his own camp and that of the Engineer, and shall arrange for the disconnection of water supply, remove all drains and culverts, backfill trenches, fill in all latrine pits, soakaway and other sewage disposal excavations, with the exception of items and services to revert to the ownership of the Employer and shall restore the site as far as practicable to its original condition and leave it neat and tidy to the satisfaction of the Engineer.

#### 9.6 SITE PERSONNEL

- 1) The Engineer will require the Contractor to submit a list of professional and sub-professional personnel to be employed on the site stating their qualifications and experience.
- 2) The Contractor shall be responsible for ensuring, that all personnel of Non-Kenyan origin employed on site by himself or his Contractors or who are otherwise connected with the construction contract through the Contractor must be approved and cleared individually in writing by the appropriate Government Official to work on the project. Where personnel are not approved, the Contractor shall be responsible at his own expense for obtaining and employing suitable and approved personnel.
- 3) The Engineer reserves the right to determine suitability of the persons employed by the Contractor and may request replacement at any time of any member of the team employed by the Contractor. If in the opinion of the Engineer the presence of such a person is deleterious to the execution of the Contract, the Engineer's decision is final and binding.
- 4) The Site Agent to be a competent person approved by the engineer.

- 5) The Contractor shall always keep a literate English speaking Agent or Engineer as his representative on the site, competent and experienced in the type of works Involved, who shall give his whole time to the Supervision of the Contractor's operations.
- 6) The name of such Agent or Representative shall be submitted in writing to the Engineer for approval and he shall receive on behalf of the Contractor all directions and instructions from the Engineer or his representative and such directions and instructions shall be deemed to have been given to the Contractor in accordance with the conditions of contract.

## 9.6 NOTICE OF OPERATIONS

- 1) No important operations shall be carried out without the consent of the Engineer in writing, or without full and complete notice also in writing, being given to the Engineer by the Contractor sufficiently in advance of the time of the operation as to enable the Engineer to make such arrangements, as he may deem necessary for its inspection.
- 2) The Contractor shall supply, from time to time, to the Engineer in writing, full information with respect of locations in which the work is being prepared.
- 3) The Contractor shall give the Engineer not less than 24 hours notice of his intentions to set out or give levels for any part of the works, in order that arrangements may be made for checking. The Contractor shall carefully preserve any benchmarks, setting out pegs or other line or level markings installed or made by the Engineer. Working shall be suspended for such times as may be necessary for checking the lines and levels on any part of the work.

## 9.7 SETTING OUT

1. It will be the responsibility of the Contractor to obtain before commencing work the value and location of the benchmarks to be used for the works from the Engineer. All temporary benchmarks will be referred hereto. The Contractor shall construct such temporary benchmarks as the engineer may direct and agree the level thereof with the Engineer. The establishment of such temporary benchmarks will be deemed to be part of the Contractor's responsibility in setting out the works and no additional payment will be allowed.
2. Should the Contractor discover any error in the alignment or levels of the basic setting out, he shall at once notify the Engineer, who will then issue amended drawings or instructions regarding the correction of the error.
3. All approved setting out points, lines, stations etc shall be marked by concrete markers and steel pegs or as otherwise approved by the Engineer.

4. The contractor shall allow in the Bill of Quantities for complying with the provisions of this Clause and any abortive setting out occasioned by errors in the alignment of levels of the Contractor's basic setting out.

## 9.8 HEALTH AND SAFETY ON SITE

1. The Contractor shall ensure, so far as is reasonably practicable and to the satisfaction of the Engineer, the health, safety and welfare at work of his employees including those of his sub-contractors and of all other persons on the site.
2. From the time any portion of the works is commenced, until the end of the maintenance period, the Contractor shall be responsible for protecting the public from anything dangerous to persons or property and for the safe and easy passage of pedestrians and vehicular traffic.
3. The Contractor shall designate one of his senior staff, who shall have specific knowledge of safety regulations and experience of safety precautions on similar works and who shall advise on matters affecting the safety of workmen and on measures to be taken to promote safety in compliance with the factories Act Cap. 514 as a safety officer.
4. The Contractor shall provide protective clothing and equipment, first aid stations with such personnel and equipment as are necessary. The appropriate information, instruction, training and supervision will be arranged by the Contractor to ensure the safety and health of all the persons employed on the works, all in accordance with the laws of Kenya.
5. The Contractor shall provide adequate waterborne sanitation and refuse collection and disposal complying with the laws of Kenya and all local by- laws, and to the satisfaction of the Engineer, for all houses, offices, workshops erected on site. Construction of pit latrines will not be permitted unless the Engineer has given his approval in writing.
6. During the period of execution of the works the Contractor shall ensure that no pollution of existing water courses or of reservoir catchment areas is allowed to take place as a result of his operation.
7. In addition to providing, equipping and maintaining adequate first aid stations throughout the works in accordance with the Laws of Kenya, the Contractor shall provide and maintain on site for a duration of contract a fully equipped dispensary. This shall be with a qualified Clinical Officer who shall offer the necessary medical advice on AIDS/HIV and related diseases to Engineers and Contractors site staff. The contractor shall allow for all costs of providing these facilities in his rates.

## 9.9 PRIVATELY OWNED AND PUBLIC UTILITY SERVICES

- 1) The Contractor shall make himself acquainted with the position of all existing works and services inter alia sewers, storm water drains, cables for electricity and telephone and lighting poles and water mains before any excavation commences.
- 2) The Contractor will be held responsible for damage caused in the course of the execution of the works to some existing works and services and shall indemnify the Employer against any claims arising from such damage (including consequential damages). Any damage caused must be made good at the Contractor's own expense.
- 3) Such existing works and services, where exposed the execution of the works, must be properly shored, hung-up and supported to the satisfaction of the Engineer and of the Authority concerned. The Contractor shall exercise special care, when refilling trenches or other excavations around some existing works / services.
- 4) Poles supporting cables, etc adjacent to the works will be kept securely in place, until the work is completed and will then be made as safe and permanent as before.
- 5) Notwithstanding the foregoing requirements and without lessening the Contractor's responsibility, the contractor shall inform the Engineer immediately when existing works have been exposed and conform to any requirements of the Authority concerned and of the Engineer.
- 6) Any damage to or interference with existing services occasioned during the progress of the works, will be deemed to be the responsibility of the Contractor' who shall undertake to make good at his own expense any damage so caused to the existing underground services or other features, and shall be liable in respect of all claims arising from such damage or interference, however occasioned.
- 7) Only when and as directed by the Engineer the position of an existing work or service can be changed by the Contractor to meet the requirements of the proposed work. The cost of such work will be paid for on a day work basis, except where a specific item has been provided in the Bills of Quantities.

## 9.10 EXISTING ROADS AND ACCESSES

- 1) The Contractor shall comply with all requirements of the Employer, owners or the competent Authority concerning the use of traded equipment or other construction plant on any public or private road.
- 2) The cost of providing all diversions, signs, operators, flagment and all reinstatement to the approval of the Engineer will be deemed to be included in the rates entered in the Bill of Quantities, as will the cost of any road opening permit.

- 3) Before excavating across any public road, the Contractor shall give 10 days notice in writing to the Engineer and the Local Authority his intention to excavate. He shall satisfy the Engineer, the Local Authority and the Police as to the precautions he proposes to take and the signs and lights to be provided and operated. On any road or track at least 4 red lights shall be suitably placed on either side of the trench and diversions shall be clearly marked, signed and maintained.
- 4) The Contractor shall further give to the Engineer a 24 hours notice before excavating across a private road. Existing access to lands, property and all other things will be maintained by the Contractor during the continuance of the Works to the Engineer's satisfaction. The cost of such maintenance will be deemed to be covered by and included in the rates entered on the Bills of Quantities.
- 5) When a road, used by the -Contractor for transporting labour or construction plant or for delivery of any materials for the works, is dosed under Section 71 of the traffic ordinance 1962 or amendments thereto, the Contractor shall obey such closure and shall use alternative roads.

#### 9.11 COMPLIANCE WITH STATUTES AND REGULATIONS

- 1) In addition to the requirements of Clause 26 of the General Conditions of Contract, the Contractor shall be responsible for acquainting himself with all current valid statute ordinances or bye-laws or building regulations, which may affect the Works and shall include in his rates for all costs arising from compliance with the same. This applies in particular to the training levy and similar taxes for which no claims on the part of the Contractor will be entertained-
- 2) The Contractor shall also keep in close touch with Police and other Government Officials of the area regarding their requirements in the control of traffic or other matters, and shall provide all assistance or facilities, which may be required by such officials in the execution of their duties.
- 3) The Contractor's attention is drawn to legal Notice No.237 of October, 1971, which requires payment by the sub-Contractor for Training Levy at the rate of 0.25% of the Contract sum on all contracts of more than KSh50,000.00 value and his tender must include for all costs arising or resulting thereof. The Contractor without delay shall pay the Training levy. The original receipt shall be given to the Engineer for verification. The Engineer will certify no payment certificate, until the Contractor complies with the above legal notice.

#### 9.2 WATER SUPPLY

- 1) The Contractor shall provide clean and sufficient supply of fresh water both for construction of the works and for all offices and workshops, etc. includes the arrangement of pipe lines, metres, etc for connecting to local water main, the provision

of storage tanks or water conveyance where necessary, payment of all fees and water charges.

- 2) The water shall be reasonably clear of suspended solids and free from any matter in quantities considered by the Engineer to be deleterious to the proposed work. Water supplied to the Engineer's offices, laboratories, etc. shall be drinkable to the satisfaction of the Medical Officer in the area. No separate payment shall be made for the provision of water or its attendant facilities and the Contractor shall allow for all these in his tender rates.
- 3) In the event that a water main is not available on or near the site, or that any available mains will not have sufficient capacity to provision of water adequate for the works, then the Contractor shall provide temporary tanks or other means of collecting, storing and distributing water on the site.

#### 9.12 LIGHTING,POWERANDTELEPHONE

- 1) The Contractor shall make his own arrangements for the supply of light, power and telephone required for the construction of the works and shall pay all fees and charges in connection therewith.
- 2) The Contractor shall arrange with the appropriate authority for a temporary meter and supply of electricity and provide all temporary wiring, power and lighting points as he may consider necessary In the event no fixed electricity being available, the Contractor shall provide the necessary power generating plant his own expense.

#### 9.13 WORKING AREA

- 1) The Contractor shall restrict his operations to those areas made available to him by the Engineer and shall at all times provide and maintain an adequate access for the Employer's employees and vehicles to carry out their normal duties in and around the existing works.
- 2) The Contractor shall, before entering upon any land purchased, rented, or for the use of which compensation has been paid, ensure that all formalities have been completed and the agreement of the Owner, Tenant and the Engineer has been obtained.
- 3) All requirements of land for temporary works and construction purposes shall be to the approval of the Engineer but the Contractor will make all necessary arrangements with the property owners concerned and pay all charges arising there from. On or before completion of the Contract, the Contractor shall remove all temporary works and shall restore all such land to the condition in which it was immediately prior to the occupation thereof as far as is reasonable and practicable. No separate payment will be made to the Contractor on account of these items and the Contractor must make due allowance for them in his rates



#### 9.14 CO-ORDINATION OF THE WORKS

- 1) The Employer reserves the right to execute works on the site which are not included in this Contract. He will employ for this purpose either his own employees or another Contractor. The Contractor shall ensure that neither his own operations nor trespass by his employees will interfere with the operations of the Employer nor his Contractor employed on such works.
- 2) The Contractor will be required to carefully co-ordinate his activities and work, both on and off site, with the activities and work of the other Contractors, Sub-Contractors, statutory, undertaking and all supervisory staff for the works appointed by the Employer. He shall allow all works to proceed without undue hindrance and will cooperate to expedite execution of the works.
- 3) If any dispute or difference of any kind whatsoever shall arise between the Contractor or statutory undertaking regarding the phasing, progress or execution of the works then the Engineer shall have full power to direct in what order the works, or any portion thereof shall be carried on or completed and he may from time to time require the whole or any portion of the works to be discontinued or the execution thereof postponed for such a period as he may think fit.
- 4) The Contractor shall respect any works executed by others and articles supplied or installed by others and will be held responsible for any loss or damage thereto, if caused by him or his Contractors.

#### 9.15 COPIES OF ORDERS AND TEST CERTIFICATES

- 1) Before entering into any Contract for the supply of any material or article the Contractor shall obtain the Engineer's approval in writing of the Contractor from whom he proposes to obtain such materials or goods. Should the Engineer at any time be dissatisfied with such materials or goods or with the method of operations carried out at such Contractor's works or place or business, he shall be empowered to cancel his previous given approval of sub-contract and shall specify any other supplier whom he may choose, or shall approve another sub-contractor for the supply of such materials or goods. The Contractor shall then obtain such said materials or goods from such other supplier and shall bear any additional cost thereof, together with the costs and consequences of replacing any unsatisfactory materials already incorporated in the work.
- 2) The Contractor shall deposit with the Engineer samples of materials and manufactured articles including the manufacturer's specification, when and where appropriate.
- 3) When instructed by the Engineer, the Contractor shall submit test-certificates from the suppliers of the materials and goods to be used for the contract to the Engineer. Such certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the specifications and shall give the results of all

tests carried out. The Contractor shall provide adequate means of identifying the materials and goods delivered to the site with the corresponding certificates.

- 4) The Contractor shall provide the Engineer with copies of all orders for the supply of materials and goods required in connection with the works as the Engineer may require.
- 5) All materials and manufactured articles shall be stored on site in a manner acceptable to the Engineer. The Contractor shall carefully protect from weather and vermin all work, materials and manufactured articles, which may be affected.

#### 9.16 PROGRESS PHOTOGRAPHS AND RECORD DRAWINGS

- 1) Colour negatives showing the progress of the works shall be taken every month by the Contractor from positions to be selected by the Engineer. The Contractor shall supply proof prints of each negative from which the Engineer shall select negatives. The Contractor shall produce 2No. sets of those selected colour prints which shall be handed over to the Engineer together with all the negatives. Each photograph shall be marked with the number of negative and a statement shall be submitted giving location and date when taken and a brief description or title.
- 2) The photographs shall be mounted on A4 loose-leaf sheets, minimum 200g, with transparent plastic sheets...
- 3) After the work has been completed, the Contractor shall furnish as built drawings, showing the works as constructed together with all other information that may either be required or be useful for the operation and maintenance of the works in the future, such as alignment and depth of cover of pipelines, type of soil, rock levels, type, dimensions and location of structures, size of pipelines and cables encountered during excavation
- 4) All drawings shall be A 1 in size to the ink border and drawn on a permatrace paper.

#### 9.17 SITE MEETINGS

The Main Contractor to provide for monthly site meetings to be held on site, and where the sub-Contractor(s) will be expected to attend.